Executive Summary for Health Care Leaders

Microsystems in Health Care:
The Essential Building Blocks of High Performing Systems

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Importance of Focusing Attention on Clinical Microsystems

The Problem is the System

The health care system in the United States can, under certain conditions and in special locations, deliver magnificent, sensitive, state-of-the-art care. It can snatch life from the jaws of death and produce medical miracles. The true case study of Ken Bladyka, cited below, is one example of our system performing at a stellar level.

Our health care system, however, is often severely flawed and dysfunctional. The Institute of Medicine’s recent report *Crossing the Quality Chasm: A New Health System for the 21st Century* makes the point of system failure crystal clear.¹

- “Health care today harms too frequently and routinely fails to deliver its potential benefits.”
- “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.”
- “During the last decade alone, more than 70 publications in leading peer-reviewed clinical journals have documented serious quality shortcomings.”
- “The current system cannot do the job. Trying harder will not work. Changing systems of care will.”

So the question is, what is the true nature of our health system—sometimes it works well, but all too often it fails to deliver what is needed? (Refer to Bladyka Case sidebar, Page 4.)

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

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

- Clinical staff working together (or against each other)
- In smooth running, front line, health care units (or tangles)
- Information readily available, flowing easily, and in a timely fashion (or not)
- That are often embedded in helpful larger organizations (or cruel Byzantine bureaucracies)
- That are seamlessly linked together (or totally disjointed)
High-quality, sensitive, efficient (or harmful, even lethal, wasteful, and expensive) care

In brief, it can be said that the true structure of the health system is composed of a few basic parts – front line clinical microsystems plus overarching larger organization plus patient subpopulations needing care. As the Bladyka case illustrates, “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.”

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

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

Dr. Donald Berwick, MD, President and CEO of the Institute for Healthcare Improvement summarizes the foregoing ideas with a diagram he calls the “chain of effect in improving health care quality.” Figure 1 shows the “chain of effect” and highlights the pivotal role that is played by the microsystems of care delivery. To bring about fundamental change in the health system of the magnitude required, there will need to be systematic transformation at all levels of the system. Although many attempts have been made to change the system – by focusing on 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 front line clinical units that actually create, support, and deliver the care. To move towards a “perfected” system of care, the performance of each individual microsystem must be optimized and the linkages between different 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 focus on the transformation of health care at the front line of service delivery.
The Bladyka Case

Ken Bladyka is a 40-year-old man with a wife, two children, a 6th degree black belt, and several national and international karate gold medals. Last summer while attending the AAU 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 as his arms and legs. 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 to report findings
- Family physician sees Ken and Paige on July 4th
- 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 is 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 prn
- Ken’s four siblings are tested for bone marrow at DHMC, Hartford, CT and San Francisco, CA
- 1 sibling, his sister Mary, has positive match
- Ken begins 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 begins at FHCRC
- 9/10 Bone marrow transplant procedure is done at FHCRC
- 9/12 Ken celebrates his 40th birthday while an inpatient at FHCRC
- 9/27 Ken transfers 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 to return to home and family and work …

Figure 2 depicts Ken’s health system journey using a flowchart. It shows the front line clinical units, i.e., the small group of people who worked directly with Ken at each step of his care, such as the family doctor office, the DHMC hematology inpatient unit, the bone marrow testing units, etc. These small front line clinical units can be seen as clinical “microsystems.” It also shows the larger umbrella organizations, or “macrosystems,” such as Dartmouth-Hitchcock Medical Center, Fred Hutchinson Cancer Research Center, etc. that played a part in the care. The Bladyka case study provides a glimpse of the true structure of the health system. But before boring in on the true structure of the delivery system it is important to emphasize some facts that arise from the Bladyka case:
1. This could happen to you.
2. This could happen to your family and friends.
3. Ken needs high-quality, safe, and affordable care.
4. Ken found front line health systems that met his special needs – these were pockets of gold that were spread across the country.
5. We need a solid gold system – i.e., high-quality, high-value, high-reliability system – throughout the nation to serve all Americans.
Describing Clinical Microsystems

Microsystems include patients, clinical people, processes, and recurring patterns – cultural patterns, information flow patterns, and results patterns. Microsystems in health care can be defined 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 both clinical and business aims, linked processes, a shared information environment, and produces performance outcomes. Microsystems evolve over time and are often embedded in larger organizations. They are complex adaptive systems and as such they must: (a) do the primary work associated with core aims, (b) meet the needs of internal staff, and (c) maintain themselves over time as a clinical unit.

Microsystems are the essential building blocks of the health system. They can be found everywhere and vary widely on quality, safety, and cost performance. Microsystems are the local milieu in which patients, providers, support staff, information, and processes converge for the purpose of obtaining and providing care to meet health needs. If a person were to explore his local health system he would discover myriad clinical microsystems: 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, etc. As described in the Bladyka case, 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 units is challenged by our conventions for managing human resources, information, and cost. Our commitment to professional disciplines and specialties as a prime organizing principle often creates barriers that impede the daily work of clinical microsystems.

The Physiology of a Clinical Microsystem

Another way to describe clinical microsystems is with a high level diagram that portrays its “physiology” – the biological-like dynamic of inputs, processes, outputs, and feedback loops of the microsystem organism.
Figure 3 illustrates the physiology of a typical internal medicine practice using a microsystem framework. This clinical microsystem, like all others, is composed of patients who form different subpopulations, e.g., healthy, chronic, and high-risk. The patients interact with clinical and support staff who perform distinct roles, e.g., physician, nurse, nurse practitioner, medical assistant, receptionist, etc. The patients and clinical staff work to meet patients’ needs by engaging in direct care processes – accessing system, assessing needs, diagnosing problems, establishing treatment plans, providing information, delivering service(s), 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, billing, etc. The result of the interaction between patients and staff and clinical and support processes is to produce patterns of critical results – biological 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, for instance, what it “feels like” to work in the clinical unit, as well as elements of business success such as direct costs, operating revenues, productivity, etc. Importantly, the clinical unit has a semi-permeable boundary that mediates relationships with patients and with many support services and external microsystems. Furthermore, it is embedded in, influences, and is influenced by, a larger organization which itself is embedded in a certain environment – a payment environment, a regulatory environment, a cultural-socio-political environment. Thus, the simple concept of a clinical microsystem is in fact a complex, adaptive system that evolves over time.

Prior Research on Microsystems, Organizational Performance and Quality

The research in this report draws on a prior body of work that is briefly cited below.

Organizations as Systems, Complexity Science and Complex Adaptive Systems

This research generally builds on ideas developed by Deming, Senge, Wheatley and others who have applied systems thinking to organizational development, leadership and improvement. In addition, the emerging fields of chaos theory, complexity science, and complex adaptive systems have influenced our thinking.
Quinn, 1992: Intelligent Enterprise: Strategy, Tactics and the Smallest Replicable Unit

The seminal idea for the microsystem in health care, however, stems from the work of James Brian Quinn that was summarized in his 1992 book, Intelligent Enterprise.11 Quinn’s book is based on primary research that he conducted on the world’s best-of-best service organizations such as Federal Express, Mary Kay Cosmetics, McDonald’s, and Nordstrom’s. His aim was to determine what these extraordinary organizations were doing to enjoy such explosive growth, high margins, and wonderful reputations with customers. A key finding was that these leading service organizations planned around, and continually engineered, the front line interface relationship that connected the organization’s core competency with the needs of the individual customer. Quinn called this front line 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, has critical implications for strategy, for 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 – i.e., a senior leader focus on continually improving the performance of the front line 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.”
- 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.”

IOM, 2000: First Study of Clinical Microsystems

This research builds directly on a recent study, supported by the Institute of Medicine and the Robert Wood Johnson Foundation, by Mohr and Donaldson. The purpose of their study was to investigate high-performing clinical microsystems.12 Their research was based on a national search for the highest quality clinical microsystems. Forty-three clinical units were identified and leaders of these units participated in in-depth interviews conducted by the 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. Their results suggested that eight dimensions were associated with high quality:

- Constancy of purpose for quality
- 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

The IOM Study was the direct forerunner of the research that is described next.

**RWJ Study: Research on Clinical Microsystems**

The aim of this research program 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 efficiency. The method was to identify twenty high-performing clinical microsystems from different parts of the care continuum and to study their performance based on 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 the Center for the Clinical Evaluative Clinical Sciences at Dartmouth.

**Research Design**

The research design was an observational study that, for the most part, used qualitative methods such as personal interviews and direct observations. The interviews and observations were supplemented with a limited review of medical records and analysis of financial data. An overview of the research design is provided in Figure 4.

**Sampling**

The objective was to select a total of twenty high-performing clinical microsystems that represented 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 from across North America, we employed five complementary search patterns:

1. **Award Winners and Measured High Performance**: Searched for clinical units that had won national or regional awards and/or had best quality-cost measures in established databases.

2. **Literature Citations**: Searched for clinical units that were prominently mentioned in the professional literature using resources such as Dow Jones Interactive, LexisNexis, TableBase, and ProQuest.

3. **Prior Research and Field Experience**: Used the lists of top performing clinical units from prior research conducted by the Institute of Medicine and used the field experience from the Institute for Healthcare Improvement's clinical performance “Breakthrough” series on best-known clinical units.

4. **Expert Opinion**: Interviewed national health care leaders and quality of care experts to request their nominations for best performing microsystems in North America.

5. **Best within Best**: Interviewed leaders of exemplary large organizations, such as Mayo Clinic, Massachusetts General Hospital, Henry Ford Health System, and the Scripps Clinic, and requested nominations for best performing small clinical units within their enterprise.

Second, the names of the clinical units that were identified in this way were entered into a table that enabled the research team to identify those microsystems that garnered the most mentions across the five different search patterns and to review the strength of each potential clinical unit with respect to exemplary performance. The research team then selected the most promising microsystems within each category (i.e., primary care, specialty care, inpatient care, etc.) and invited these sites, using a mailed invitation and personal phone calls, to take part in an interview. Third, a structured screening interview was conducted over the telephone with potential sites and the leaders of these sites were asked to complete a brief questionnaire that gathered further background information on each site and their quality-cost performance. Fourth, a total of twenty sites were selected based on the results of the screening interview, questionnaire, and willingness to participate.

The numbers of clinical sites involved in each of the phases of sampling listed above was: (1) 120 sites were identified in phase one search and included in the initial table of candidate organizations, (2) 75
sites were invited to participate in the screening interview, (3) 60 sites completed the screening interview, and (4) 20 sites was the final number selected for study.

Data Collection

Data for the project were collected using several different methods. To screen sites for possible inclusion in the study, we used two data collection instruments:

- Self-Administered Microsystem Survey: This 15-item survey was mailed to potential sites for self-completion and was used for self-assessment of performance based on key characteristics identified in the IOM Study by Mohr and Donaldson.
- Telephone Interview: A 30-minute telephone survey was conducted with potential sites based on a semi-structured interview guide that was used to gather data on the nature of the microsystem and delivery processes, the quality of care and services, and on 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 limited direct observation. We gathered information 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 20 to 90 minutes with most interviews lasting either 30 or 60 minutes. Interviews were conducted with a mix of staff within each microsystem to gain the perspective from all types of staff—clinical leader, administrative leader, physicians, nurses, clinical technicians, clinical support staff, clerical staff. In addition, interviews were held with selected staff (e.g., senior leader, financial officer, informatics leader) from the larger organization of which the clinical microsystem was a part.
- Medical Chart Review: A medical records expert, who was part of the research team, coordinated a limited review of medical records in each of the microsystems. A detailed protocol was used to select the medical records of 100 relevant patients within each clinical microsystem and structured data collection forms were used to gather specific information on the technical quality of care that was provided in each clinical unit.
• Finance Review: Information related to the financial performance of each microsystem was collected based on available data and reports such as annual reports, quarterly reports, and productivity data reflecting operating revenues, operating costs, waste reduction efforts, and operational efficiency.

Data Analysis

In general, the completeness of the data from the screening survey, screening interview, personal in-depth interviews and medical records was quite good and adequate for the task. The interviews were documented by the study’s lead field researcher using a tape recorder and/or by taking detailed notes. The area that had the most incomplete information was finance. With some notable exceptions, most of the microsystems studied did not have accurate, detailed information, at the microsystem level, to provide a sound basis for determining actual costs, revenues, and savings accrued over time. This was because financial information tended to follow organizing assumptions that failed to acknowledge the clinical microsystem as a unit of health care service production.

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. This is a standard qualitative research method that involves “deconstructing” all of 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 have content that can be coded into two or more affinity groups and the classification system that we used provided for a text unit to be classified into one or more categories.

Major success characteristics can be described as the primary factors that these high-performing microsystems appear to share in common and which appear to be associated with high quality and high-efficiency performance. Two members of the research team independently analyzed all of the verbatim content and placed them into affinity groups (coding categories). These categories - success characteristics - evolved over the course of the content analysis. Coding results between the two analysts were compared and discrepancies between the two analysts were discussed and consensus reached to resolved differences.
The data were aggregated, within 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. To gain fuller understanding of each site’s quality and cost performance and processes, we conducted limited medical record reviews and financial analyses. These results were used primarily to help identify which sites might be especially good ones to reveal “best-of-best” processes and methods.

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

(a) Problem list,
(b) Medication list,
(c) Allergy list,
(d) Evidence of patient teaching, and
(e) A site-specific clinical measure of process or outcome quality (e.g., Hg 1A/c level, mortality rate, etc.).

See Appendix 1 for more information.

Two analysts reviewed the available data on financial and operational performance for each site. Each site’s financial performance was examined, based on evidence of the following in each site:

(a) Use of financial data for performance evaluation,
(b) Use of financial data for planning,
(c) Use of financial data for expenditure control,
(d) Computation and dissemination of financial data, and
(e) Collection of financial data.

See Table 1.2 in Appendix 1 for highlights of the financial analysis.
Results

High-Performing Sites

The twenty clinical microsystems selected for study were spread across North America and represent sixteen different states and provinces. 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 the clinical microsystems were part of larger, well-known systems – e.g., Mayo Clinic, Massachusetts General Hospital, Henry Ford Health System, Intermountain Health Care, On Lok, Shoulder Hospital – whereas others were part of smaller, lesser known organizations – e.g., Norumbega, ThedaCare, Intermountain Orthopedics. Appendix 1 provides a listing of the twenty microsystems research results showing variation across sites on selected results.

Overall Results: The Nine Success Characteristics

Analysis of the results from the twenty high-performing sites suggests that each clinical unit 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. This being said, a common set of nine success characteristics were shared by these microsystems and interact with one another to produce highly favorable systemic outcomes. These nine success characteristics fall into four main groups and are listed in Figure 5.

In addition to these nine primary characteristics, three additional themes emerged from the content analysis and were frequently mentioned but not as much as the nine cited above. These other three categories are related to: patient safety, health professional education, and the external environment (i.e., financial, regulatory, policy, and market environment) in which the microsystem is embedded.

Content analysis of the interview text shows that seven of the nine success characteristics were mentioned more frequently: improvement methods (13.5%), staff focus (9.4%), performance results (8.4%), information and information technology (8.3%), patient focus (8.2%), leadership (7.7%), and interdependence of care team (7.7%). The remaining two success characteristics were important but less frequently mentioned; they were culture (4.3%) and organizational support (3.2%). All nine success characteristics were present in all twenty sites; this suggests that high-performing clinical units tend to share these characteristics in common.
There was substantial variation in the prominence of the nine success characteristics across sites. For example, leadership, which accounted for 7.7% of the coded comments on average, ranged from a high of 13.2% in a nursing home to as low as 3.1% in a hospice health site. Similarly, staff focus, which accounted for 9.4% of coded comments on average, ranged across sites from a high of 20.9% in a home health unit to 1.6% in a specialty medicine unit. This variation across sites suggests that different clinical units in different contexts with different types of patients may possess these success characteristics in greater or lesser amounts. Refer to Appendix 1 for detailed results displaying variation across the sites on the frequency of the mentions of success characteristics.

Principles Associated with the Nine Success Characteristics

Each of the nine success characteristics reflects a broad range of features and underlying principles. Table 1 provides more information on the nature of the success characteristics and illustrative principles that underlie them.

(Table 1 Here)

Specific Examples of the Nine Success Characteristics

The site interviews provide many, varied and rich examples of the ways that these success characteristics manifest themselves in these clinical microsystems. Table 2 provides some actual examples from the original interview notes of each of the nine success characteristics.

(Table 2 Here)

Best Practices: Processes and Methods Associated with High Performance

The study of the twenty high-performing sites generated dozens of “best practice” ideas (i.e., processes and methods) that Microsystems use to accomplish their goals. Many of these best practices are contained in the guidebook – *The Clinical Microsystem Action Guide* – that accompanies this report. Although a complete list of all these best practices is beyond the scope of this paper, Table 3 gives a sampling of them across four major themes.

(Table 3 Here)

Discussion and Implications of Research Findings

In this section the results are summarized, implications for leaders are discussed, and the limitations of the research project are presented.
Summary

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 different component parts of the health system, were examined using qualitative methods supplemented by medical records and finance reviews. The results, which are summarized in the tables and figures, showed that these top performing clinical units were vibrant, vital, dynamic, self-aware, small-scale clinical enterprises that were led with intelligence and staffed by skilled, caring, self-critical staff. Though each clinical unit was extraordinary and unique in many respects, they nevertheless shared nine key success characteristics that interact with each other, dynamically and over time, to produce superior, efficient care and services.

Contrasts with Prior Literature: IOM Study and Intelligent Enterprise

The nine success characteristics were generally consistent with the preceding IOM Study, with one important difference: the prominent emergence of leadership as a key success factor at the microsystem level. Careful review of the IOM Study findings and discussion with its lead investigator, however, reveals that leadership was threaded through many of the eight dimensions and was strongly present in the high-performing microsystems that were studied, but the results were classified differently by the investigators.

Results from this research indicate that the primary difference between Quinn’s “Intelligent Enterprise” findings and this study is that the senior leaders in Quinn’s world-class organizations had a laser-like, strategic, and tactical focus on the smallest replicable units within their organizations. They viewed their smallest replicable units as the microengines that generated quality and value for their customers. The minimum replicable units of service delivery were seen as the vital organs that linked customers with the organization’s core competency through the actions taken by front line service providers. They recognized the smallest replicable units as the sharp end of their enterprise – the place that created quality and value, delights or disappointments – for individual customers, and they iteratively designed, improved, incented, monitored, and replicated minimal units throughout the enterprise.

Implications For Health System Leaders and Actions to Consider

Much could be said about the implications of these results for senior leaders of health systems and for leaders within microsystems. Suggestions and guidance for microsystem leaders are contained in the
accompanying resource, *The Clinical Microsystem Action Guide*.\textsuperscript{16} Five basic suggestions for senior leaders of health systems based on this research project and prior investigations follow:

- **Results:** Focus on improving the level of microsystem performance to achieve superior enterprise-wide results. Emphasize achieving essential outcomes at the individual microsystem level and smoothly linking together related microsystems to effectively and efficiently meet patient, community and business needs.

- **Simple Rules with Linked Metrics:** Provide a few simple rules to “evaluate” the success of microsystems (e.g., accessible, patient centered, seamless, lean) and provide regular, data-based performance feedback at the microsystem level to gauge the level of performance.

- **Integration of Information:** Design an information environment, with appropriate technology, to support the work of each microsystem to provide needed high-quality, cost-effective care to patients and to make perfect “handoffs” between microsystems to give seamless, coordinated, well-rounded care that meets the changing needs of patients.

- **Mission and Motivation:** Create a clear and compelling sense of organizational purpose and structures to promote, recognize and reward high performance in microsystems, sound linkages across microsystems, and innovation in all parts of the enterprise to achieve mission. Recognize the ways in which the culture of the setting encourages high performance and ways in which the prevailing culture may need to be enriched.

- **Decentralize Accountability:** To greatest practical degree, push decision-making, process ownership, and accountability out to the microsystems; provide “centralized” support services only in areas that microsystems cannot manage better and more efficiently within their own individual boundaries. As this is done, it will be important to be very clear about organizational support for the work and performance improvement of the microsystem.

An overarching suggestion for senior leaders is to recognize the fundamental nature and power of using microsystem-based approaches for strategic thinking, operating excellence, and deployment of change and innovation. Using this framework to design care for defined patient populations will include building the finely tuned care processes, linking them, making them safe and reliable, and removing costs while adding
quality. Moreover, it will incorporate shared purpose, cooperative leadership, performance goals derived from purpose, and mutual accountability for reaching goals and outcomes aligned with purpose.\textsuperscript{17}

Limitations of Research

Before offering concluding comments we briefly summarize some of the more important limitations of this study.

- **Reality and Reductionism**: The reality of clinical microsystems and the health system in which they are embedded is immensely complex. To study it and learn about it, we inevitably must 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 offers the opportunity to gain both scope and depth of analysis, but also tends to be biased in several ways. For example, 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 the strengths of their organization than the 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 of the subjective qualitative variety. 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 could analyze the same raw interview content and arrive at different conclusions.

- **Time-Limited**: The observations are cross-sectional and time-limited. While the microsystems themselves are likely to be changing in small and large ways over time and while each has its own developmental history and staging, the research “sliced” into the world
of each microsystem and “biopsied” its structure, content, processes, outcomes, and patterns at a single point in time.

In short, 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.

**Final Comment**

In this last section we conclude with a word of caution and a call for action. First, the caution.

Robert Galvin, the director of Global Health Care for General Electric, wrote in a recent editorial:

“But there is a reason to be cautious. New ideas in health care have a tendency to oversimplify and over promise. 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’s caution must be heeded. As discussed at the outset of this paper, the health system is immense, complex, and able to deliver delightful and dreadful care. Change in the health system is subject to a linked chain of effect that connects individual patients, communities and clinicians with small, naturally occurring frontline units, with countless large and small host organizations all of which exists 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 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 policy makers, etc. – and have, for the most part, ignored targeting the essential building blocks of the system. 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 effective system design is conceptualizing the smallest replicable unit and its potential use in strategy as early as possible in the design process.”
The clinical microsystems are the smallest replicable units in the health system. Health system redesign can succeed only by leaders who take action to transform these small clinical units to optimize performance within the units and to perfect the linkages between the units. A seamless, high quality, safe, and efficient health system cannot be realized absent this transformation of the essential building blocks that combine to form the care continuum.

Much remains to be done to quantitatively validate these ideas and to make them predictive and practical for health system and clinical microsystem leaders.
<table>
<thead>
<tr>
<th>Leadership</th>
<th>Illustrative Underlying Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership maintains constancy of purpose, establishes clear goals and expectations, fosters positive culture, advocates for the microsystem in the larger organization, and provides on-the-spot leadership.</td>
<td>Leader must balance setting and reaching collective goals with empowering individual, autonomy and accountability.</td>
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<table>
<thead>
<tr>
<th>Culture</th>
<th>Illustrative Underlying Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is pattern of values, beliefs, sentiments, and norms that reflect clinical mission, quality of staff work life, and respectful patterns of interpersonal relationships.</td>
<td>Shared values, attitudes, and beliefs reflect the clinical mission and support a collaborative and trusting environment.</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Organizational Support</th>
<th>Illustrative Underlying Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>The larger organization provides recognition, information and resources to enhance and legitimize the work of microsystem.</td>
<td>The larger organization looks for ways to connect to and facilitate the work of the microsystem.</td>
</tr>
<tr>
<td>The larger organization facilitates the coordination and hand-offs between microsystems</td>
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</table>

<table>
<thead>
<tr>
<th>Patient Focus</th>
<th>Illustrative Underlying Principle</th>
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<tbody>
<tr>
<td>The primary concern is to meet all patient needs – caring, listening, educating, and responding to special requests, smooth service flow, establishing the relationship with community and other resources.</td>
<td>We are all here for the same reason – the patient.</td>
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</table>

<table>
<thead>
<tr>
<th>Staff Focus</th>
<th>Illustrative Underlying Principle</th>
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</thead>
<tbody>
<tr>
<td>There is selective hiring of right kind of people, integrating new staff into culture and work roles, aligning daily work roles with training competencies. Expectations of staff are high regarding performance, continuing education, professional growth, and networking.</td>
<td>There is a “human resource value chain” that links the microsystem’s vision with real people on the specifics of hiring, orienting, growing, retaining, and incenting staff.</td>
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<table>
<thead>
<tr>
<th>Interdependence of Care Team</th>
<th>Illustrative Underlying Principle</th>
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</thead>
<tbody>
<tr>
<td>The interaction of staff is characterized by trust, collaboration, willingness to help each other, appreciation of complementary roles, and a recognition that all contribute individually to a shared purpose.</td>
<td>It takes a multidisciplinary team to provide care.</td>
</tr>
<tr>
<td>Every staff person is respected for the vital role they play in achieving the mission.</td>
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<table>
<thead>
<tr>
<th>Information and Information Technology</th>
<th>Illustrative Underlying Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information is key, technology smooths the linkages between information and patient care by providing access to a rich information environment. Technology can facilitate effective communication and multiple formal and informal channels are used to keep everyone informed. Everyone’s ideas are heard and they are connected to important patient care topics.</td>
<td>Information is the connector – patient to staff, staff to staff, needs with actions to meet needs.</td>
</tr>
<tr>
<td>The information environment has been designed to support the work of the clinical unit.</td>
<td>Everyone gets the right information, at the right time, to do his or her work.</td>
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<table>
<thead>
<tr>
<th>Process Improvement</th>
<th>Illustrative Underlying Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>An atmosphere for learning and redesign is supported by the continuous monitoring of care, use of benchmarking, frequent tests of change, and staff that has been empowered to innovate.</td>
<td>Studying, measuring and improving care is an essential part of the daily work.</td>
</tr>
<tr>
<td><strong>Performance Patterns</strong></td>
<td>Outcomes are routinely measured, data is fed back to the microsystem, and changes are made based on the data.</td>
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<td>-------------------------</td>
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<tr>
<td>Performance focuses on patient outcomes, avoidable costs, streamlining delivery, using data feedback, promoting positive competition, and frank discussions about performance</td>
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Table 2. Specific Examples of the Nine Success Characteristics

<table>
<thead>
<tr>
<th>Success Characteristics</th>
<th>Specific Examples</th>
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</table>
| **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 having standardized processes allows for that time.” |
| **Culture**             | “The work ethic is very strong here. Many years ago the unit became a self-staffing unit. We scheduled ourselves. There is a work ethic. People work very hard. It’s one of the cultural things – and the ownership.”
|                         | “The initial entrance barrier is a bit higher because the culture is stronger here than in some of the other units I work in. So it’s a bit harder to break into the unit or to be integrated since they have such a strong team. I feel respected and like I am a valuable member of the team.” |
| **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 the 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…. Our purpose is to set an example to those who have forgotten about what is 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.”
|                         | “I like molding people into positions…. I would rather take someone with no experience and mold them then 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.”
|                         | “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 check ups.”

“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.”

“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 are all together under one roof…There is informal communication all the time, and I stop to have individual conversations with the managers. There is telephone, email, and pagers, although the most common way right now is people just pulling me into the office.”

“We are all linked (MIMPS). 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 look out for tiny things that will improve care for our patients or our own lives, whether its 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 principals. But I would say, if you look at industry, they’ve learned that … you have to do that. The Toyota plant out in Fremont California being one of the more prominent examples. The GM executives asked ‘How can you afford to shut down the production line?’ and [the Toyota executives] said, ‘Well how can you afford not to shut down the production line?’”

Performance Patterns

“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 dollars, that is compared to an average hospital that has $250 - $500 dollars 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.”
Table 3. Illustrative Best Practices Used by High-Performing Clinical Microsystems

<table>
<thead>
<tr>
<th>Best Practice Category</th>
<th>Description of Best Practice</th>
</tr>
</thead>
</table>
| **Leading Organizations**                  | • Annual retreat to promote mission, vision, planning, and deployment throughout the microsystem.  
• Open door policy by leaders of the microsystem.  
• Shared leadership within the microsystem (e.g., physician, nurse, manager).  
• Use of story telling to highlight improvements needed and improvements made.  
• Promotion of culture, reflective practice and learning.  
• Intentional discussions related to mission, vision, values. |
| **People**                                 | • 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.  
• Screen potential hires for attitude, values & skill alignment.  
• Designed training and orientation of new staff into work of microsystem. |
| **Information and Information Technology**  | • Tracking 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 IT staff on microsystem team. |
| **Performance & Improvement**              | • Use of benchmarking information on processes & outcomes.  
• Use of “data walls” and display of key measures for staff to view & use to assess microsystem performance.  
• Extensive use of protocols and guidelines for core processes.  
• Encouraging innovative thinking and tests of change. |
List of Figures

1. Chain of Effect in Improving Health Care Quality
2. Flowchart of Ken Bladyka’s Journey Through Health System
3. The Physiology of a Clinical Microsystem
4. Research Design for Study of Twenty Clinical Microsystems
5. Clinical Microsystems’ Nine Success Characteristics
Figure 1. Chain of Effect in Improving Health Care Quality

### The Chain of Effect in Improving Health Care Quality

I. Patient and the Community

II. Micro-system of care delivery

III. Macro-organization

IV. Environmental Context

Source: Donald Berwick, MD, IHI

Figure 2. Flowchart of Ken Bladyka’s Journey Through Health System

**Ken’s Journey Flowcharted**

- 7/4: Ken calls PCP to report findings
- PCP sees Ken and Paige same day
- PCP refers to DHMC Hematology Department
- MD on-call sees Ken, orders labs
- Ken: Starts own Medical Record
- Admit to DHMC for aplastic anemia or by autoimmune disease
- Inpatient Care: Daily labs + transfusion + Dr. Pam Ely (hematologist)
- Discharged to home
- Outpatient daily labs and transfusions prn
- Re-admitted to DHMC prn
- Siblings tested for bone marrow: Hartford, San Francisco, DHMC
- Ken: Search for “best place, best outcomes in world”
- Select Fred Hutchinson Cancer Research Center
- 1 sister (Mary) of 4 siblings match
- Ken, Paige and Mary fly to Seattle
- 8/24: Admit to Fred Hutchinson Cancer Research Center
- 9/2: Chemotherapy at Fred Hutchinson Cancer Research Center
- 9/10: Procedure in Bone Marrow Transplant Unit
- 9/12: Ken’s 40th Birthday
- Follow up care in Paul Gross Housing unit for 100 days
- ???
Figure 3. The Physiology of a Clinical Microsystem: A Specific Case Example

Building a Team to Manage a Panel of Primary Care Patients

Mission: The Dartmouth-Hitchcock Clinic exists to serve the health care needs of our patients.

People with healthcare needs

Very High Risk
Chronic
Very High Risk
Healthy
Healthy
Chronic

Assign to PCP
Orient to Team
Assess & Plan Care

Functional & Risks
Biological
Costs
Expectations

Functional
Risks
Biological
Costs
Satisfaction

People with healthcare needs met

Processes

Telephone First
Physical Space
Info Systems & Data
Billing
Referrals
Pharmacy
Radiology
Laboratory
Medical Records
Scheduling
Department
Southern Region
Hitchcock Clinic System

Measuring Team Performance & Patient Outcomes and Costs

Measure
Current
Target
Measure
Current
Target

Panel Size Adj.
Direct Pt. Care Hours: MD/Assoc.
% Panel Seeing Own PCP:
Total PMPM Adj.
PMPM-Team

External Referral Adj.
PMPM-Team

Patient Satisfaction
Access Satisfaction
Staff Satisfaction

TEAM MEMBERS:

11 Nashua Internal Medicine

Director: Barry MD

William, MD
Jane, MD
Mary, MD
Leslie, MD
Erica, RN
Laura, RN
Maggie, RN
Bonnie, LPN
Carole, LPN
Mary, LPN
Lynn, MA
Amy, Secretary
Buffy, Secretary
Mary Ellen, Secretary
Tryphee, Secretory
Mary Beth, MA
Kristy, Secretary
Buffy, Secretary
Mary Ellen, Secretary
Mary Smith, MA

© Eugene C. Nelson, DSc, MPH
Paul B. Batalden, MD
Dartmouth-Hitchcock Clinic, June 1998

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Figure 4. Research Design for Study of Twenty Clinical Microsystems

**Sampling**

Selecting high-performing clinical microsystems via a multi-tiered search pattern

1. Award Winners and Measured High Performance
2. Literature Citations
3. Prior Research and Field Experience
4. Expert Opinion
5. Best within Best

Choosing 20 clinical microsystems for study

1. Assess Outcomes of Search Pattern
2. Create Table of Sites by Search Pattern
3. Conduct Survey and Telephone Interview
4. Choosing and Inviting Sites to Participate

**Data Collection**

Utilizing two data collection instruments

- **Self-Administered Microsystem Survey** - self-assessment of performance based on key characteristics
- **Telephone Interview** - Examine delivery processes, the quality of care and services, and on cost-efficiency and waste reduction
- **Two-day site visit for interviews and direct observation**
  - Depth Interviews - Microsystem staff and larger organization staff
  - Medical Chart Review - Assessment of technical clinical quality of care
  - Finance Review - Assessment of operational performance and cost-efficiency

**Data Analysis**

Assessment of screening interviews and face-to-face depth interviews

1. Entered and analyzed via QSR-NU*DIST
2. Major success characteristics determined from cross-case analysis

Assessment of chart review and financial performance

- **Medical Chart Review**
  1. Specific and aggregate quality indicators assessed
  2. Scoring, rating, and ranking completed for each site
- **Finance Review**
  1. Aggregate financial information reviewed
  2. Each site rated on a rank-order cost-efficiency success scale
Figure 5. Clinical Microsystems’ Nine Success Characteristics

LEADING ORGANIZATIONS
- Clinical Microsystem Leadership
- Culture
- Organizational Support

PEOPLE
- Patient Focus
- Staff Focus
- Interdependence of Care Team

PERFORMANCE AND IMPROVEMENT
- Process Improvement
- Performance Patterns

INFORMATION
- Information and Information Technology
Appendix 1. Selected Results of Microsystem Analysis

This appendix contains detailed results for the coding of text units into success characteristics (Table 1.1) and results for the medical chart review study (Figure 1.1, 1.2), and some highlights of the financial analysis, (Table 1.2).
Table 1.1. Frequency of mentions of coded text units (% of all text units coded) into nine success characteristics across twenty clinical microsystems.

<table>
<thead>
<tr>
<th>Code Name</th>
<th>Leadership</th>
<th>Culture</th>
<th>Organizational Support</th>
<th>Patient Focus</th>
<th>Staff Focus</th>
<th>Interdependence of Care Team</th>
<th>Information and Technology</th>
<th>Process Improvement</th>
<th>Performance Patterns</th>
</tr>
</thead>
<tbody>
<tr>
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<td>8.0%</td>
<td>3.0%</td>
<td>3.2%</td>
<td>6.2%</td>
<td>7.5%</td>
<td>10.2%</td>
<td>17.7%</td>
<td>20.4%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Mean % overall</td>
<td>7.7%</td>
<td>4.3%</td>
<td>3.2%</td>
<td>8.2%</td>
<td>9.4%</td>
<td>7.7%</td>
<td>8.3%</td>
<td>13.5%</td>
<td>8.4%</td>
</tr>
</tbody>
</table>
Figure 1.1 Results of medical record review of core measures in twenty clinical Microsystems

**Aggregate Data for Core and Site-Specific Measures**

- Problem List
- Medication List
- Allergy List
- Evidence of Teaching
- Site Specific Aggregate

The bar chart shows the percentage of aggregate data for core and site-specific measures across different categories. The results indicate varying levels of compliance with each measure, with the site-specific aggregate showing the highest percentage.
Figure 1.2 Results of the Overall Quality Assessment

Global Evaluation of Overall Quality by Site and By Assessment Strategy

HH - Home Health
IC - Inpatient Care
NH - Nursing Home
PC - Primary Care
SC - Specialty Care

Score (%)

Type of Microsystem

HH  #1  #2  #3  #4
IC  #2  #3  #4
IC  #1  #2  #3  #4
NH  #1  #2  #3  #4
NH  #1  #2  #3  #4
PC  #1  #2  #3  #4
PC  #1  #2  #3  #4
SC  #1  #2  #3  #4
SC  #1  #2  #3  #4
SC  #1  #2  #3  #4

HH - Home Health
IC - Inpatient Care
NH - Nursing Home
PC - Primary Care
SC - Specialty Care

Strategy 1
Strategy 2
Table 1.2 Highlights of Financial Analysis

<table>
<thead>
<tr>
<th><strong>Collection, Computation and Dissemination of Financial Data</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Almost half of the microsystems have made awareness of cost efficiency a part of the everyday work of all the staff in the microsystem.</td>
</tr>
<tr>
<td>• Operations and financial indicators are often not measured at the microsystem level.</td>
</tr>
<tr>
<td>• Some sites have developed “microsystem-grown” financial/operations tracking systems.</td>
</tr>
<tr>
<td>• Financial borders of the microsystems are difficult to define.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Use of Financial Data for Expenditure Control</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Most of the microsystems that emphasize finance and efficiency in operations focused mainly on expense reduction.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Use of Financial Data for Planning and/or Performance Evaluation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Some of the microsystems explicitly rely on standardization of clinical processes and/or system redesign as a cost/waste reduction strategy.</td>
</tr>
<tr>
<td>• Several of the microsystems focus on clinical quality improvement or patient satisfaction as an explicit strategy, with the belief that financial success follows excellence in those areas.</td>
</tr>
<tr>
<td>• Seven of the twenty sites mentioned employing outside resources to fund or provide expertise for quality improvement efforts.</td>
</tr>
<tr>
<td>• Several sites emphasize a collaborative leadership model in which clinical leaders and administrators together make policy, strategic plans and decisions.</td>
</tr>
<tr>
<td>• Clinical management and operations efficiency are sometimes viewed as separate considerations.</td>
</tr>
<tr>
<td>• A site’s awareness of self as a clinical microsystem does not necessarily correlate with awareness of financial/operations aspects of the microsystem.</td>
</tr>
</tbody>
</table>
# Appendix 2. List of Twenty Sites Included in Clinical Microsystem Study

<table>
<thead>
<tr>
<th>Name of Microsystem</th>
<th>Location</th>
<th>Name of Macrosystem</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Home Health Care</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gentiva Rehab Without Walls</td>
<td>Lansing, MI</td>
<td>Gentiva Health Services</td>
</tr>
<tr>
<td>Interim Pediatrics</td>
<td>Pittsburgh, PA</td>
<td>Interim HealthCare of Pittsburgh</td>
</tr>
<tr>
<td>On Lok SeniorHealth Rose Team</td>
<td>San Francisco, CA</td>
<td>On Lok SeniorHealth</td>
</tr>
<tr>
<td>Visiting Nursing Service Congregate Care</td>
<td>New York, NY</td>
<td>Visiting Nursing Service Of New York</td>
</tr>
<tr>
<td>Queens Team 11S</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Inpatient Care</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Henry Ford Neonatal Intensive Care Unit</td>
<td>Detroit, MI</td>
<td>Henry Ford Hospital, Henry Ford Health System</td>
</tr>
<tr>
<td>Intermountain Shock/Trauma/Respiratory Intensive Care Unit</td>
<td>Salt Lake City, UT</td>
<td>Latter-day Saints Hospital, Intermountain Health Care</td>
</tr>
<tr>
<td>Center for Orthopedic Oncology and Musculoskeletal Research</td>
<td>Washington, DC</td>
<td>Washington Cancer Institute, Washington Hospital Center, MedStar Health</td>
</tr>
<tr>
<td>Shouldice Hernia Repair Centre</td>
<td>Thornhill, Canada</td>
<td>Shouldice Hospital</td>
</tr>
<tr>
<td><strong>Nursing Home Care</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bon Secours Wound Care Team</td>
<td>St. Petersburg, FL</td>
<td>Bon Secours Maria Manor Nursing and Rehabilitation Center</td>
</tr>
<tr>
<td>Hospice of North Iowa</td>
<td>Mason City, IA</td>
<td>Mercy Medical Center North Iowa, Mercy Health Network</td>
</tr>
<tr>
<td>Iowa Veterans Home, M4C Team</td>
<td>Marshalltown, IA</td>
<td>Iowa Veterans Home, Veterans Commission</td>
</tr>
<tr>
<td><strong>Primary Care</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grace Hill Community Health Center</td>
<td>St. Louis, MO</td>
<td>Grace Hill Neighborhood Health Centers, Inc.</td>
</tr>
<tr>
<td>Massachusetts General Hospital Downtown Associates Primary Care</td>
<td>Boston, MA</td>
<td>Massachusetts General Hospital, Partners Healthcare</td>
</tr>
<tr>
<td>Norumbega Evergreen Woods Office</td>
<td>Bangor, ME</td>
<td>Norumbega Medical, Eastern Maine Healthcare</td>
</tr>
<tr>
<td>ThedaCare Kimberly Office Family Medicine</td>
<td>Kimberly, WI</td>
<td>ThedaCare Physicians</td>
</tr>
<tr>
<td><strong>Specialty Care</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dartmouth-Hitchcock Spine Center</td>
<td>Hanover, NH</td>
<td>Dartmouth-Hitchcock Medical Center</td>
</tr>
<tr>
<td>Midelfort Behavioral Health</td>
<td>Eau Claire, WI</td>
<td>Midelfort Clinic at Luther Campus, Mayo Health System</td>
</tr>
<tr>
<td>Orthopedic Specialty Practice</td>
<td>Boise, ID</td>
<td>Intermountain Health Care</td>
</tr>
<tr>
<td>Overlook Emergency Department</td>
<td>Summit, NJ</td>
<td>Overlook Hospital, Atlantic Health System</td>
</tr>
<tr>
<td>Sharp Diabetes Self Management Training Center</td>
<td>La Mesa, CA</td>
<td>Grossmont Hospital, Sharp HealthCare</td>
</tr>
</tbody>
</table>
References

1. Institute of Medicine, Crossing the Quality Chasm, National Academy Press, Washington, DC, 2000.