PART ONE

CASES AND PRINCIPLES

CHAPTER ONE

SUCCESS CHARACTERISTICS OF HIGH-PERFORMING MICROSYSTEMS

Learning from the Best

Eugene C. Nelson, Paul B. Batalden, Thomas P. Huber, Julie K. Johnson, Marjorie M. Godfrey, Linda A. Headrick, John H. Wasson

Chapter Summary

Background. Clinical microsystems are the small, functional frontline units that provide most health care to most people. They are the essential building blocks of larger organizations and of the health system. They are the place where patients, families, and careteams meet. The quality and value of care produced by a large health system can be no better than the services generated by the small systems of which it is composed.

Methods. A wide net was cast to identify and study a sampling of the best-quality, best-value small clinical units in North America. Twenty microsystems, representing a variety of the component parts of a health system, were examined from December 2000 through June 2001, using qualitative methods supplemented by medical record and finance reviews.

Results. The study of these twenty high-performing sites generated many best-practice ideas (processes and methods) that microsystems use to accomplish their goals. Their success characteristics were related to high performance and include leadership, macrosystem support of microsystems, patient focus, community and market focus, staff focus, education and training, interdependence of care team, information and information technology, process improvement, and performance results. These ten

success factors were interrelated and together contributed to the microsystem's ability to provide superior, cost-effective care and at the same time create a positive and attractive working environment.

Conclusions. A seamless, patient-centered, high-quality, safe, and efficient health system cannot be realized without transformation of the essential building blocks that combine to form the care continuum.

The health care system in the United States can, under certain conditions, deliver magnificent and sensitive state-of-the-art care. It can snatch life from the jaws of death and produce medical miracles. The case of Ken Bladyka, presented later in this chapter, is one positive example of the health care system's performance. Yet the system is often severely flawed and dysfunctional. The Institute of Medicine (IOM) report *Crossing the Quality Chasm: A New Health System for the 21st Century* (Institute of Medicine [U.S.], Committee on Quality of Health Care in America, 2001), makes the point of system failure clear:

- "Health care today harms too frequently and routinely fails to deliver its potential benefits"(p. 1).
- "Tens of thousands of Americans die each year from errors in their care, and hundreds of thousands suffer or barely escape from nonfatal injuries that a truly high quality care system would largely prevent" (p. 2).
- "During the last decade alone, more than 70 publications in leading peer-reviewed clinical journals have documented serious quality shortcomings" (p. 3).
- "The current system cannot do the job. Trying harder will not work. Changing systems of care will" (p. 4).

This chapter introduces the concept of the clinical microsystem, summarizes recent research on twenty high-performing microsystems sampled from the care continuum, and stresses the strategic and practical importance of focusing health system improvement work specifically on the design and redesign of small, functional clinical units.

Qualitative research methods were used to analyze 250 hours of conversations with microsystem personnel; these conversations were augmented by chart reviews and financial data. Principles, processes, and examples were gleaned from the interviews to describe what these exemplary microsystems are doing to achieve superior performance.

So, what *is* the true nature of our health system? Sometimes it works well, but all too often it fails to deliver what is needed.

True Structure of the System, Embedded Systems, and Need to Transform Frontline Systems

The true structure of the health system the patient experiences varies widely. Patients in need of care may find

- Clinical staff working together—or against each other
- Smooth-running frontline health care units—or units in tangles
- Information readily available, flowing easily, and in a timely fashion—or not
- Health care units that are embedded in helpful larger organizations—or cruel, Byzantine bureaucracies
- Health care units that are seamlessly linked together—or totally disjointed
- High-quality, sensitive, efficient services—or care that is wasteful, expensive, and at times harmful or even lethal

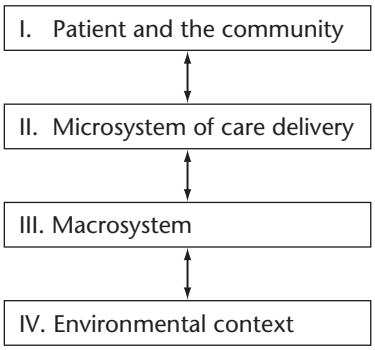
In brief it can be said that the true structure of the health system is composed of a few basic parts—frontline clinical microsystems, mesosystems, and overarching macrosystems. These systems have a clinical aim and are composed of patients, staff, work patterns, information, and technology, and they exist in a context. These elements are interrelated to meet the needs of patient subpopulations needing care. As the Bladyka case will illustrate, "it is easy to view the entire health care continuum as an elaborate network of microsystems that work together (more or less) to reduce the burden of illness for populations of people" (Nelson et al., 2000, p. 669).

Here are three fundamental assumptions about the structure of the health system:

1. Bigger systems (*macrosystems*) are made of smaller systems.
2. These smaller systems (*microsystems*) produce quality, safety, and cost outcomes at the front line of care.
3. Ultimately, the outcomes of a macrosystem can be no better than the outcomes of the microsystems of which it is composed.

The concept of clinical microsystems is spreading and has been used in many national and international programs: the IOM's *Crossing the Quality Chasm* report, the Institute for Healthcare Improvement's Idealized Design of Clinical Office Practice program and also its Pursuing Perfection program (Kabcenell, 2002) and Transforming Care at the Bedside program (Rutherford, Lee, & Greiner, 2004), the Cystic Fibrosis Foundation's Accelerating Improvement in CF CareCollaborative, the Vermont Oxford Network of Neonatal Intensive Care Units ("Your Ideal NICU") program, the United Kingdom's health system renewal program, and so on.

FIGURE 1.1. CHAIN OF EFFECT IN IMPROVING HEALTH CARE QUALITY.



Source: Donald M. Berwick. Used with permission.

Donald Berwick's "chain of effect in improving health care quality" (Berwick, 2001) (see Figure 1.1) shows the major elements that need to work well and work together well for high-quality care to be delivered, and highlights the pivotal role played by the microsystems of care delivery. Clinical microsystems are the places where patients and families and health care teams meet, and consequently they are positioned at the *sharp end* of the health care delivery system, where care is delivered, medical miracles happen, and tragic mistakes are made. Our approach in this book is focused primarily on this microsystem level, where frontline clinical teams interact with patients and produce outcomes.

To bring about fundamental change of the magnitude required in the health system, our country needs a systematic transformation *at all levels* of the system. This requires a *system-based* approach, one that recognizes the reality and functional integrity of human systems. Although many attempts have been made to change the health system—by focusing on the individual patients, the individual physicians serving these patients, the larger provider organizations, the payment system, and other aspects of health care policy—there have been very few efforts to understand and change the frontline clinical units that actually deliver the care. To move toward a *perfected* macrosystem of care, the performance of each individual microsystem must be optimized within that system's context and the linkages between all the various clinical microsystems must be seamless, timely, efficient, and thoroughly reliable. Although change is required at all levels of the system, the powerful new idea here is that the microsystem concept offers an opportunity to transform health care at the front line of service delivery.

Describing Clinical Microsystems

Microsystems involve people in varying roles, such as patients and clinicians; they also involve processes and recurring patterns—cultural patterns, information flow patterns, and results patterns. This book defines microsystems in health care in the following way:

> A clinical microsystem is a small group of people who work together on a regular basis to provide care to discrete subpopulations of patients. It has clinical and business aims, linked processes, and a shared information environment, and it produces performance outcomes. Microsystems evolve over time and are often embedded in larger organizations. They are complex adaptive systems, and as such they must do the primary work associated with core aims, meet the needs of their members, and maintain themselves over time as clinical units.

Microsystems, the essential building blocks of the health system, can be found everywhere and vary widely in terms of quality, safety outcomes, and cost performance. A microsystem is the local milieu in which patients, providers, support staff, information, and processes converge for the purpose of providing care to individual people to meet their health needs. If a person were to explore his or her local health system, he or she would discover myriad clinical microsystems, including a family practice, a renal dialysis team, an orthopedic practice, an in vitro fertilization center, a cardiac surgery team, a neonatal intensive care unit, a home health care delivery team, an emergency department, an inpatient maternity unit, a rapid response team, and an extended care facility. Clinical microsystems are living units that change over time and *always* have a patient (a person with a health need) at their center. They come together to meet patients' needs—and they may disperse once a need is met (for example, a rapid response team, or a *fast* squad, forms quickly, comes together around the patient for a short period of time, and disperses after the patient has been stabilized or transported).

As described in the Bladyka case in the following box and illustrated in Figure 1.2, these individual microsystems are tightly or loosely connected with one another and perform better or worse under different operating conditions. Our ability to see them as functional, interdependent systems is challenged by our conventions of compartmentalizing and departmentalizing, considering separately, for example, human resources, accounting, and information technology. Our commitment to professional disciplines and specialties as a prime organizing principle often creates barriers that impede the daily work of clinical microsystems.

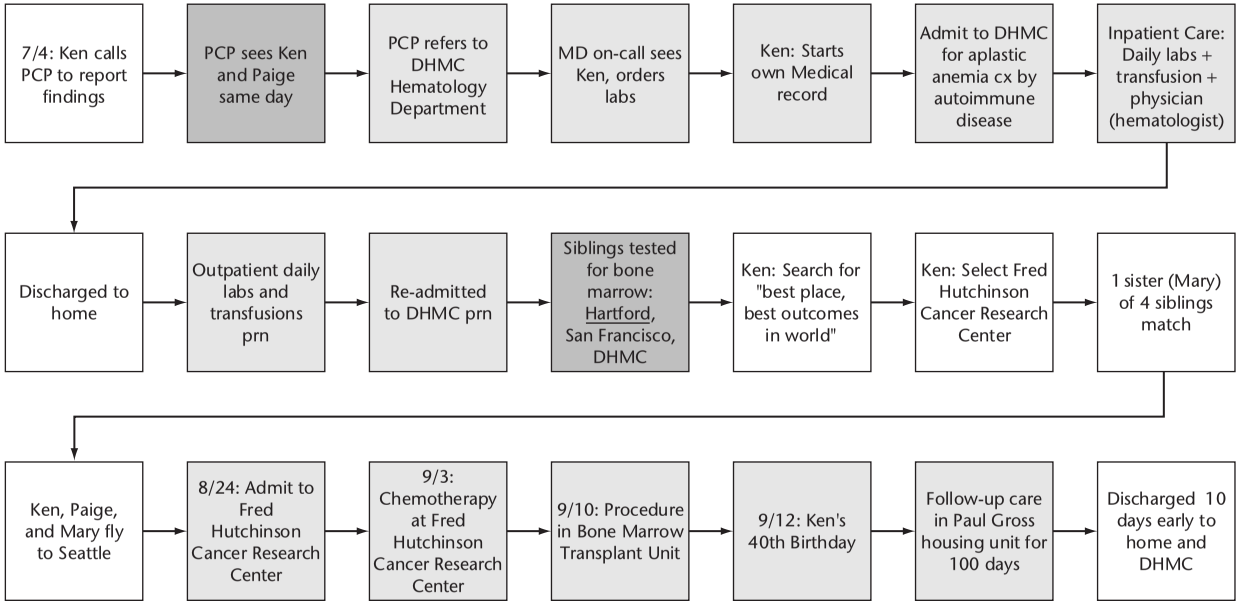
The Bladyka Case

Ken Bladyka is a thirty-nine-year-old resident of New Hampshire who has a wife, two children, and a sixth degree black belt. He has earned several national and international karate championships. Last summer, while attending the Amateur Athletic Union National Karate Championships to watch his son compete, he noticed bruises on his arm. When he got home he noticed more bruises and petechiae on his legs, and Paige, Ken's wife, was horrified when she saw severe bruises on his back as well. This happened on the Fourth of July, and the following sequence of activities transpired over the next three months:

- 7/4: Ken calls his family physician, his primary care provider, to report findings.
- Family physician sees Ken and Paige that same day.
- Family physician refers Ken to Dartmouth-Hitchcock Medical Center (DHMC) hematology department in Lebanon, New Hampshire.
- Doctor on call sees Ken and orders labs.
- Ken starts his own medical record.
- Ken admitted to DHMC with diagnosis of aplastic anemia complicated by autoimmune disease.
- Inpatient care—daily labs and transfusions—provided under direction of hematologist.
- Ken discharged to home, receives outpatient daily labs and transfusions as needed, and readmitted to DHMC hematology service as needed.
- Ken's four siblings tested for bone marrow matches at DHMC, and at health care facilities in Hartford, Connecticut, and San Francisco, California.
- One sibling, his sister Mary, has a positive match.
- Ken begins a search for "best place with best outcomes in world" and selects Fred Hutchinson Cancer Research Center (FHCRC) in Seattle, Washington.
- 8/23: Ken, Paige, and Mary fly to Seattle, and on 8/24 Ken is admitted to FHCRC.
- 9/3: Chemotherapy is begun at FHCRC.
- 9/10: Bone marrow transplant procedure done at FHCRC.
- 9/12: Ken celebrates his fortieth birthday while an inpatient at FHCRC.
- 9/27: Ken transferred to Paul Gross Housing unit for 100 days of follow-up care.
- 10/3: Testing at FHCRC reveals that bone marrow transplant has started to produce positive results.
- Ken continues to recover and recuperate while residing at Paul Gross Housing unit and anxiously awaiting his return to home and family and work. . . .

Figure 1.2 uses a flowchart to depict Ken's health system journey. It shows the frontline clinical units, the different small groups of people who worked directly with Ken at each step of his care, such as the office of his primary care provider (PCP), the DHMC hematology inpatient unit, and the bone marrow testing units. These small, frontline clinical units are what this book calls *clinical microsystems.* Figure 1.2 also

FIGURE 1.2. FLOWCHART OF KEN BLADYKA'S JOURNEY THROUGH THE HEALTH SYSTEM.



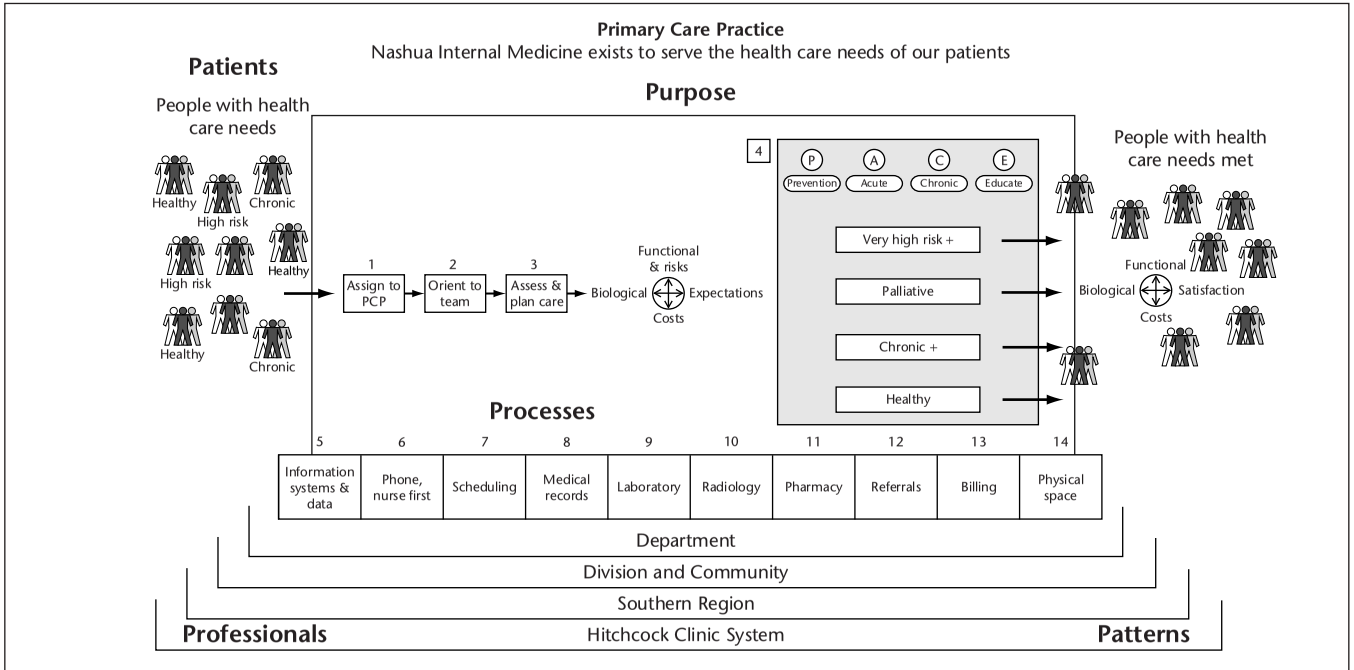
shows the larger umbrella organizations, or *macrosystems*—the Dartmouth-Hitchcock Medical Center, and the Fred Hutchinson Cancer Research Center—that played a part in Ken Bladyka's care. This case study provides a glimpse of the true structure of the health system. Before examining this structure further it is important to emphasize some facts that arise from the Bladyka case:

- This could happen to you.
- This could happen to your family and friends.
- Ken needed high-quality, safe, and affordable care.
- Ken found frontline health systems that met his special needs, but these pockets of gold were spread across the country.
- We need a solid-gold system—meaning a high-quality, high-value, high-reliability system—throughout the nation to serve all Americans.

Another way to describe clinical microsystems is with a high-level diagram that portrays a typical microsystem's *anatomy*—the set of elements that come together, like biological structures that work together toward a common goal, to form the microsystem organism. Figure 1.3 illustrates the anatomy of a typical internal medicine practice. This clinical microsystem, like all others, has a mission, or core *purpose*—in this case, to achieve the best possible outcomes for patients—and is composed of *patients* who form different subpopulations (such as healthy, chronic, and high risk). The patients interact with *professionals,* including clinicians and support staff, who perform distinct roles, such as physician, nurse, nurse practitioner, medical assistant, and so on. The patients and staff work to meet patients' needs by engaging in direct care *processes,* such as accessing systems, assessing needs, diagnosing problems, establishing treatment plans, and following up over time. These direct care processes are assisted by supporting processes that involve distinct tools and resources, such as medical records, scheduling, diagnostic tests, medications, and billing. The results of the interactions between patients and staff and clinical and support processes can be used to produce *patterns* of critical results, such as biological and safety outcomes, functional status and risk outcomes, patient perceptions of goodness of care, and cost outcomes, that combine to represent the value of care. The patterns of results also include the elements of practice culture, what it *feels like* to work in the clinical unit, as well as elements important to business success, such as direct costs, operating revenues, and productivity.

Another important feature of the clinical unit is that it has a semipermeable boundary that mediates relationships with patients and families and with many support services and other microsystems. Furthermore it is embedded in, influences, and is influenced by a larger organization that itself is embedded in a particular environment—a payment environment; a regulatory environment; or

FIGURE 1.3. ANATOMY OF A CLINICAL MICROSYSTEM.



TEAM MEMBERS: Nashua Internal Medicine		
Sherman, MD	Missy, RN	Amy, Secretary
Leslie, MD	Diane, RN	Buffy, Secretary
Joe, MD	Katie, RN	Mary Ellen, Secretary
Deb, NP	Bonnie, LPN	Kristy, Secretary
Ron, PA	Carole, LPN	Charlene, Secretary
Erica, RN	Nancy, LPN	
Laura, RN	Mary Beth, MA	
Maggi, RN	Lynn, MA	

Skill Mix: MDs 2.8 RNs 6.8 NP/PAs 2 MA 4.8 LPN ___ SECs 1

Measuring Team Performance & Patient Outcomes and Costs					
Measure	**Current**	**Target**	**Measure**	**Current**	**Target**
Panel size adj.			External referral adj. PMPM-Team		
Direct pt. care hours: MD/assoc.			Patient satisfaction		
% Panel seeing own PCP:			Access satisfaction		
Total PMPM adj. PMPM-Team			Staff satisfaction		

Source: Nelson, E. C., & Batalden, P. B., unpublished document, 1998.

a cultural, social, and political environment. Thus the clinical microsystem, although a comparatively simple concept, is still in fact a complex, adaptive system that evolves over time.

Complex adaptive systems are found in nature and in human groups. They can be contrasted with mechanical systems, which tend to be more predictable and not subject to emergent behavior. Fritof Capra, a noted physicist and author, suggests that a useful way to analyze complex adaptive systems arising in nature is to use a framework that addresses structure, process, and patterns (Capra, 1996; Nelson et al., 1998). Patterns are the consistent behaviors, sentiments, and results that emerge from the relationships of the parts involved in a complex adaptive system (Zimmerman, Lindberg, & Plsek, 1999).

Previous Research on Microsystems, Organizational Performance, and Quality

The clinical microsystem work described in this chapter represents an extension of the authors' earlier work on improvement in health care. For example, in 1996 the authors wrote a four-part series on clinical improvement that was published in the *Joint Commission Journal on Quality Improvement* (Nelson, Mohr, Batalden, & Plume, 1996; Nelson, Batalden, Plume, & Mohr, 1996; Mohr, Mahoney, Nelson, Batalden, & Plume, 1996; Batalden, Mohr, Nelson, & Plume, 1996). That series described concepts and methods for improving the quality and value of care provided for specific subpopulations of patients.

The microsystem work described herein amplifies this earlier work by taking into account the structural units—that is, clinical microsystems—responsible for delivering care to specific patient populations, and the manner in which these microsystems function, which involves the interplay of patients, professionals, processes, and patterns within and between microsystems. The primary emphasis of the authors' former work was on the clinical process that generates outcomes—quality and costs—for patients served by clinical systems. This new body of work retains a strong emphasis on clinical processes and patient-based outcomes but expands the frame to include

- An explicit focus on the local context—that is, the naturally occurring clinical units that form the front line of health care delivery
- Consideration of the information environment that supports or undermines care delivery
- The interactions and relationships among people within microsystems and the interactions between clinical microsystems that work together to provide comprehensive care

- The relationships between clinical microsystems and the larger systems in which they are embedded—for example, the mesosystems, macrosystem, and larger community

The research on microsystems described in this chapter generally builds on ideas developed by Deming (1986), Senge (1990), Wheatley (1992), and others who have applied systems thinking to organizational development, leadership, and improvement. The emerging fields of chaos theory, complexity science, and complex adaptive systems have also influenced our thinking (Arrow, McGrath, & Berdahl, 2000; Hock, 2005; Kelly, 1994; Peters, 1987; Wheatley, 1992).

The seminal idea for the microsystem in health care stems from work of James Brian Quinn that he summarized in *Intelligent Enterprise* (Quinn, 1992). In this book he reports on primary research conducted on the world's best-of-the-best service organizations, such as FedEx, Mary Kay Inc., McDonald's, Intel, SAS, and Nordstrom. His aim was to determine what these extraordinary organizations were doing to enjoy such explosive growth, high margins, and wonderful reputations with customers. He found that these service sector leaders organized around, and continually engineered, the frontline interface that connected the organization's core competency with the needs of the individual customer. Quinn called this frontline activity the *smallest replicable unit,* or the minimum replicable unit, that embedded the service delivery process. The smallest replicable unit idea—or the microsystem idea, as we call it—has critical implications for strategy, information technology, and other key aspects of creating intelligent enterprise. Two excerpts from Quinn's book convey the power and scope of this organizing principle and the need for senior leaders to focus their attention on creating the conditions to continually improve the performance of frontline delivery units.

- On core strategy: "Critical to relevant effective system design is conceptualizing the smallest replicable unit and its potential use in strategy as early as possible in the design process" (p. 104).
- On informatics and improvement: "Through careful work design and iterative learning processes, they both reengineered their processes to use this knowledge and developed databases and feedback systems to capture and update needed information at the micro levels desired" (p. 105).

Donaldson and Mohr (2000) investigated high-performing clinical microsystems; this research provided important background material for the IOM's Committee on Quality of Health Care in America in writing *Crossing the Quality Chasm.* Donaldson and Mohr's work was based on a national search for the highest-quality clinical microsystems. Forty-three clinical units were identified, and leaders

of those units participated in extensive interviews conducted by the report authors. The results of the interviews were analyzed to determine the characteristics that seemed to be most responsible for enabling these high-quality microsystems to be successful. The results suggested that eight dimensions were associated with high quality:

- 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 flows
- Ongoing measurement of outcomes
- Supportiveness of the larger organization
- Connection to the community to enhance care delivery and extend influence

Our study of clinical microsystems has built directly on Mohr and Donaldson's work.

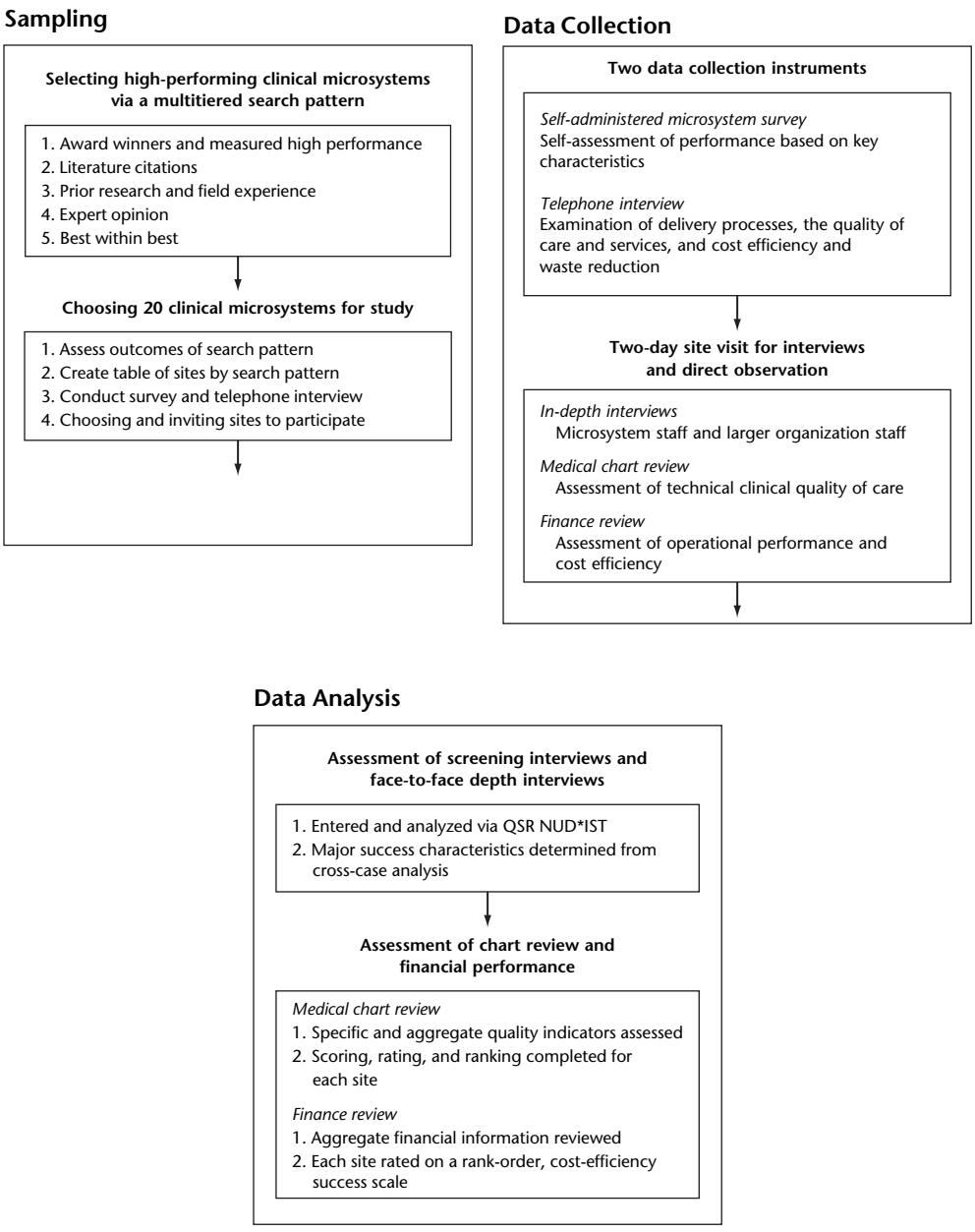
Study of Clinical Microsystems

The aim of our research study, which we conducted from June 2000 through June 2002, was to identify the success characteristics—the principles, processes, and methods—that high-performing clinical microsystems use to provide care that is characterized by both high quality and cost efficiency. Our method was to identify twenty high-performing clinical microsystems representing different parts of the care continuum and to study their performance through site visits, detailed personal interviews, direct observations, and reviews of medical record and financial information. The research was sponsored by the Robert Wood Johnson Foundation and was conducted by a research team based at Dartmouth Medical School's Center for the Evaluative Clinical Sciences. The research methods are described in more detail in the following section.

Research Design

The research design was an observational study that for the most part used qualitative methods, such as personal interviews and direct observations, with a limited review of medical records and analysis of financial data. Figure 1.4 displays an overview of the research design.

FIGURE 1.4. RESEARCH DESIGN FOR STUDY OF TWENTY CLINICAL MICROSYSTEMS.



Sampling

The objective was to select a total of twenty high-performing clinical microsystems (that is, small groups of people who work together regularly to provide care to discrete subpopulations of patients) that represented a number of different components of the care continuum: primary care, specialty care, inpatient care, nursing home care, and home health care.

First, to begin the process of identifying twenty of the best performers across North America, we employed five complementary search patterns:

- Award winners and measured high performance. We searched for clinical units that had won national or regional awards or had the best quality and cost measures in established databases.
- Literature citations. We searched, using resources such as Dow Jones Interactive, LexisNexis, Tablebase, and ProQuest, for clinical units prominently mentioned in the professional literature.
- Prior research and field experience. We used the lists of top-performing clinical units from prior research conducted by the Institute of Medicine (Donaldson & Mohr, 2000), and we used the field experience from the Institute for Healthcare Improvement's Breakthrough Series on the performance of the best-known clinical units.
- Expert opinion. We interviewed national health care leaders and quality-of-care experts to request their nominations for best-performing microsystems in North America.
- Best within best. We interviewed leaders of exemplary large organizations, such as the Mayo Clinic, Massachusetts General Hospital, Henry Ford Health System, and Scripps Clinic, and requested nominations for the best-performing small clinical units within their organizations.

Second, we entered the names of the identified clinical units into a table that enabled the research team to identify those microsystems that had garnered the most mentions across the five different search patterns and to review the strength of each clinical unit with respect to exemplary performance (120 sites identified). We then selected the most promising microsystems within each category (primary care, specialty care, inpatient care, nursing home care, and home health care) and invited these sites, using a mailed invitation and personal phone calls, to take part in an interview (75 sites invited).

Third, we conducted structured screening interviews over the telephone with potential sites and asked their leaders to complete a brief questionnaire that gathered further background information on each site and its quality-cost performance (60 sites completed a screening interview).

Fourth, we selected the final 20 sites on the basis of the results of the screening interview, questionnaire, and willingness to participate.

Data Collection

We used several methods to collect data for the project. To screen sites for possible inclusion in the study, we used two data collection instruments:

Self-administered microsystem survey. This fifteen-item survey was mailed to potential sites for self-completion and was used for self-assessment of performance based on key characteristics identified in Donaldson and Mohr's IOM study in 2000.

Telephone interview. A thirty-minute telephone survey was conducted with potential sites. Lead field researchers used a semistructured interview guide to gather data on the nature of the microsystem and its delivery processes, the quality of care and services, cost efficiency, and waste reduction.

After sites had been selected for inclusion in the study, a two-day site visit was held to conduct in-depth interviews and to provide an opportunity for direct observation. As part of this site visit, information was gathered using these methods:

In-depth interviews. An interview guide was used to conduct detailed, face-to-face interviews with staff in each microsystem. These interviews ranged in length from approximately twenty to ninety minutes, with most lasting either thirty or sixty minutes. Interviews were conducted with a mix of staff in each microsystem, to gain perspectives from all types of staff—the clinical leader, administrative leader, physicians, nurses, clinical technicians, clinical support staff, and clerical staff. In addition, interviews were held with selected staff (for example, the senior leader, financial officer, and information officer) of the larger organization of which the clinical microsystem was a part.

Medical chart review. A medical record expert who was part of the research team coordinated a review of medical records in each of the microsystems. A detailed protocol was used to select the medical records of 100 relevant patients of each clinical microsystem. These records represented cases involving typical services provided and medical problems commonly treated by the unit. Structured data collection forms were used to gather specific information on the technical quality of care provided in each clinical unit.

Finance review. Information related to the financial performance of each microsystem was collected from available data and reports, such as annual reports, quarterly reports, and productivity data reflecting operating revenues, operating costs, waste reduction efforts, and operational efficiency.

For each microsystem site, complete data included the screening survey; screening interview; personal, in-depth interviews; and medical and financial records. The interviews were documented by the study's lead field researcher (T.P.H.), using a tape recorder or taking detailed notes (or doing both). The only data set with partial information related to finance. With some notable exceptions most of the microsystems studied did not have sufficient accurate, detailed information to provide a sound basis for determining actual costs, revenues, and savings accrued over time. Financial information tended to reflect classic accounting system assumptions that focus detailed data collection on individual practitioners and standard departments rather than on the functional unit, the actual microsystem. Consequently, it was not possible to assess accurately each site's financial performance and productivity.

Data Analysis

The verbatim information from the screening interviews and the face-to-face, in-depth interviews was transcribed and entered into a content analysis program called QSR NUD*IST. The interview information was then analyzed, with the assistance of the content analysis software, using the method known as cross-case analysis (Miles & Huberman, 1994). This is a standard, qualitative research method that involves deconstructing all the meaningful utterances (interview segments) into individual text units and then placing the text units into affinity groups and reconstructing the information for the purpose of identifying common themes—in this case major success characteristics. Some text units had content that could be coded into two or more affinity groups, and the classification system we used allowed us to assign a text unit to one or more categories.

Major success characteristics can be described as the primary factors that these high-performing microsystems appeared to have in common and that appeared to be associated with high-quality and high-efficiency patterns of performance. Two members of the research team (T.P.H. and J.J.M.) independently analyzed all the verbatim content and placed the content into affinity groups (coding categories). Using conventional content analysis methods enabled these categories to evolve as case material was processed. The coding results from the two analysts were compared, and discrepancies between the two were discussed, and consensus was reached to resolve differences. The data were aggregated for each site to determine what proportion of the coded verbatim text units fell within each of the primary success characteristics.

The screening process was designed to identify high-quality, high-efficiency sites. The subsequent site visits provided strong confirmation that the site selection process was successful at identifying high performers. All twenty sites were exemplary in many ways. Nevertheless each site was to some extent unique and had its own set of particular strengths and further improvement opportunities with respect to quality and efficiency.

Results of the medical record reviews and financial analyses were used primarily to help us identify sites that might be especially promising for best-of-best processes and methods.

Analysis of the medical charts was based on a review of 100 randomly selected records, which were coded for five features of care:

- A problem list
- A medication list
- An allergy list
- Evidence of patient teaching
- A site-specific clinical measure of process or outcome quality (for example, glycosolated hemoglobin level or mortality rate) that was relevant for the patient subpopulation treated by the clinical unit

After all the data were in, some sites displayed evidence of superior performance across the board. That is to say, internal trend data on technical quality, health outcomes, costs, and revenues, in addition to the results from the site interviews and the medical record reviews, provided extremely strong evidence of stellar, summa cum laude performance. We used these sites somewhat more heavily in identifying best-of-best processes and methods within the set of twenty high-performing clinical units. We relied especially on several clinical microsystems that had extraordinary results. The members of this select group shared many common methods and processes, even though they were in different regions of the country and had little knowledge of one another. For example, all these units made extensive use of daily interdisciplinary huddles; monthly performance review sessions; data displays showing results over time; home-grown, real-time informatics solutions; and annual, all-staff retreats for establishing improvement themes and monitoring performance in mission-critical areas.

Results

The twenty clinical microsystems selected for study represented sixteen states and Canadian provinces (see Appendix 1.1 at the end of this chapter for a complete listing). There were four primary care practices, five medical specialty practices,

four inpatient care units, four home health care units, and three nursing home and hospice facilities. Many of these clinical microsystems were parts of larger, well-known systems, such as the Mayo Clinic, Massachusetts General Hospital, and Intermountain Health Care. Others, however, were parts of smaller, lesser-known organizations, such as Norumbega (Maine), ThedaCare (Wisconsin), and Intermountain Orthopedics (Idaho).

Success Characteristics of High-Performing Sites

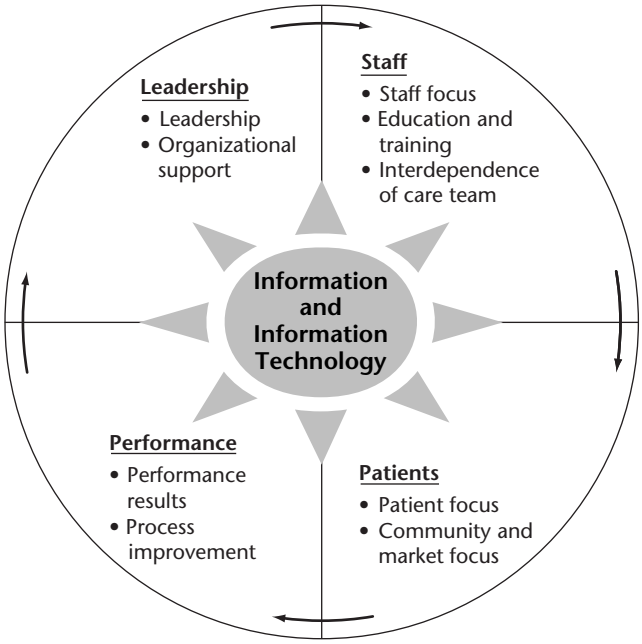
Analysis of the results suggests that each of the twenty high-performing clinical units is indeed a complex, dynamic system, with interacting elements that come together to produce superior performance. No single feature or success characteristic can stand alone to produce high-quality, high-value systemic results. That being said, these microsystems shared a set of primary success characteristics, and these characteristics interacted with one another to produce highly favorable systemic outcomes:

- Leadership of microsystem
- Macrosystem support of microsystem
- Patient focus
- Staff focus
- Interdependence of care team
- Information and information technology
- Process improvement
- Performance results

These primary success characteristics fall into five main groups and interact dynamically with one another. Figure 1.5 displays these groupings. It also shows two additional success characteristics that involve health professional education and training and the external environment (including the financial, regulatory, policy, and market environments) in which the microsystem is embedded. These themes were often mentioned in our research, although not as frequently as the primary ones we identified. A third additional theme, patient safety, was also identified, but again in a less frequent pattern so it was not included in the final success characteristics.

Content analysis of the interview text showed that seven of the eight primary success characteristics were mentioned frequently. For example, process improvement methods were mentioned in 13.5 percent of all text units coded, and staff focus was mentioned in 9.4 percent. Organizational support of microsystem (3.2 percent) was important but less frequently mentioned.

FIGURE 1.5. SUCCESS CHARACTERISTICS OF HIGH-PERFORMING CLINICAL MICROSYSTEMS.



There was substantial variation in the prominence of the primary success characteristics across sites. For example, leadership, which accounted for 7.7 percent of the coded comments on average, ranged from a high of 13.2 percent in a nursing home to a low of 3.1 percent in a home health site. Similarly, staff focus, which accounted for 9.4 percent of coded comments on average, ranged across sites from a high of 20.9 percent in a home health unit to 1.6 percent in a specialty medicine unit. This variation suggests that different clinical units in different contexts serving different types of patients may possess these success characteristics in greater or lesser degrees.

Principles Associated with the Success Characteristics

Each of the primary success characteristics reflects a broad range of features and also reflects underlying principles. Table 1.1 provides more information on the nature of the success characteristics and the illustrative principles that underlie them. For example, patient focus reflects a primary concern with meeting all patient

TABLE 1.1. SCOPE OF PRIMARY SUCCESS CHARACTERISTICS AND ILLUSTRATIVE UNDERLYING PRINCIPLES.

Scope of Success Characteristic	Illustrative Underlying Principle
Leadership. The role of leadership for the microsystem is to maintain constancy of purpose, establish clear goals and expectations, foster positive culture, and advocate for the microsystem in the larger organization. There may be several types of leaders in the microsystem, including *formal* leaders, *informal* leaders, and *on-the-spot* leaders.	The leader balances setting and reaching collective goals with empowering individual autonomy and accountability.
Organizational support. The larger organization provides recognition, information, and resources to enhance and legitimize the work of the microsystem.	The larger organization looks for ways to connect to and facilitate the work of the microsystem. The larger organization facilitates coordination and handoffs between microsystems.
Patient focus. The primary concern is to meet all patient needs—caring, listening, educating, responding to special requests, innovating in light of needs, providing a smooth service flow, and establishing a relationship with community and other resources.	We are all here for the same reason—the patient.
Staff focus. The microsystem does selective hiring of the right kind of people, integrates new staff into culture and work roles, and aligns daily work roles with training competencies. Staff have high expectations for performance, continuing education, professional growth, and networking.	A *human resource value chain* links the microsystem's vision with real people on the specifics of staff hiring, orienting, and retaining and of providing continuing education and incentives for staff.
Education and training. Expectations are high regarding performance, continuing education, professional growth, and networking.	Intentional training and development of all staff is key to professional formation and optimal contributions to the microsystem.
Interdependence of care team. The interaction of staff is characterized by trust, collaboration, willingness to help each other, appreciation of complementary roles, and recognition that all contribute individually to a shared purpose.	A multidisciplinary team provides care. Every staff person is respected for the vital role he or she plays in achieving the mission.

(*continued*)

TABLE 1.1. (*Continued*)

Scope of Success Characteristic	Illustrative Underlying Principle
Information and information technology. Information is essential; technology smoothes the linkages between information and patient care by providing access to the rich information environment. Technology facilitates effective communication, and multiple formal and informal channels are used to keep everyone informed all the time, help everyone listen to everyone else's ideas, and ensure that everyone is connected on important topics.	Information is *the* connector—staff to patients, staff to staff, needs with actions to meet needs. The information environment is designed to support the work of the clinical microsystem. Everyone gets the right information at the right time to do his or her work.
Process improvement. An atmosphere for learning and redesign is supported by the continuous monitoring of care, the use of benchmarking, frequent tests of change, and a staff empowered to innovate.	Studying, measuring, and improving care is an essential part of our daily work.
Performance results. Performance focuses on patient outcomes, avoidable costs, streamlining delivery, using data feedback, promoting positive competition, and frank discussions about performance.	Outcomes are routinely measured, data is fed back to the microsystem, and changes are made based on the data.

needs—caring, listening, educating, responding to special requests, innovating in light of needs, providing a smooth service flow, and establishing a relationship with community and other resources—and can be encapsulated with a simple principle: we are all here for the same reason—the patient.

Specific Examples of Success Characteristics

The site interviews provide many varied and rich examples of the ways that the primary success characteristics manifest themselves in these clinical microsystems. Table 1.2 provides some examples from the original interview notes for each of the primary success characteristics. For example, here is a typical statement revealing patient focus: "At first you think you would miss the big cases that you had at a general hospital, and you do at first, but then after a while you realize they were just cases. Here you get to interact with the patient and the patient is not just a case but instead is a person."

TABLE 1.2. SPECIFIC EXAMPLES OF THE PRIMARY SUCCESS CHARACTERISTICS.

Success Characteristic	Specific Example
Leadership	"Leadership here is fantastic, they outline the picture for us and provide a frame, then hand us the paint brushes to paint the picture."
	"I have been here for 25 years and it has allowed me to create a system that allows me the freedom to interact and manage the staff like human beings. I get to interact with them as real people and being highly organized allows that flexibility."
Organizational support	"We are not one of the top priorities so we have been left alone; I think that's been one of the advantages. We have a good reputation, and when we need something we get it. The larger organization is very supportive in that we get what we want, mostly in terms of resources."
	"One of the things that we do fight quite often is the ability to create the protocols that fit our unit, the larger organization protocols don't work. We need to tweak them—and so we do."
Patient focus	"At first you think you would miss the big cases that you had at a general hospital, and you do at first, but then after a while you realize they were just cases. Here you get to interact with the patient and the patient is not just a case but instead is a person."
	"I think medicine had really come away from listening to the patient. People can come in here for a heart disease appointment and all of a sudden they will start to cry. You think, okay, let's see what else is going on. I'd like to think our clinical team is real sensitive to that. . . . 'My wife left me, I don't see my kids anymore, my job is going down hill.' Jeez and you're feeling tired? I wonder why. . . . Our purpose is to set an example to those who have forgotten about what it means to be in medicine, which is to help people. It's not about what is the most expensive test you can order."
	"We created the unit for patients first. For instance, when we designed the new [unit], we didn't give up family room space."
Staff focus	"We have high expectations about skills and how we hire new staff. . . . When we hire new staff we look for interpersonal skills, and a good mesh with values and the mission. We can teach skills but we need them to have the right attitude."
Education and training	"I like molding people into positions. . . . I would rather take someone with no experience and mold them than take someone who thinks they already know everything. We have a way of doing things here for a reason, because it works, so we want people to work here that can grasp this and be part of the organization."

(*continued*)

TABLE 1.2. (*Continued*)

Success Characteristic	Specific Example
	"They allow you here to spread your wings and fly. There are great safety nets as well. You can pursue initiatives. There are always opportunities. They encourage autonomy and responsibility."
Interdependence of care team	"Together, the team works. When you take any part away, things fall apart. It's really the team that makes this a great place to work."
	"We decided as a team that our patients needed flu vaccinations, so we all volunteered on a Saturday, opened the practice and had several hundred patients come through. We ended up doing quite a bit more than flu shots including lab work, diabetic foot checks and basic checkups."
	"Here it's a real team atmosphere. Nobody gets an attitude that is disruptive. People get past the point of acting as individuals and instead work as a real team. It seems that people respect each other. For instance, when I get a new prescription, I go to the residents first. I don't try to bypass them by going to other staff alone. I will sometimes ask the residents to come with me to talk to other staff to make sure we are doing the right thing for the patient."
Information and information technology	"We use face-to-face, e-mail, and telephone. All of us try to get to the five different clinics. We have about 250 people in our staff. I know all of them, and [the executive director] and [the director of disease care] know most of them. It's about staying in touch. . . . And there is good documentation."
	"We have a system of electronic discharge. The computer is great. The physician anywhere in a satellite clinic has instantaneous access."
	"We have good information systems on labs, outpatient notes, immunization, pharmacy. . . . For instance, the immunization record here is linked to the state database. So they can get that information directly."
Process improvement	"It goes back to our processes. When we talk about how we do something in our office, we create a flow sheet. We get out the yellow stickies and we talk about every step in the process. And as a group we come up with this. Then we step back and we look at all this extra work that we make for ourselves, and then we streamline it."
	"Buried treasure. We are constantly on the lookout for tiny things that will improve care for our patients or our own lives, whether it's financial, a system component that needs improvement, or a process change."
	"I can tell you when I was practicing by myself it was painful at times, to say, 'Here you've got to do this,' and you know we're going to shut down the practice for half a day to get people really up to speed in these principles. But I would say, if you look at industry, they've learned that . . . you have to do that. The Toyota plant out in Fremont,

(*continued*)

TABLE 1.2. SPECIFIC EXAMPLES OF THE PRIMARY SUCCESS CHARACTERISTICS. (*Continued*)

Success Characteristic	Specific Example
	California, being one of the more prominent examples. The GM executives asked just exactly that. 'How can you afford to shut down the production line?' and they say, 'Well how can you afford *not* to shut down the production line?'"
Performance results	"It takes a little over a minute for us to turn around an operating room. Since we do the same surgery and we know how many cases there will be in each room, we have shelves with operating packs that after a surgery can be replaced very fast with all the appropriate tools."
	"We have a very low disposable cost per case, around $17–$18, compared to an average hospital that has $250–$500 for a similar case."
	"We have the lowest accounts receivable in the entire system. We are very proud of this. What we did was basically look at every category of expense and worked through each detail to get to the most efficient care, for instance, scheduled drugs via the pharmacy."

Best Practices: Processes and Methods Associated with High Performance

The study of the high-performing sites generated many *best practice* ideas (processes and methods) that microsystems use to accomplish their goals. Some of these noteworthy practices are discussed in *The Clinical Microsystem Action Guide* (Godfrey et al., 2002). Although a complete list of all these noteworthy practices is beyond the scope of this chapter, Table 1.3 provides a sampling of them across the major themes. For example, one process used in many sites to ensure that the patient focus was correct was to hold a daily case conference to discuss the status of each patient and to develop an optimal treatment plan that best matched the patient's changing needs.

Discussion

The results showed that the top-performing clinical units were vibrant, vital, dynamic, self-aware, and interdependent small-scale clinical organizations led with intelligence and staffed by skilled, caring, self-critical staff. Although each clinical unit was extraordinary and unique in many respects, each nevertheless shared ten success characteristics that interacted with each other dynamically and over time to produce superior, efficient care and services.

The success characteristics were generally consistent with the findings of the IOM's 2001 report *Crossing the Quality Chasm,* but there was one important

TABLE 1.3. ILLUSTRATIVE BEST PRACTICES USED BY HIGH-PERFORMING CLINICAL MICROSYSTEMS.

Best Practice Category	Description of Noteworthy Practice
Leading organizations	• Annual retreat to promote mission, vision, planning, and deployment throughout microsystem • Open-door policy among microsystem leaders • Shared leadership within the microsystem (for example, among physician, nurse, and manager) • Use of storytelling to highlight improvements needed and improvements made • Promotion of culture to value reflective practice and learning • Intentional discussions related to mission, vision, values
Staff	• Daily huddles to enhance communication among staff • Daily case conferences to focus on patient status and treatment plans • Monthly all staff (*town hall*) meetings • Continuing education *designed into* staff plans for professional growth • Screening of potential hires for attitude, values, and skill alignment • Training and orientation of new staff into work of microsystem
Information and information technology	• Tracking of data over time at microsystem level • Use of *feed forward* data to match care plan with changing patient needs • Information systems linked to care processes • Inclusion of information technology (IT) staff on microsystem team
Performance and improvement	• Use of benchmarking information on processes and outcomes • Use of *data walls* and displays of key measures for staff to view and use to assess microsystem performance • Extensive use of protocols and guidelines for core processes • Encouragement of innovative thinking and tests of change

difference. This was the emergence of leadership as a key success factor at the microsystem level. Careful review of the IOM findings and discussion with the report's lead investigator (J. J. Mohr, telephone conversations with E. C. Nelson, November 2001), however, reveal that leadership was threaded through many of the eight dimensions discussed in that report and was strongly present in the

high-performing microsystems that were studied. Thus some of the difference between our findings and the IOM findings arises from the use of different systems of classification when examining study results.

The results from our study differ from Quinn's findings reported in *Intelligent Enterprise* (Quinn, 1992), which were derived from study of world-class service organizations outside the health care sector. The senior leaders Quinn studied had a laserlike strategic and tactical focus on the smallest replicable units within their organizations. They viewed those units as the microengines that generated quality and value for their customers, as the vital organs that linked customers with the organization's core competency through the actions taken by frontline service providers at what we are calling the sharp end. Given the importance that Quinn's leaders placed on these units, they iteratively designed, improved, provided incentives for, monitored, and replicated units throughout the organization. In contrast, the senior leaders of the larger delivery systems in which our twenty high-performing health care microsystems were embedded were for the most part not focused on supporting excellence in the frontline clinical units. These health system leaders showed some recognition of outstanding performance and some degree of special assistance for outstanding units, but they lacked a strategic focus on creating the conditions that would generate excellent interdependent performance in all the microsystems that constituted their health system. In short they did not make the attainment of microsystem excellence a basic pillar of their management strategy.

Finally, our microsystem study has some important limitations, briefly summarized in the following list:

Reality and reductionism. The reality of clinical microsystems and the health systems in which they are embedded is immensely complex. To study it and learn about it, we inevitably had to reduce, enormously, the actual reality to a relatively small number of features, dimensions, and interactions. Much is lost in this reduction. By focusing down on *this* we tend to ignore all of *that.*

Methods. The case study approach adopted for this study gave us scope and depth of analysis but also tended to produce bias in several ways. For example, in case studies the point of view of the investigators will create insights in some areas and cause blind spots in others. Some of the staff interviewed may be inclined to place their organization in a somewhat more favorable light than warranted by actual conditions and may direct the investigators to learn more about its strengths than its weaknesses.

Sample. The observations are based on a small sample of just twenty microsystems that were drawn purposefully from a universe of microsystems that numbers in the tens of thousands.

Data. The data used in the study were primarily subjective and qualitative. Only limited amounts of objective data were gathered and used in the research.

Analysis. The method of content analysis, although it is a conventional and time-honored research tool, requires classification of the raw data—in this case the text units from the interviews—by the researchers. A different research team analyzing the same raw interview content might arrive at different conclusions.

Time-limited findings. The observations are cross-sectional and time limited. Although the microsystems themselves are likely to be changing in small and large ways over time and although each has its own development history and staging, the study "sliced" into the world of each microsystem and "biopsied" its structure, content, processes, outcomes, and patterns at a single point in time.

In sum the methods that were used to learn about clinical microsystems were conventional and useful, but they are clearly imperfect and restricted in diverse, important ways. Much remains to be done to quantitatively validate these findings and to make them predictive for health system and clinical microsystem leaders.

Practical Implications

This opening chapter introduced the new idea—of microsystem thinking—and summarized important research on what makes some microsystems so very good. There are grounds for excitement and hope for the health care system if we can put these ideas to work in the real world of health care delivery. Of course, as Robert Galvin, the director of Global Healthcare for General Electric, has written: "there is a reason to be cautious. New ideas in health care have a tendency to oversimplify and overpromise. Whether it be managed care, continuous quality improvement, or defined contribution, proponents seem to subscribe to the 'domino theory' of health policy: that is if only this one new idea could be applied appropriately, the great stack of complicated issues in health care would fall into place one by one" (Galvin, 2001, p. 57).

As discussed at the outset of this chapter, the health system is immense, complex, and able to deliver delightful and dreadful care. Change must contend with a linked chain of effect that connects individual patients, communities, and clinicians with small, naturally occurring frontline units and these units with countless large and small host organizations, all of which exist in a modulating policy, legal, social, financial, and regulatory environment. Oversimplification of the health system is as common as it is foolhardy.

Yet with this caution in mind, we believe that the critical role of these naturally occurring, small clinical units, which represent a vital link in the larger health care chain of effect, has been largely ignored. For the most part, fundamental changes in the health system have been directed elsewhere—at clinicians, consumers, purchasers, large managed care organizations, reimbursement policymakers, and so on—and have for the most part ignored targeting the system's essential building blocks.

The domino effect cannot ripple through the system if some of the dominoes are absent. Clinical microsystem thinking has been absent in health system reform. Once again we are reminded of Quinn's observation, "Critical to relevant effective system design is conceptualizing the smallest replicable unit and its potential use in strategy as early as possible in the design process" (Quinn, 1992, p. 104).

We hope that the remaining chapters in this book on clinical microsystems will provide useful theories and models, practical ideas, and helpful tools that readers can use to

- Plan individual patient care and efficient services
- Create rich information environments
- Promote the strategic spread of high-performing clinical microsystems that excel at meeting patients' needs and are stimulating work environments

Conclusion

Clinical microsystems are the smallest replicable units in the health system. Health system redesign can succeed only with leaders who take action to transform these small clinical units in order to optimize performance to meet and exceed patient needs and expectations and to perfect the linkages between the units. A seamless, patient-centered, high-quality, safe, and efficient health care system cannot be realized without the transformation of the essential building blocks that combine to form the care continuum.

APPENDIX 1.1. THE TWENTY SITES EXAMINED IN THE CLINICAL MICROSYSTEM STUDY.

Name of Microsystem	Location	Name of Macrosystem
	Home Health Care	
Gentiva Rehab Without Walls	Lansing, MI	Gentiva Health Services
Interim Pediatrics	Pittsburgh, PA	Interim HealthCare of Pittsburgh
On Lok SeniorHealth Rose Team	San Francisco, CA	On Lok SeniorHealth
Visiting Nursing Service Congregate Care Program, Queens Team 11S	New York, NY	Visiting Nursing Service of New York
	Inpatient Care	
Henry Ford Neonatal Intensive Care Unit	Detroit, MI	Henry Ford Hospital, Henry Ford Health System
Intermountain Shock/Trauma/Respiratory Intensive Care Unit	Salt Lake City, UT	Latter-Day Saints Hospital, Intermountain Healthcare
Center for Orthopedic Oncology and Musculoskeletal Research	Washington, DC	Washington Cancer Institute, Washington Hospital Center, MedStar Health
Shouldice Hernia Repair Centre	Thornhill, Canada	Shouldice Hospital
	Nursing Home Care	
Bon Secours Wound Care Team	St. Petersburg, FL	Bon Secours Maria Manor Nursing and Rehabilitation Center
Hospice of North Iowa	Mason City, IA	Mercy Medical Center North Iowa, Mercy Health Network
Iowa Veterans Home, M4C Team	Marshalltown, IA	Iowa Veterans Home, Veterans Commission
	Primary Care	
Grace Hill Community Health Center	St. Louis, MO	Grace Hill Neighborhood Health Centers, Inc.
Massachusetts General Hospital Downtown Associates Primary Care	Boston, MA	Massachusetts General Hospital, Partners Healthcare
Evergreen Woods Office	Bangor, ME	Norumbega Medical, Eastern Maine Healthcare
ThedaCare Kimberly Office Family Medicine	Kimberly, WI	ThedaCare Physicians

(*continued*)

APPENDIX 1.1. THE TWENTY SITES EXAMINED IN THE CLINICAL MICROSYSTEM STUDY (*Continued*).

Name of Microsystem	Location	Name of Macrosystem
	Specialty Care	
Dartmouth-Hitchcock Spine Center	Lebanon, NH	Dartmouth-Hitchcock Medical Center
Midelfort Behavioral Health	Eau Claire, WI	Midelfort Clinic at Luther Campus, Mayo Health System
Orthopedic Specialty Practice	Boise, ID	Intermountain Healthcare
Overlook Hospital Emergency Department	Summit, NJ	Overlook Hospital, Atlantic Health System
Sharp Diabetes Self Management Training Center	La Mesa, CA	Grossmont Hospital, Sharp HealthCare

References

Arrow, H., McGrath, J., & Berdahl, J. (2000). *Small groups as complex systems.* Thousand Oaks, CA: Sage.

Batalden, P. B., Mohr, J. J., Nelson, E. C., & Plume, S. K. (1996). Improving health care: Part 4. Concepts for improving any clinical process. *Joint Commission Journal on Quality Improvement, 22*(10), 651–659.

Berwick, D. (2001). Which hat is on? Plenary Address at the Institute for Healthcare Improvement's 12th Annual National Forum, Orlando, FL.

Capra, F. (1996). *The web of life: A new scientific understanding of living systems.* New York: Anchor Books.

Deming, W. E. (1986). *Out of the crisis.* Cambridge, MA: MIT Center for Advanced Engineering Study.

Donaldson, M., & Mohr, J. (2000). *Exploring innovation and quality improvement in health care microsystems: A cross-case analysis.* Technical Report for the Institute of Medicine Committee on Quality of Health Care in America. Washington, DC: Institute of Medicine.

Galvin, R. (2001). The business case for quality. *Health Affairs, 20*(6), 57–58.

Godfrey, M. M., Batalden, P. B., Wasson, J. H., & Nelson, E. C. (2002). *Clinical microsystem action guide* (Version 2.1). Hanover, NH: Dartmouth Medical School.

Hock, D. (2005). *One from many.* San Francisco: Berrett-Koehler.

Institute of Medicine (U.S.), Committee on Quality of Health Care in America. (2001). *Crossing the quality chasm: A new health system for the 21st century.* Washington, DC: National Academies Press.

Kabcenell, A. (2002). Pursuing perfection: An interview with Don Berwick and Michael Rothman. *Joint Commission Journal on Quality Improvement, 28,* 268–278.

Kelly, K. (1994). *Out of control: The rise of neo-biological civilization.* Reading, MA: Addison-Wesley.

Miles, M., & Huberman, A. (1994). *An expanded sourcebook: Qualitative data analysis.* Thousand Oaks, CA: Sage.

Mohr, J. J., Mahoney, C. C., Nelson, E. C., Batalden, P. B., & Plume, S. K. (1996). Improving health care: Part 3. Clinical benchmarking for best patient care. *Joint Commission Journal on Quality Improvement, 22*(9), 599–616.

Nelson, E. C., Batalden, P. B., Mohr, J. J., & Plume, S. K. (1998). Building a quality future. *Frontiers of Health Service Management, 15*(1), 3–32.

Nelson, E. C., Batalden, P. B., Plume, S. K., & Mohr, J. J. (1996). Improving health care: Part 2: A clinical improvement worksheet and users' manual. *Joint Commission Journal on Quality Improvement, 22*(8), 531–547.

Nelson, E. C., Mohr, J. J., Batalden, P. B., & Plume, S. K. (1996). Improving health care: Part 1. The clinical value compass. *Joint Commission Journal on Quality Improvement, 22*(4), 243–258.

Nelson, E. C., Splaine, M. E., Godfrey, M. M., Kahn, V., Hess, A., Batalden, P., et al. (2000). Using data to improve medical practice by measuring processes and outcomes of care. *Joint Commission Journal on Quality Improvement, 26*(12), 667–685.

Peters, T. J. (1987). *Thriving on chaos: Handbook for a management revolution.* New York: Knopf.

Quinn, J. B. (1992). *Intelligent enterprise: A knowledge and service based paradigm for industry.* New York: Free Press.

Rutherford, P., Lee, B., & Greiner, A. (2004). *Transforming care at the bedside.* Retrieved June 20, 2006, from http://www.ihi.org/IHI/Results/WhitePapers/TransformingCareattheBedsideWhitePaper.htm.

Senge, P. M. (1990). *The fifth discipline: The art and practice of the learning organization.* New York: Doubleday.

Wheatley, M. J. (1992). *Leadership and the new science: Learning about organization from an orderly universe.* San Francisco: Berrett-Koehler.

Zimmerman, B., Lindberg, C., & Plsek, P. (1999). *Edgeware: Insights from complexity science for health care leaders.* Irving, TX: VHA.