Exploring Innovation and Quality Improvement in Health Care Micro-Systems: A Cross-Case Analysis

A Technical Report for the Institute of Medicine Committee on the Quality of Health Care in America by Molla S. Donaldson, Dr.P.H., M.S., and Julie J. Mohr, Ph.D., M.S.P.H.

ISBN: 0-309-54155-7, 100 pages, 8 1/2 x 11, (2001)

Exploring Innovation and Quality Improvement in Health Care Micro-Systems

A Cross-Case Analysis

A Technical Report for the Institute of Medicine
Committee on the Quality of Health Care in America

by

Molla S. Donaldson, Dr.P.H., M.S., and
Julie J. Mohr, Ph.D., M.S.P.H.

Submitted to the Robert Wood Johnson Foundation
November 3, 2000
RWJF Grant Number 36222

INSTITUTE OF MEDICINE
Washington, D.C.

INSTITUTE OF MEDICINE • 2101 Constitution Avenue, N.W. • Washington, DC 20418

NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

Support for this project was provided by The Robert Wood Johnson Foundation. The views presented in this report are those of the authors and are not necessarily those of the funding agency.

The full text of this report is available on line at **www.nap.edu.**

For more information about the Institute of Medicine, visit the IOM home page at **www.iom.edu.**

Printed in the United States of America.

Cover Art: Interdisciplinary morning rounds at The George Washington University Hospital Intensive Care Unit.

"Knowing is not enough; we must apply.
Willing is not enough; we must do.

—Goethe

INSTITUTE OF MEDICINE

Shaping the Future for Health

The **National Academy of Sciences** is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Bruce M. Alberts is president of the National Academy of Sciences.

The **National Academy of Engineering** was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. William A. Wulf is president of the National Academy of Engineering.

The **Institute of Medicine** was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, upon its own initiative, to identify issues of medical care, research, and education. Dr. Kenneth I. Shine is president of the Institute of Medicine.

The **National Research Council** was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Bruce M. Alberts and Dr. William A. Wulf are chairman and vice chairman, respectively, of the National Research Council.

ABSTRACT

Objective. To identify key characteristics that enable health care micro-systems to continuously improve the quality of care. Micro-systems are small, organized patient care units with a specific clinical purpose, set of patients, technologies and practitioners who work directly with these patients.

Data Sources. Structured interviews were used to collect primary data (summer, 1999) from 43 micro-systems providing primary and specialty care, hospice, emergency, and critical care.

Study Design. Qualitative methods, specifically cross-case analyses, were used to understand how micro-systems function, what they know about their level of performance, how they improve care, the leadership needed, the barriers they have encountered, and how they have dealt with these barriers.

Principal Findings. Responses to each interview topic are summarized, including key lessons identified by respondents that may point the way toward replication. A framework for thinking about health care micro-systems emerged from a cross-case analysis of the interviews. Eight themes—integration of information, measurement, interdependence of the care team, supportiveness of the larger system, constancy of purpose, connection to community, investment in improvement, and alignment of role and training—were present in the micro-systems to varying degrees. It is possible that the most effective micro-systems will demonstrate a high level of performance in each of these themes. We identify directions for further research that could contribute to designing and redesigning delivery systems, improving care, preparing future health professionals, and formulating health policy.

Key Words. Micro-system, systems of care, quality improvement, health care delivery

Acknowledgments

We are appreciative of the many individuals and groups who made this project possible and who assisted our work. The support of the Robert Wood Johnson Foundation, and the assistance of the Project Officer, Susan B. Hassmiller, Ph.D., were critical to our undertaking this work, and we are grateful for Dr. Hassmiller's encouragement and advice during the study process.

Second, we wish to thank the individuals at all the sites that participated and gave their time to provide us with extensive information about their groups. We hope this report accurately reflects their extraordinary achievements and that it will provide them with useful information as their work advances.

Two groups provided invaluable guidance in the study design and identification of sites. The first was a Steering Group that included Paul B. Batalden, M.D.; Donald M. Berwick, M.D.; Eugene C. Nelson, Sc.D.; Thomas Nolan, Ph.D.; and Stephen M. Shortell, Ph.D. The second was the Institute of Medicine Subcommittee on Building the 21st Century Health System. Its members were Donald M. Berwick, M.D., M.P.P. (*Chair*); Christine K. Cassel, M.D.; Rodney Dueck, M.D.; Jerome H. Grossman, M.D.; John E. Kelsch; Risa Lavizzo-Mourey, M.D.; Arthur Levin, M.P.H.; Eugene C. Nelson, D.Sc., M.P.H.; Thomas Nolan, Ph.D.; Gail J. Povar, M.D., M.P.H.; James L. Reinertsen, M.D.; Joseph E. Scherger, M.D., M.P.H.; Stephen M. Shortell, Ph.D.; Mary Wakefield, R.N., Ph.D.; and Kevin Weiss, M.D., M.P.H.

In addition, Andrew Balas, M.D., Ph.D., organized a telephone conference to help us formulate questions and identify sites for our section on information technology. Participants included Paul Clayton, Ph.D., Columbia University; Patricia Flatley Brennan, University of Wisconsin; Jerome Grossman, M.D., Liongate Corp; David Kindig, University of Wisconsin; and Clement McDonald, M.D., Regenstrief Institute. Connie Davis, M.N., A.R.N.P., helped us to identify sites that had innovative chronic disease management programs, and Joanne Lynn, M.D., helped us to identify sites with innovative programs addressing care at the end

of life. Charles M. Kilo, M.D., M.P.H., and the staff of the Institute for Health Care Improvement graciously included one of us (MSD) at a meeting of the prototype sites for the Idealized Design of Office Design project.

Finally, we would like to express our gratitude to the IOM staff who facilitated the project. We are grateful for the overall direction provided by Janet Corrigan, Ph.D., director of the Division of Health Care Services and project director of the Committee on the Quality of Health Care in America; the advice of Linda T. Kohn, Ph.D., on the design of and protocol for the study, program assistance by Kelly Pike and Shari K. Maguire, research assistance by Anand Parekh and Tracy McKay; assistance in the report review process from Claudia Carl and Clyde Behney in the IOM's Office of Reports and Communication; the editorial assistance of Mike Edington; and help in financial management by Kay Harris and Jennifer Cangco.

REVIEWERS

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Research Council's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making the published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their participation in the review of this report:

MARY C. CORLEY, Associate Professor, Department of Integrative Systems, School of Nursing, Virginia Commonwealth University

KATE GOONAN, Vice President, Clinical Quality Service, University of Massachusetts Memorial Healthcare, Marlborough

ARNOLD KALUZNY, Professor of Health Policy and Administration, School of Public Health, University of North Carolina at Chapel Hill

BRUCE VAN CLEAVE, Vice President, Clinical Affairs, Trinity Health System, Farmington Hills, MI

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations nor did they see the final draft of the report before its release. The review of this report was overseen by Paul Cleary, Professor, Department of Health Care Policy, Harvard Medical School, appointed by the Institute of Medicine, who was responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authors and the institution.

Contents

ABSTRACT v

INTRODUCTION 1

BACKGROUND 2
Defining Health Care Micro-Systems 3
Use of Qualitative Methods 5

METHODS 8
Stage 1: Literature Review, Nomenclature, and Study Design 8
Operational Definition 9
Stage 2: Study Design and Data Collection 9
Instrument and Protocol Development 9
Site Selection 11
Instrument Testing and Interviewer Reliability 11
Data Collection 13
Stage 3: Data Analysis 19
Case-Level Summary Analysis of Health Care Micro-Systems 19
Cross-Case Analysis 20

RESULTS 21
I. Case-Level Summaries by Topic 21
Level of Performance 21
Patient Experience 23
Information and Information Technology 25
Improvement 26
Leadership and Management: Lessons for Replication 28
II. Cross-Case Analysis—Themes Related to Effective Micro-System Performance 47
Integration of Information 47
Measurement 47
Interdependence of the Care Team Members 50

Supportiveness of the Larger System 50
Constancy of Purpose 52
Connection to Community 54
Investment in Improvement 54
Alignment of Role and Training 55

CONCLUSIONS AND DIRECTIONS FOR FURTHER RESEARCH AND POLICY 57
Limitations of This Research 57
Directions for Further Research 60
IOM Quality of Care Study 61

REFERENCES 62

APPENDIXES
A Example of Thin and Thick Description for Quantitative Analysis 65
B Letter of Invitation 67
C Rosters 69
D Pre-Interview 71
E Telephone Interview 74

TABLES

METHODS
Stage 2: Study Design and Data Collection
TABLE 1 Range of Micro-Systems Studied 12
TABLE 2 Micro-System Descriptions 14
TABLE 3 Question Completion Rate 18
Stage 3: Data Analysis
TABLE 4 Micro-System Variables 20

RESULTS
I. Case-Level Summaries by Topic
TABLE 5 Importance of Executive and Governance-level Support for Innovation and Improvement Efforts 31
TABLE 6 Importance of Strong, Focused, and Sustained Clinical Leadership 33
TABLE 7 Importance of Collaboratively Functioning Multidisciplinary Clinical Teams 35
TABLE 8 Importance of Explicit Attention to the Development of Systems of Care 37
TABLE 9A Importance of Good Information Systems for Individual Patient Care 40
TABLE 9B Importance of Good Information Systems for Improving Care 41
TABLE 10 Importance of a Focus on the Needs of Patients 44

II. Cross-Case Analysis—Themes Related to Effective Micro-System Performance

TABLE 11 Summary of Micro-System Framework 48
TABLE 12 Micro-System Examples of Integration of Information 49
TABLE 13 Micro-System Examples of Measurement 51
TABLE 14 Micro-System Examples of Interdependence of Care Team 52
TABLE 15 Micro-System Examples of Supportiveness of the Larger System 53
TABLE 16 Micro-System Examples of Constancy of Purpose 55
TABLE 17 Micro-System Examples of Connection to Community 56
TABLE 18 Micro-System Examples of Investment in Improvement 57
TABLE 19 Micro-System Examples of Alignment of Role and Training 59

Exploring Innovation and Quality Improvement in Health Care Micro-Systems: A Cross-Case Analysis

INTRODUCTION

This is the final report to The Robert Wood Johnson Foundation on the study methods, findings, and conclusions of grant number 36222 to the Institute of Medicine (IOM) to assist its Committee on the Quality of Health Care in America (QHCA). One objective for the IOM committee was the identification of key characteristics and factors that enable or encourage providers, health care organizations, health plans and communities to continuously improve the quality of care. To advance its work, a subcommittee of QHCA, the Subcommittee on Building the 21st Century Health System, used the micro-systems study as an opportunity to use the empirical findings from structured interviews to guide its deliberations and to increase its understanding of exemplary health care delivery systems.

Specifically, the tasks set out for the study and described in this report were:

- to define and describe health care micro-systems; and
- to analyze characteristics that enable specific micro-systems to improve the quality of care provided to their patient populations.

This study reports on structured interviews used to collect primary data (summer, 1999) from 43 micro-systems providing primary and specialty care, hospice, emergency, and critical care. It summarizes responses to the interviews about how micro-systems function, what they know about their level of performance, how they improve care, the leadership needed, the barriers they have encountered, and how they have dealt with these barriers. Analysis includes, first, summary description of each interview topic, including a section on lessons for replication identified by respondents that may point the way toward replication of the work of these micro-systems. Second, the analysis includes eight themes that emerged from the cross-case analysis of the interviews. These themes provide a framework for thinking about how health care micro-systems function. It is possible that the most effective micro-systems will be able to demonstrate a high level of performance in each of these areas. The study also identifies directions for further research that could contribute to designing and redesigning delivery systems, improving care, preparing future health professionals, and formulating health policy.

BACKGROUND

A primary task for the IOM Subcommittee was to settle on the level of analysis it would use to anchor its work. A number of possibilities were offered: an entire health system, an integrated delivery system, an organization that delivers a particular kind of care, such as a hospital or nursing home, and so forth. The Subcommittee chose to focus on units it calls *micro-systems*.

This reason for this choice requires some explanation of both the origin of the term *micro-unit* or *micro-system* and the place of systems thinking in health care. Although the term *micro-system* is new to health care and may, at first, seem jarring, it was chosen carefully. The prefix *micro-* emphasizes its focus on small systems that are often embedded in larger *macro*-systems. The term *system* emphasizes that success in achieving clinical purposes requires the conscious development of *systems* to guide care processes.

The committee adopted the term *micro-system* in contrast to more traditional terms, such as *team, practice*, or *panel* to emphasize the idea that a micro-system encompasses not just the practitioners but also the patients, technologies (including information technologies), and processes of care that are integral to their work. It also emphasizes *systemness* as a feature that can be purposefully advanced using regular, ongoing information about the outcomes of care that indicate how well the micro-system processes meet patients' needs.

As described by Bertalanffy and others in early work on general systems theory, a system is a set of interdependent elements interacting to achieve a common aim.[1] These elements may be both human and nonhuman, such as equipment and technologies.[2] During the period following World War II, cybernetics and information theory, which originated in the disciplines of physics and biology, began to be applied across scientific disciplines to systems engineering and operations research to understand increasingly complex levels of organization, including social systems.[3,4] Since that time, organizational theorists, researchers, and managers have turned to systems theory for help in improving the performance of organizations. To date, however, the application of operations research has moved ahead faster and more widely in the business community than in health care. In many ways, the clinical office of today is little changed from the 1950s. The process of care is organized around individual patient visits with little clinical information technology to assist decisionmaking and very little information about performance to guide improvement, whether concerning patient health outcomes or their experience.

Despite substantial market pressure to improve both productivity and the acceptability of services, office practices and units within larger organizations (such as within hospitals) encounter substantial barriers in making threshold changes in their performance and even greater barriers in disseminating their successes within or across organizations. At the same time, the morale of health care professionals has been severely strained by efforts to do more with fewer resources even while coping with an avalanche of new technologies and knowledge.

This study began by looking beyond health care to other industries for help in framing the investigation. A primary source for the conceptual framework came from the work of James Brian Quinn. Quinn approached a study of business performance by identifying

breakthrough levels of successful performance in industries worldwide and asking how they accomplished it.[5] Quinn found that many of the world's best run organizations recognized the advantage of focusing on small functioning units to improve timeliness and cycle time, product quality, service, customer and worker satisfaction, as well as to reduce production costs. He described these small units as *microunits* of production, meaning that they were the smallest or minimum "replicable unit," which for this study means a unit whose processes are repeatable with small variation in response to local conditions and that have available to them all the necessary resources to do their work.

Although the approach originated with routine manufacturing and rules-based, automatable systems, it proved to be applicable, as well, to service operations where it led to large increases in customer satisfaction. Surprisingly, the larger the organization, the greater the leverage for gains because of a larger information database and greater possibility for experimentation. Using these small units as a starting place, Quinn found that highly effective service technologies were connected in a variety of new organizational forms that seemed to have some common characteristics: they had much "flatter" hierarchies than their predecessors; they were built around core service competencies typically consisting of special depth in some unique technologies, knowledge bases, skills, or other systems; and they interacted with customers using excellent information technologies and organizational design. Organizations discovered that these forms also made their workplaces more personally challenging and satisfying places to work.

The micro-system study explored whether such an approach to understanding highly effective systems could be applied to professional organizations, and, in particular, to health care units—a special, form of service industry, often thought to be unique because inputs (patients) are so variable, outputs ill-defined, and the need for professional expertise so great. Health care requires a mix of rules-based action and judgment based on individual needs, and this combination seemed to defy simple notions based on manufacturing.

Defining Health Care Micro-Systems

Adapting Quinn's notion of the micro-unit, Batalden and coworkers[6] have described the concept of a health care *micro-system* that delivers the core "product" of health care—patient care. It is at this interface that patients experience care and that the quality of care is determined. Although health care is provided to patients by caregivers who work in very complex organizational arrangements, the overwhelming amount of their own daily work is as part of a small system consisting of people—the patients and practitioners—and the technologies they use. Nelson and his colleagues[7] have described the essential elements of a micro-system:

- a core team of health care professionals;
- a defined population they care for;*

*Batalden notes that the population may be an enrolled population in a prepaid, capitated system or those who are seen regularly by a given set of providers who work together at a single site.

- an information environment to support the work of caregivers and patients; and
- support staff, equipment, and a work environment.

Accordingly, for this study, we defined a micro-system as: *a small, organized patient care unit with a specific clinical purpose, set of patients, technologies and practitioners who work directly with these patients.*

One example of a health care micro-system is a primary care or specialty practice; an office-based, physician-led practice caring for 9,800 patients with, for example, about 3,000 square feet of space in a downtown office building, six physicians, two nurse-practitioners, staff, hospital privileges, and so forth. Other micro-systems include: a cardiac care unit in a medical center, an emergency department in a community hospital, a hospice, a dialysis unit, a diabetes management program, or a back-pain treatment center. For every micro-system, clusters of tasks can be specified. Such clusters in office practice include, for example, greeting and establishing a relationship with a patient; making an initial assessment and recording findings; ordering laboratory tests and incorporating results into care plans; performing procedures, and providing instructions for self-care, next steps, and follow-up.

The key components of a micro-system are not new: patients, populations, clinicians, activities, and information technology exist in every health care setting. However, most often these small systems—their elements and working dynamics—are not recognized by the larger organizations that provide the organizational context for their work, such as in the design of human resource policies and information technologies, or by groups outside health care organizations, such as third party payers devising payment policies and employers seeking accountability for the care of their employees.

As a result, payment and incentives may ignore collaborative working relationships and be misdirected at too “low” or too “high” a level. For example, payment policies are typically devised to affect the behavior of physicians rather than a collaborative multidisciplinary team. Conversely, incentives and regulations may be directed at entire organizations (such as hospitals) rather than recognizing and rewarding the small work groups—micro-systems—that affect quality directly.

Micro-systems do their work today along a spectrum of performance that can range from very good to very poor. We emphasize that in this study, the term *micro-system* is *not* reserved for groups that demonstrate extraordinary performance along all the dimensions of care or in their “systemness.” In part, this is because at present that would constitute an extremely small, perhaps a null, set. More importantly, it draws attention to the fact that these small care systems are ubiquitous throughout health care, and their influence on quality is key to understanding how to improve care.

Batalden and his colleagues have suggested that effective micro-systems might provide (1) greater standardization of common activities and customization of care to individual patients, (2) greater use and analysis of information to support daily work, (3) consistent, measured improvement in performance, (4) extensive cooperation and teamwork within the

micro-system, (5) and an opportunity for spread of best practices across micro-systems within their larger organizations.[8]

Some previous research on teams has focused on functional and interdisciplinary workgroups and the systems that facilitate or impede the management of these workgroups.[9] For example, a firm system—parallel teams of practitioners and students and patients randomly assigned to the teams—was introduced over two decades ago at MetroHealth Medical Center in Cleveland, Ohio as a way to create and maintain longitudinal relationship of small groups of teachers, students, and patients.[10, 11, 12] This has been a valuable approach to evaluating different innovations in patient care and organizational design.

This study continues the tradition of learning about innovation and improvement from clinical practices in dynamic settings. It used a purposive sampling of what experts in the field considered to be high performing micro-systems to learn about their organization, aims, and their approaches to measurement and improvement.

Micro-systems do not, of course, function in isolation. Many work processes cut across micro-systems as well as clinical disease states such as those involving multiple chronic illnesses. Micro-systems must coordinate seamlessly with other micro-systems, and a major challenge is effectively managing the handoffs and feedback of information among micro-systems. The interaction of micro-systems is critical to ensuring that information is available when needed and is consistent, that patients receive timely services, and that waste and duplication are minimized.

The larger organizations of which they are a part—which we call the *macro-* or *umbrella* organization—can help this to occur. That is, in addition to linkages among micro-systems, micro-systems may be part of a larger organization (e.g., a cardiac care unit in a hospital, a group practice that has contracts with health plans, an ophthamology practice within a multispecialty clinic), and they are embedded in and interact with a legal, financial, and regulatory environment that may foster or impede their effectiveness. Although not a focus of this study, leaders of macro-organizations interact with the environment to mediate the effect on micro-systems of such financial incentives, regulation, or workforce issues.

Use of Qualitative Methods

> *Qualitative inquiry cultivates the most useful of all human capacities—the capacity to learn from others.*
>
> *—Patton 1994*[13]

This study examined micro-systems in the context in which they exist so that meaningful inferences could be made about them. Choosing a strategy to guide the work required careful consideration of quantitative and qualitative methodologies. Both qualitative and quantitative research involves a process of inquiry into a human or social problem. The method selected, however, depends on the questions that the researcher seeks to answer. For example, small area analysis of quantitative data[14] shows that diabetic Medicare beneficiaries vary in their rates of retinal exams, HgA1c, and low-density lipoprotein (LDL) monitoring.

Across the United States, retinal exams vary by geographic region from 25.1 percent to 66.1 percent. HbA1c monitoring varies from 8.9 percent to 70.2 percent, and LDL monitoring varies from 6.8 percent to 68 percent. Such a quantitative analysis does not explain, however, why such variation occurs or the barriers that may exist to providing these services. Nor does it reveal how to change the care to improve the outcomes. To connect the quantitative findings to small group behavior, qualitative methods can be helpful in elucidating the behavior of the system that is producing the results.

Quantitative methods test theory, with an emphasis on hypothesis testing and verification. Data gathered in a quantitative study is in the form of numbers evaluated, using descriptive and inferential statistics. A quantitative approach to a study on health care micro-systems might involve a variable-oriented analysis that computes the correlation between a variable and a selected outcome. Another quantitative option would be to use regression analysis to determine the relative importance of a set of variables in determining such an outcome. These approaches, however, require clarity about the important variables going in to the study.

Because this study was intended to be an exploratory look at micro-systems as a unit of analysis, the important variables were not clear at the outset but were, rather, expected to emerge as the study progressed. Neither was it clear what outcomes might be measured. We were interested in the performance of micro-systems, recognizing that in some cases this was measurable (e.g., rates of favorable or unfavorable patient outcomes), but that in other cases the outcomes of interest were subjective and not easily measured, for example, patients' experience, the professional culture, and interest in innovation and assessment of performance. For these reasons, a qualitative strategy was chosen as most appropriate for this research.

Qualitative methods develop theory by emphasizing rich description and discovery. These methods assume that the phenomena under study are part of a system and cannot be reduced to a few variables with a clear cause and effect relationship. Qualitative methods build on the theme of naturalistic inquiry, which is "a discovery-oriented approach that minimizes investigator manipulation of the study setting and places no prior constraints on the outcomes of the research."[15] Data are in the form of words and are evaluated subjectively by systematically reducing data to themes and categories. Qualitative methods are inductive to the extent that the research design allows important themes to emerge from patterns found in the data.

A criticism of qualitative methods has been the focus on individual cases, which limits the external validity of the research. In response, it can be argued that generalizability is not a goal of qualitative research in general[16, 17] nor of this study, in particular. The qualitative methods used in this study should best be understood as descriptive, hypothesis generating and, to a limited extent, hypothesis testing (see below). Further data gathering and qualitative analysis (for example using multiple respondents at each site or negative cases for comparison) paired with quantitative analysis to test hypotheses, may be the most fruitful route to confidence in the generalizablity of study findings and their predictive value.

Personal insights by the researchers are the essential information derived from the interview data and they are critical to understanding the complexities of micro-systems and the organizations in which they are embedded. However, the research must approach the phenomenon under study with what Patton calls "empathic neutrality."[18] To be neutral to the findings means not approaching the phenomenon with a set of preconceived ideas. That means one approaches micro-systems with a desire to learn about them as interrelationships emerge.

In qualitative research, it is important to separate the description of the data from the interpretation of the data. Geertz[19] and Denzin[20] discuss "thick" and "thin" description. "Thick description" depends on presenting descriptive data or recording verbatim comments so that researchers can make their own interpretations later. "Thin description," on the other hand, summarizes the facts without including any of the context. Thick description sets up analysis and makes possible interpretation.[21] Appendix A shows examples of each type of description. For this research, thick description was used and later coded. Each micro-system was recorded and presented in sufficient detail so that the micro-system, or "case," could be understood in its local context.

This study used two methods: first, descriptive summaries of the interviews derived from thick description; and, second, cross-case analysis. Cross-case analysis offers a way to reconcile the need for "thick description" of uniquely individual cases yet captures the themes and patterns that emerge across cases.[22] Two approaches to cross-case analysis are available: case-oriented analysis and variable-oriented analysis.[23] A case-oriented approach starts by considering each case as its own entity. Only after understanding the relationships, configurations, associations, and the like within the case does the researcher move to a comparative case analysis. The goal is to discover the underlying themes, similarities, and associations that hold across cases.

A variable-oriented approach to cross-case analysis starts with a framework of several variables or themes that cut across cases. For example, variables that may be relevant to a study of health care micro-systems may be the use of information, the role of information technology, or coordination of patient care. Although the study starts with key variables in mind, the variables may evolve and be clarified as the study progresses and as cases are included in the analysis. The variable-oriented approach is more conceptual and theory-centered from the beginning, and less emphasis is placed on the specific details of a particular case.

Neither approach to cross-case analysis—case-oriented or variable-oriented—is necessarily better. As Miles and Huberman point out, the process is one of alternating, combining, or integrating methods as a study progresses.[24] They suggest a mixed strategy that combines the two approaches and uses a "stacking" technique. Such a process was used in this study. To use this technique, the researcher writes up a series of cases using a more or less standard set of variables. Matrices are used to display the data for each case. Without losing any of the individual case-level data, cases are then "stacked" in a "meta-matrix." Analysis continues by systematically comparing the stacked cases and condensing the meta-matrix.

METHODS

The study methodology was a qualitative analysis of structured interviews. It was conducted in three stages: (1) literature review, nomenclature, and study design; (2) protocol development, sampling, instrument design and testing, and data collection; and (3) analysis.

Stage 1: Literature Review, Nomenclature, and Study Design

The first phase of this study involved convening a steering group to (a) develop a working definition of a *micro-system,* (b) identify high performing micro-systems, and (c) advise us on study design and interview questions. The steering group was composed of members of the QHCA's Subcommittee on Developing the 21st Century Health System, chaired by Donald M. Berwick, M.D. The steering group included: Donald M. Berwick, M.D., Stephen M. Shortell, Ph.D., Eugene C. Nelson, Sc.D., Thomas Nolan, Ph.D. (all members of the subcommittee), and an unpaid consultant to the committee, Paul B. Batalden, M.D. In addition to the co-authors, Anand Parekh, an intern and second-year medical student, staffed the project. We conducted a literature review on characteristics of various micro-systems in health care as well as in other manufacturing and non-health care service industries.

In addition to the steering group members, we sought suggestions for methodology and interview content from the staff of groups with substantial expertise and experience with qualitative analysis.

In designing this study it was important that the effort be coordinated with the work of Paul B. Batalden, M.D. and his colleagues at Dartmouth's Center for Clinical Evaluative Sciences for two reasons: 1) Dr. Batalden is a recognized expert in the area of micro-systems, and his input into the IOM project was considered a valuable resource; and 2) the data and information gathered by IOM on micro-systems were expected to be useful contributions to Dr. Batalden's separate proposal to study micro-systems. To maximize communications between the Dartmouth group and IOM project, we

- held bi-weekly telephone conferences between Dartmouth and IOM staff during spring, 1999 seeking his review and comment at critical points in the project (i.e., selection of the sample frame, development of the interview protocol and methods, draft analysis of findings);
- appointed Dr. Batalden as a consultant to the committee and a member of the steering group; and
- were assisted by Julie Mohr, a Dartmouth College graduate student whose now completed doctoral dissertation topic was on micro-systems.

We also collaborated with the leaders of the Institute for Health Care Improvement's Idealized Design of Office Practice (ID-COP) project. That project has enlisted some 42 clinical sites to apply design principles for improvement in clinical office practice. Dr. Donaldson participated in a two-day conference of these site leaders which provided further insight into some organizational and leadership issues relevant to improving performance. Because some of the recommended sites were participants in ID-COP, it also helped this study's site selection process.

Finally, Andrew Balas, M.D., Ph.D., University of Missouri-Columbia, convened experts in medical informatics for a telephone conference to assist the study staff in formulating questions about the role of information technologies in these micro-systems.

Operational Definition

The first task of the steering group was to develop a clear conceptual and operational definition of the micro-system that would be easily conveyed to the interview sites. Some questions the group addressed were: What size group is too big or too small to be a micro-system? How can we identify micro-systems? That is, what definition would include perhaps 80 percent of the groups that we were to talk with but not be too restrictive? The group did not establish *a priori* a minimal or maximum size for a micro-system. Generally, a micro-system must be large enough to accomplish its clinical purpose, but small enough to allow knowledge of the individual parts and to manage the interactions among its parts. The group identified several ways that micro-systems might recognize themselves as groups, including

- the members recognize themselves as having a common aim, service line, or clinical purpose such as care of patients with a specific clinical condition, a panel of patients, or care of a defined population; there is a self-conciousness about working together for a defined purpose; or
- units that have a direct service relationship to patients; that is, they speak to or touch the patient or are “one step away” from doing so;
- the members recognize themselves as part of a team that consciously organizes its work processes;
- the people who share an intimacy of working relationship; and
- the people who cross-cover for one another, share call rotation, define the content and process of care for their patients and formulate clinical guidelines.

The Steering Group developed the following working definition of a micro-system, choosing a general and inclusive definition so that it might learn from the respondents how they describe their own micro-systems. *A micro-system is a small, organized patient care unit with a specific clinical purpose, set of patients, technologies and practitioners who work directly with these patients.*

Stage 2: Study Design and Data Collection

During the second stage of the study we developed and finalized the protocol, selected the micro-system sites, drafted, pilot tested, and revised the interview instruments, conducted tests of interrater reliability, conducted the interviews, and transcribed notes.

Instrument and Protocol Development

During late spring and summer 1999—we developed the methodology and structured interview content. The Steering Group reviewed several drafts of the interview protocol and instruments. The methodology used was a structured one and a half-hour interview with each micro-system leader preceded by a mailed two-page pre-interview survey

The interview protocol included a letter of invitation from Dr. Berwick, chair of the Subcommittee on Building the 21st Century Health System (Appendix B), committee and subcommittee rosters (Appendix C), a two-page pre-interview survey (Appendix D), and an IOM brochure. Several days after mailing the letter of invitation, study staff called to make sure the invitation had been received and that it had been sent to the right person (the leader of the micro-system). An interview time was then scheduled and the respondent was asked to complete the pre-interview survey and fax it to us at least one day before the scheduled interview. Before the interview, the interviewer reviewed the pre-interview survey information to adjust the interview format and to make notes about which items needed to be clarified.

The interview instrument is shown in Appendix E. At the time of the interview, the interviewer introduced him or herself and briefly explained the purpose of the interview, stated that no information would be attributed to them without their explicit permission, and that the interviewer would be taking notes and might wish to follow up to clarify information at a later time. Interviews were timed to be completed within 90 minutes unless the respondent wanted to continue. Immediately after the interview, the interviewer transcribed his or her notes and completed a summary sheet.

The interviews were intended to gather information in two ways. The first was a form of hypothesis testing, the second hypothesis generating. With regard to the first, the conceptual work of the IOM quality of care committee and the Steering Group had led to a series of guesses about how effective micro-systems might do their work, which led to question areas that the steering group outlined. We organized the questions into five topics to provide structure and order for the interview but intentionally made the questions related to them open ended so as to elicit new themes that the investigators might not expect.

The interview addressed five overall topics: (1) level of performance, (2) patient experience, (3) information and information technology, (4) investment in improvement, and (5) leadership. Each topic began with an open-ended question, such as (for the first topic): What does your micro-system do very well? Can you give me some examples? A number of more specific questions followed, including a set of optional probes. For example, the first section (“Level of Performance”) included the following questions:

- What is your micro-system successful at doing? How do you define success?
- How do you know you are successful? What data are you collecting?
- If I were a patient, how would I experience care at your micro-system differently?
- If I were a clinician, how would I experience it differently from another micro-system that treats similar patients?
- How would you describe the day-to-day work environment? What does it feel like to work at ___?
- What has your micro-system done to support professional ethics, encourage peer feedback or skill development?
- Optional: How long has the micro-system been working this way? How is it different now from an earlier time?

Site Selection

Sites were selected based on their likelihood of informing the research. We used an interative process sometimes called a "snowball strategy" (Patton 1994). Using this strategy one asks well-informed individuals to nominate sites and to provide the names of other knowledgeable people to ask for nominations. In this study we asked individuals to nominate sites that had a reputation for innovative models of delivery, innovative use of technology, level of performance, or investment in improvement. Sites were identified by (2) consultation with experts in the field of quality and members of the IOM steering group and Committee on the Quality of Health Care in America, (3) participants in the Institute for Healthcare Improvement's Breakthrough Series who had made significant improvement between the beginning and end of their project; (4) Dr. Paul Batalden, who identified micro-systems that he used as case studies in various educational programs at Dartmouth Medical School; (5) Dr. Joanne Lynn, who headed the Center to Improve Care of the Dying and IHI's Breakthrough Series on end-of-life care and suggested hospice and palliative care programs, and (6) Dr. Connie Davis, Center for Health the Center for Health Studies of the Group Health Cooperative of Puget Sound and national program office for "Improving Chronic Illness Care" who recommended several chronic disease management programs for inclusion, particularly those focused on diabetes care. We also sought published descriptions of the work of micro-systems, including disease management programs, in such journals as the *Joint Commission Journal on Quality Improvement* and the *International Journal for Quality*.

This process yielded 112 suggestions for sites to include in the study. After further inquiry, we reduced this list to 77 and finally culled it by asking the steering group to pick a small number of their most highly recommended sites from the longer list. We chose only sites that were recommended by at least two members of the Steering Group. This winnowing process resulted in a final list of 45 sites. Two sites later declined to participate in the study, resulting in the final 43 sites that were included in the study.

The distribution of sites is shown in Table 1. As shown in the table, the micro-systems included in the study are diverse geographically, clinically, and in terms of the population they serve. We interviewed individuals at a range of sites that included hospital units (such as emergency departments, cardiac care, and newborn intensive care), primary care and other ambulatory settings, chronic disease management programs, hospice care, and a hospital specializing in a single procedure. All except two sites were in the United States—one in Canada and one in the United Kingdom.

Instrument Testing and Interviewer Reliability

The interviewers took hand-written notes during the interview and did not tape record the interviews because of the quasi-public nature of the National Academies and the possible requirement for any formal communications with an Academy committee to be placed in a

TABLE 2 Range of Micro-Systems Studied

			Geographic Setting						
			Northeast	Midwest	South	West/Soutwest	West Coast	Non-U.S.	Total Micro-Systems Studied
			15	8	4	5	9	2	43
		N							% of Total
Clinical Focus	Primary Care	15	6	2	0	1	5	1	35%
	Specialty Care	19	4	7	2	2	4	0	44%
	Hospital Unit	9	5	0	2	1	0	1	21%
									100%
Population Served	Pediatric	19	7	2	1	3	4	2	44%
	Adolescent	27	10	5	2	3	5	2	63%
	Adult	38	13	8	3	4	8	2	88%
	Geriatric	39	14	7	4	3	9	2	91%
	Rural	14	8	2	2	0	0	2	33%
	Urban	27	4	6	3	4	8	2	63%
	Suburban	15	4	3	2	2	2	2	35%

For distribution of population served, percents do not add up to 100% because sites may serve more than one type of population

public access file (pursuant to Section 15 of the Federal Advisory Committee Act). For this reason, it was essential that we establish the reliability of the three interviewers (Donaldson, Mohr, and Parekh).

To assure the quality of note taking, the interview process was pilot tested in several ways. Several interviews were conducted as conference calls with the interviewer, the respondent, and two note takers. Immediately following the interview, the interviewer and note takers transcribed their notes and compared their documents. As a result, some questions were re-ordered or dropped, and probes were added.

When we were confident that the interviewer could conduct an interview and simultaneously take good notes, the interview process was simplified to include a single interviewer-

note taker. To facilitate interviewing and note taking, the interview was formatted with space for note taking after each question. This helped us keep track of the context of the answers because the answers were kept with the questions, instead of having separate pages of notes. Transcripts were written up immediately following the interview, and most importantly, before conducting another interview.

Data Collection

Invitations to Participate. Key contacts within each micro-system (micro-system leaders) were identified and sent an introductory packet of information asking them to participate. A follow-up phone call from an IOM staff member was made several days after the introductory packet had been sent to schedule a time for the interview. Participants were reminded to complete and return the pre-interview survey prior to the telephone interview. All the sites complied with this request.

The Preinterview Survey. The purpose of the pre-interview survey was to gather basic information about the micro-system. This proved to be an effective method for learning, before the interview, what the micro-system does, the composition of the providers and staff, and the demographics of the population served. It allowed the person conducting the interview to review basic descriptive information about the site before the interview and to ask for any clarification of pre-interview responses during the interview. Based on the pre-interview responses, the interview format could also be adjusted to delete questions that were not relevant to the site. For example, the interview contained a section on information technology, but some sites indicated that computer based clinical information was not relevant for their site. During the interview, the response was confirmed, and questions that related to computer-based clinical information were skipped. Deleting questions that were not applicable ahead of time helped to make the most efficient use of interview time. In addition, beginning the interview by discussing what the interviewer knew about the micro-system site helped to quickly establish rapport between interviewer and interviewee. Table 2 summarizes responses to the pre-interview survey, including how the micro-systems describe their own site and type of micro-system (primary care, specialty care, hospital unit) and how it was organized.

Telephone Interviews. Telephone interviews were conducted during a three-month timeframe, June 29, 1999 through September 3, 1999. Interviews were conducted with the person identified as the "leader" of the micro-system. This was usually a physician, although several nurses were interviewed, as well as several administrative leaders. Three interviews included more than one interviewee on the call, but for the most part, the interviews included only one person at each site.

Three people conducted the interviews. Of the 43 micro-system interviews, Mohr conducted 25, Donaldson conducted eight, and Parekh conducted 10 interviews. Several individuals sent additional materials to provide more detail. In a few cases the interviews were interrupted by an urgent clinical situation, and the interviewer scheduled a time to complete the interview. In a number of interviews the respondent volunteered to stay past the 90-minute limit. Overall, the respondents expressed strong interest and willingness to help the committee in its work.

TABLE 2 Micro-System Descriptions

Primary Care Micro-Systems (*n* = 15)
1. We are a primary care practice with five physicians. Each physician makes three or four home visits a day.
2. We are a multi-physician family practice office with three full-time and four part-time physicians plus one physician assistant. We have four office staff to answer phones and make appointments, a "fringe" nurse to handle emergencies, nurses and medical assistants to get patients to rooms, give injections, and draw blood, a medical secretary, several file clerks, an office manager, a billing person and two managed care coordinators.
3. We are an outpatient primary care satellite of a larger multi-specialty system. There are three smaller subgroups that are increasingly independent with the help of an area manager.
4. We provide comprehensive primary health care to 28,000 patients annually through five neighborhood centers and an extensive Community Health Program. We employ a large number of our neighbors and patients as staff. 80 percent of our patients have household incomes below the Federal Poverty Level.
5. We have 270,000 patients and 110 FTEs. We divided the geographic area into 15 teams with seven different sites. Each team has eight to nine FTEs (doctors and nurses). Patients are divided equitably among the sites.
6. We provide comprehensive primary care and hospital care to a small, rural town of about 15,000. We are a private practice with five GIM docs, three NPs, one PA, six RNs, two receptionists and three billing people.
7. A community based practice with four physicians, two NPs, one PA, three MAs, five receptionists, and office manager. We care for 6,500 patients.
8. We are the largest family practice in the area. We have 25 physicians and nine nurses (RNs, LPNs, and MAs). We are divided into three teams.
9. We deliver primary care through a team of four physicians, two LPNs, a RN, a MA. We deliver care to about 6,000 people. We operate within a clinic of about 20 physicians
10. 10 Family Practitioners and four associate providers are divided into three teams with two RNs and two MAs per team. The teams share a phone center and a receptionist.
11. We integrate acute and long-term care for frail elders into a single system.
12. We have 7.5 FTE physicians and 26 FTE staff taking care of 14,000 patients. 75% of our patients are in managed care programs.

Continued

TABLE 2 Micro-System Descriptions—*Continued*

Primary Care Micro-Systems (*n* = 15)—*Continued*

13. We are a community health center with two primary care medical clinics, two school-based teen health centers, and four dental clinics. We have eight FPs, one PA, five NPs, three CNMs. Teams include a provider, nurse, medical assistant, social worker, nutritionist, and outreach worker.

14. We provide health care to indigent people. We have a large enhanced prenatal program. 11 board certified family practice physicians, two part-time pediatricians eight mid-level practitioners, three PA's, two LCSW, five NP's, one RD), three RN's, four Prenatal case managers, two LPN's, two Referral case managers, one medical assistant, front office, and administrative support

15. We focus on providing family medicine services. We are one FTE physician, two FTEs NP/PA providers, five FTE RNs.

Specialty Care Micro-Systems (*n* = 19)

1. We are an ob/gyn private practice with five physicians, two PAs, two NPs, one office manager and 25 employees. We have an in-house lab and attached outpatient surgical center.

2. We are a hospice composed of three outpatient (home-based) teams (corresponding to three geographic areas of the state) and a 10-bed inpatient unit. Each team has a patient care coordinator and medical director assigned to it.

3. We provide team-based, function-focused behavioral health care for adults with severe mental illness. three psychiatrists, two vocational specialists, four therapists, eight nurses, six clinical case managers.

4. The Diabetes Care Team consists of the patient, their primary care practitioner, a Primary Care Coordinator (RN), and a Diabetes Self-Care Specialist (LPN)

5. This is an outpatient endoscopy unit with five part-time physicians, three fellows, one NP, six to eight RNs, three technicians, and clerical staff. We primarily care for adult patients.

6. A Spine Center with 18 physicians from 15 disciplines (all depts are represented from primary care to neurosurgery); multidisciplinary care for multidimensional problem - one stop shopping; diagnosis and care for patients with various spine maladies, acute, chronic, operative, non-operative.

7. We are a joint effort of two health systems. We assist and encourage adults to do advanced care planning and then make sure written plans are available and followed. This involves 500 physicians. in the community and many RNs, PAs, and social workers.

8. Breast Cancer Screening Program. When women come to our micro-system, it is a screening center that also has a radiology center, as well as all the necessary elements for coordination of care and follow-up of care.

Continued

TABLE 2 Micro-System Descriptions—*Continued*

Specialty Care Micro-Systems (*n* = 19)—*Continued*

9. We provide diabetes management with Certified Diabetes Educators (Nurses) and endocrinology support

10. Breast Care/Screening in a breast center. Radiologists and support staff and general surgeons are integrated and comprise the system with some integration with the health system at large—primary care oncology, radiation therapy and pathology

11. Three person congestive heart failure case management team which treats the patient as a whole. There are currently 150 active patients. 450 have been served by our program since it started on Jan. 1, 1995. Recently, in our clinic, I have been seeing 12-13 patients a day either in person or on the phone.

12. Diabetes services are provided throughout the multi-hospital integrated health care delivery system with medical support for this continuum of care provided in partnership with primary care and specialty physicians practicing in many locations. one clinical psychologist, one PA, six-10 RD, CDEs, 2200 primary care and specialty care physicians

13. We work with cardiac services on improving clinical and financial outcomes, decreasing morbidity and mortality.

14. We're a specialty clinic providing women's and newborn care.

15. Our medical group is responsible for a population of 240,000. There are 7,000 patients with diabetes. The care team is the pcp, the diabetes resource nurse, the LPN, the endocrinologist, and the nutritionist. Diabetes care is integrated into primary care.

16. We're providing diabetes care at a county health department. We are working as part of a grant for the state.

17. We're working on improving pain management, throughout the our hospital.

18. An ophthalmic consultation center specializing in the management/treatment of complex eye disease and surgery. The primary customer for care are patients and their referring eye doctors (mostly optometrists).

19. We are a mental health department in a large multispecialty clinic—hospital system. The department provides medical, counseling and psychological testing services to all age ranges. We have five psychiatrists (four adult, one child/adolescent), two psychologists, six registered nurses, 16 therapists, and three chemical dependency counselors.

Continued

TABLE 2 Micro-System Descriptions—*Continued*

Hospital Unit Micro-Systems (*n* = 9)
1. We are a geriatric unit in a large medical center.
2. We are a Level III Intensive Care Nursery caring for intermediate and critically ill newborns. It is staffed by a multidisciplinary team of neonatalogists, residents, NNPs, nurses, respiratory therapists, and others.
3. We are an Emergency Department with 10 docs, a slew of nurses, and other people.
4. We are a cardiothoracic surgical unit.
5. The Critical Care micro-system consists of 36 beds divided into the 12 bed Shock-Trauma-Respiratory ICU, the 16 bed Medical-Surgical ICU, and the eight bed Respiratory Special Care Unit. All are open ICUs. The hospital is a academic referral center for a 400 mile radius and a Level 1 Trauma Center. The system integrates the activities of five full time hospital employed academic critical care medicine (CCM) physicians along with six private practice pulmonary/ CCM physician with about 90 private staff physicians who admit and care for this population including the active Level 1 trauma and the neurosurgical services.
6. Critical Care Services: MICU (10 beds), SICU (14 beds), CCU (10 beds (total = 34 beds), NICU, EC, and Critical Care Transport teams. 225 physicians, all specialties and subspecialties
7. We do only [one or two surgical procedures]. We have 11 surgeons, eight assistants. The entire staff is about 75.
8. We are five surgeons doing cardiothoracic surgery. Private practice. three partners, two associates. We work at the hospital with 12 mid-level PAs and NPs who were hired by the hospital. We have four secretarial office staff
9. We are a MICU and SICU. We have an open ICU—any physician with admitting privileges can admit to the ICU.

As noted, not every respondent was asked every question because some questions were not relevant or were optional. Table 3 summarizes the interview completion rate. For each question, the table shows the number of sites asked the question and the completion rate for that question (calculated as the number of sites asked divided by 43). This is a very conservative rate, however, because in responding to the open-ended questions, some respondents formulated a response to a later question before the interviewer had an opportunity to ask it. When this occurred, the information was recorded as part of the original question rather than breaking apart responses and inserting them into later sections. Responses that answered a later questions were frequent and are not reflected in this table. However, all responses were incorporated into the final analysis.

TABLE 3 Question Completion Rate

Interview Question	Sites Asked	% Completion (sites asked / 43)
Level of Performance	**43**	**100%**
Success	42	98%
Measures	28	65%
Patient	37	86%
Clinician	28	65%
Culture	23	53%
Professional	10	23%
How long	22	51%
Patient and Clinician Experience	**41**	**95%**
New Patient	28	65%
Scheduling	15	35%
Risk assessment	17	40%
Pt information	23	53%
Unusual problems	24	56%
Waits and delays	25	58%
Incentives	9	21%
Community	16	37%
Information and IT	**34**	**79%**
Improvement	**40**	**93%**
Specific projects	28	65%
Evidence of success	4	9%
Barriers	26	60%
Awareness of results	2	5%
Funded projects	5	12%
Leadership training	6	14%
Expert systems	25	58%
Clinical evidence	12	28%
Best practices	15	35%
Information sharing	6	14%
Error and patient safety	21	49%
What happens	21	49%
Culture	3	7%
Procedures	3	7%
Sources of error	6	14%
Leadership	**42**	**98%**
Macro-system helps	19	44%
Macro-system is toxic	17	40%
Ideal financial structures	15	35%
Replication	30	70%
Barriers	23	53%

A contact summary sheet (top of Appendix D) was used to summarize each interview (Miles and Huberman 1994). Its purpose was to capture the primary issues that emerged from the interview shortly after it was completed. The contact summary sheet prompted the interviewer to think about the main issues that emerged during the interview and to identify verbatim comments that illustrated them. This step was helpful in the transition from transcribing notes to coding data because it engaged thinking about the analysis throughout the interview process and while the interview was fresh in mind, instead of waiting until the completion of all the interviews to begin analysis.

Stage 3: Data Analysis

Case-Level Summary Analysis of Health Care Micro-Systems

Q.S.R. NUD*IST was selected as best suited for managing and organizing the data which comprised multiple cases but a single source from each case. Q.S.R. NUD*IST® 4.0 (Non numerical Unstructured Data Indexing Searching and Theorizing) is a multi-functional software system for the development, support and management of qualitative data analysis. Because this research was exploratory, it was important to be able to code and make coding revisions as the analysis progressed. This software facilitated the coding, sorting, and refining of categories by creating logs of the changes that were made and allowing custom searching and retrieval of text.

Transcribed interviews were entered as data to form display matrices. These can be thought of as meta-matrices, or master charts used to assemble multiple cases in a standard format.[25] The objective is to include all the case-level data in one matrix before summarizing, refining, and further reducing the data. The matrices are considered to be “partially ordered” because very little order is imposed on the display of the data. The completed meta-matrices are the first look at the cross-case data.

The creation of the matrices required identifying variables that were thought to be relevant to the study. To avoid imposing a rigid framework on the data early in the analysis, initially the interview questions were used as the relevant variables. For example, because each interview is coded by interview question, it is possible to find all the micro-system responses to Question I.6. “If I were a patient at _____ , how would I experience the care differently?” Although the questions from the interview served as the initial relevant variables, additional variables emerged as the study progressed.

Looking at the data by interview question is useful, but still represents raw data. For this reason, coding was then used to assign descriptive codes to each phrase, sentence, or groups of words that represent common concepts. This is called “first level coding.”[26] Table 4 lists the variables that emerged from the transcripts and that were used for the first level coding of the interview data.

TABLE 4 Micro-System Variables

Variable	Working Definition
1. Investment in Improvement	An effort to ensure that improvement is part of the work of the micro-system.
2. Alignment of Roles and Training	The match between a health professionals' educational training, certification, etc. and their work.
3. Constancy of Purpose	Integration of the aim throughout the micro-system.
4. Values	A set of beliefs that guide the work of the micro-system
5. Organizational Support	Ways the macro-system facilitates the work of the micro-system.
6. Multidisciplinary Team	The existence and recognition of the team approach to care.
7. Community Connection	Micro-system is a resource to the community/community is a resource to the micro-system.
8. Micro-system Measures	Variables high-performing micro-systems are monitoring (or think are important to monitor).
9. Use of Information and Information Technology	Information is key, technology can be very helpful.
10. Barriers	Challenges and constraints to the work of the micro-system.
11. Resources for Replication	Necessary elements to design and implement a similar micro-system.
12. Evidence of the Micro-System	An indication that the site is a micro-system.
13. Improvement Example	Examples of improvement projects made within the micro-systems
14. Leadership	Importance of leadership to the work of the micro-system

Cross-Case Analysis

Cross-case analysis involved searching each interview for examples. This was an iterative process because themes emerged and evolved throughout the coding. As the analysis continued, the variables listed in Table 4 were refined—some were grouped into categories, and some were dropped because they did not rise to the status of a theme that could characterize the micro-system. For example, "barriers" was a common idea found throughout the interviews, but barriers are not a characteristic of micro-systems. How the micro-systems deal with barriers, perhaps through an investment in improvement or use of information and information technology, did appear to be characteristic of the micro-systems interviewed, however and were coded in this way.

Eight themes emerged that became a framework for thinking about characteristics of high performing micro-systems. Because the framework emerged during the analysis, it was necessary to return to the data and search each interview again and again to ensure that each interview was correctly coded.

RESULTS

Leaders of 43 micro-systems responded to questions grouped into five topics: level of performance, patient experience, information and information technology, improvement, and leadership. Analysis is presented in two parts. The first analysis (I) is a case-level summary of each of the five topics with samples of verbatim responses. The fifth and last topic includes, in addition, some cross-cutting issues that respondents emphasized as they described requirements for replication of their accomplishments, what we call "lessons" for replication.

The second part of the analysis (II) was a cross-case analysis based on eight themes that appeared to be associated with high performing micro-systems. Those themes are: integration of information, measurement, interdependence of care team, supportiveness of the larger system, constancy of purpose, connection to community, investment in improvement, and alignment of roles and training.

I. Case-Level Summaries by Topic

Level of Performance

To determine the level of performance of the micro-system, the first part of the interview asked respondents what their micro-system does very well and how they know this; that is, what data are being collected about performance. The majority of micro-systems (70 percent) identified taking care of specific types of patients (e.g., the frail elderly) or providing a specific type of care (e.g., women's reproductive care or diabetes care) as what they do especially well. Other areas that were identified are working as a team (14 percent), using information technology (12 percent), conducting research (7 percent), educating and training providers and staff (5 percent), improving access to care (5 percent), and communicating (1 percent).

The connection between what the micro-system does very well and how micro-systems knew they did was so not so clear. Forty-nine percent of the micro-systems interviewed mentioned measuring their success by looking at clinical outcomes or some defined set of measures that includes clinical, functional, and financial indicators. Seven percent of the micro-systems cited measuring their micro-system performance against guidelines or protocols. For example, one micro-system tracks which protocols are being used, by how many physicians, and what percent of time. Forty-four percent of the micro-systems mentioned measuring patient satisfaction, and seven percent of the micro-systems identified provider satisfaction as an important indicator.

Nine percent of the micro-systems identified benchmarking as a specific method for comparing their outcomes to others. However, one micro-system leader viewed benchmarking as potentially problematic:

> *We measure success against ourselves. We try very hard not to measure against benchmarks. Benchmarks can limit you. Sometimes the benchmarking in and of itself becomes the goal. We do 1400 hearts a year. We should be the benchmark. Success to us is any incremental thing that makes us better than yesterday. . . . It is a mistake to benchmark pieces of your process against multiple other pieces of process. . . . Just keep working on little projects to improve what you are doing.*

Finally, nine percent of the micro-systems interviewed acknowledged that measuring and collecting data is difficult work.

> *Other people use surveys and other ways to benchmark. We just do it seat-of-the-pants. We figure that we will get feedback. We don't use any modern techniques to measure anything. It's very expensive. We don't have extra capital to invest in recreational data collection to prove how we are doing to someone else when we know how we are doing.*

When thinking about the micro-system concept, a common question is, "How do we recognize a micro-system? Is it just another word for a team?" In consideration of these questions, respondents were asked to describe how a patient would experience care differently in their micro-system. Similarly, respondents were asked how a clinician would experience the micro-system differently from another micro-system that treats similar patients.

Respondents reported most frequently that patients would perceive care differently because of the level of information that the micro-system gives the patient. Respondents mentioned, for example, making welcome calls to new enrollees, sending information about the services provided, and making sure the patient has a copy of the physician's notes at the conclusion of the appointment. One respondent noted that there are "no barriers to information."

> *Data on the measures we are monitoring are displayed on a wall—patients can see what the micro-system is working on.*

The level of information may include an increased use of information technology. Some micro-systems are communicating with patients by e-mail and referring patients to web sites for patient education. Other differences in the patient experience were a team approach to care and the focus on building a relationship with the patient and family.

When asked how *clinicians* would experience the micro-system differently, one respondent said, "the clinical part is not that different—it's the technology and the teams." Other respondents indicated that technology has an increasingly significant role. However, one person articulated the importance of not confusing information with information technology:

> *Frankly, all this stuff about how information systems are what has been holding us back¾that's [nonsense]. Everyone is just waiting for some kind of cure-all information technology system instead of figuring out how to track things themselves.*

Other differences that respondents pointed out as being different for clinicians in their micro-systems were standardization cross training of staff, and the infusion of improvement into daily work.

To understand the culture of the micro-system, we asked respondents to describe the day-to-day work environment of their micro-system. Most comments discussed the impact of a team approach to care.

> *There has been a radical change since we introduced teams. You can see it even where they hang out. Before the docs were together, the nurses together, etc. But now the team hangs out with the team. At the morning meetings, you may see the medical assistants providing the leadership. The medical director calls it the "fast break"—three people on the floor and anybody can finish the play.*

Other aspects of the culture mentioned by micro-system leaders were the freedom to make decisions regarding own work, an increased level of communication, and a commitment to improve.

Respondents were asked whether their micro-system had made specific efforts to support professional ethics, encourage peer feedback or develop the skills of its members. Answers range from micro-systems that admitted "we haven't done much" to one micro-system that has a full-time person who is responsible for organizing and leading sessions on the issues involved in working in teams. Other sites acknowledged the importance of this type of training, but lacked a systematic way of doing it,

> *We try to do this through the course of our activities. But we don't do it conscientiously. It's kind of on-the-job training.*

The final (optional) question in the "level of performance" section asked how long the micro-system had been working the way the respondent described it. Answers ranged from one year to "since 1945." Of the respondents who were asked this question (n = 22), three sites reported more than ten years (16 years, 22 years, and 55 years). All the others reported less than ten years.

Patient Experience

In the second section of the interview, respondents were asked to describe the patient's experience in the micro-system. Specific questions asked about a new patient's experience, scheduling, risk assessment, referral, waits and delays, and patient education. These questions were designed to elicit information about innovations in delivery of care.

Six of the sites have moved to an "open access" model, where patients are given an appointment to be seen the same day they call if they wish to come in that day.

> *We assure that a patient can be seen that day if they can be seen by five; otherwise, the next day. That is not a big problem because phone calls to be seen*

that day drop way off in the afternoon. The primary focus has to be: "We are here for you."

Another comment from a micro-system with open access shows that they feel they have developed an approach that works well.

In the old system, variation in quality was caused when patients went elsewhere to be seen (for example, an urgent care center) or when they gave up trying to be seen. Now the variation in quality is based on the doctors. In the first generation of open access people carve out slots based on predicted urgent care demand. But you need to move beyond this and dispel the myth of "needs vs. wants where wants are seen as unjustified demands. . . . The way to manage demand is over time, not with a call to a nurse.

Other sites continue to carve out slots for urgent, same-day appointments but otherwise schedule future appointments. This does not appear to eliminate barriers to access and, as the following comment suggests, may not be the best solution for providers, patients, or the health care system in general.

We have quick access, but not open access. We take care of anyone who just walks in, but we don't advertise that. We try to triage based on urgency. Next available appointment slots may be a month out. The extenders have more open slots. The older, established MDs have a longer wait time for next available appointment. We maintain 10 percent open slots for same day appointments.

Other innovations in organizing and delivering care include building time into the daily work for teams to communicate, present cases, and learn from each other. Building in mechanisms for communication seems to be key to managing referrals, as well, and information technology can facilitate this communication.

We started as a multi-specialty group. If I pick up a phone I can connect directly to a specialist. This makes the transfer of care smooth. The Epic system generates referrals for non-urgent referrals. My notes go with the referral. It's the same method for getting information back to me. We are also connected via e-mail, and we do a fair amount of communicating this way.

Many micro-system have specifically addressed the need to reduce waiting time and delays. They described improvements such as standard stocking of rooms, pulling up information about the patient before the visit, and adding a patient-flow facilitator to the team.

We asked respondents how their patients get information about their health condition. Predominately, they reported that patient education is conveyed during one-on-one interaction with providers, via printed materials, videos, and classes. There appears to be an increasing level of comfort with technology and the integration of technology into patient education. Everett Rogers's framework for studying the adoption of innovation can be applied to this phenomenon.[27] Rogers's findings from decades of research in the diffusion of innovation

demonstrate that the rate of adoption over time follows an S-shaped curve. During the early stages of an innovation, such as use of computer technology in providing patient education, there are relatively few adopters, but eventually more and more groups adopt it. Figure 1 shows Rogers's model for diffusion of innovation overlaid with three examples from the micro-system interviews regarding the current use of e-mail for patient education in these micro-systems.

Respondents were also asked about incentives that reward management and staff for meeting and exceeding patient expectations. Responses fall into three categories, (1) no incentives, (2) incentives, and (3) misaligned incentives. The first is no incentive:

> *The only reward is the knowledge that you are providing good personal care for each patient.*

Another micro-system discussed an Independent Development Plan (IDP) that recognizes successful efforts to improve with a raise in salary.

> *We just started this year. Next year it will be mandatory to meet your IDP to get a raise. For example, one group wanted to improve patient satisfaction in their team. One team wanted to decrease supply costs. They cut supply costs by 28 percent.*

Two respondents mentioned incentives that appear to be misaligned; that is, the incentives do not promote the functioning of the micro-system either because the incentive is not connected to the work of the micro-system or because the incentive is not given to all the people working in the micro-system.

> *There are only incentives for high-level administrators to meet HEDIS measures. Nothing filters down.*
>
> *If at the end of a quarter, there are savings from the unit, the money is split one third to the facility, one third to the health plan, and one third to the physicians.*

The final question in the patient *experience* section asked respondents how the micro-system seeks input from the community or keeps the community aware of what the micro-system is doing. The micro-systems responded that they interact with the community at two levels—acting as a resource for the patient population and acting as a resource for other clinicians and health care providers by providing education and setting the standard of care in the community.

Information and Information Technology

Forty-nine percent of the sites included in this study indicated that patient records are paper based; 39 percent indicated that patient records and financial systems are computer based but separate; and 12 percent indicated that patient records and financial systems are to

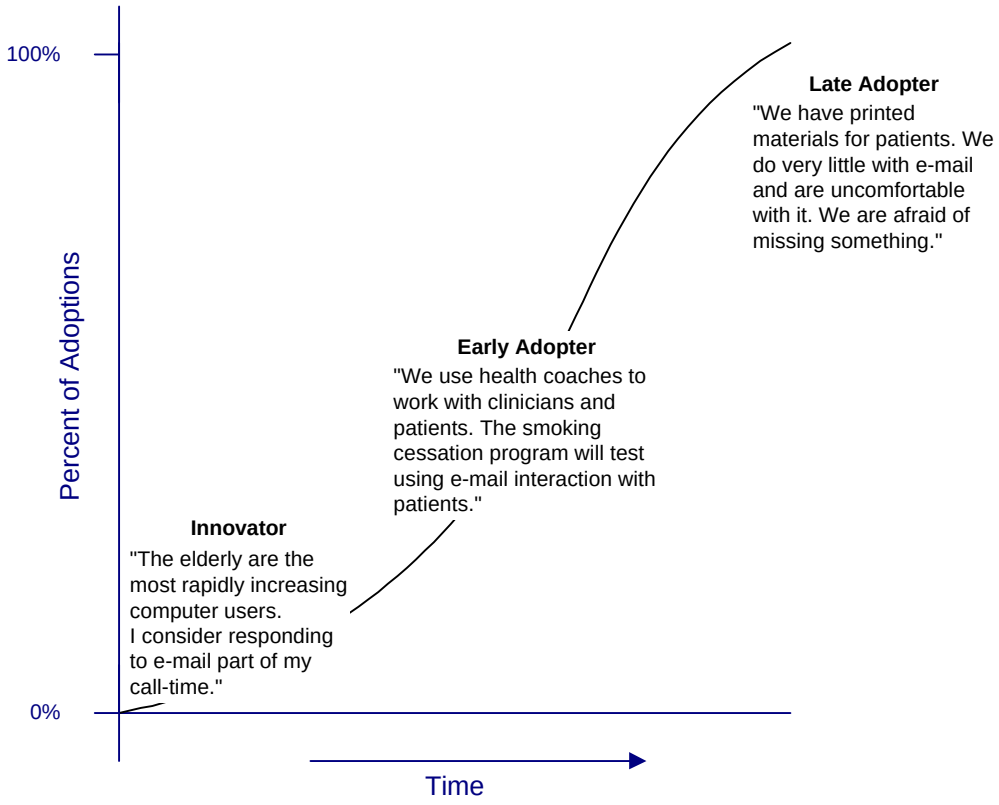

FIGURE 1 The Diffusion of Innovation and the Use of E-Mail for Patient Education.

some extent or entirely integrated. Computer-based records tended to be concentrated in hospital units.

The majority (58 percent) of the sites interviewed were either linked or had access to patient data from other units, such as laboratories, pharmacies, or the emergency department. Some micro-systems used computer-based information systems to generate reports about their practice (n = 15), to support real-time patient care (n = 12), or to support clinical decisions (n = 6). Only one micro-system indicated that the clinical information system includes direct data input by patients (patients use a touch pad to answer relevant questions and report on their health status),

> *You would be given a touchpad computer when you come in for your visit for filling out all the intake information. Your picture would be taken digitally. All this would happen, and the doctor would see it, before you see the doctor. The doctor would explain your responses—e.g., what the SF-36 score means.*

Improvement

The micro-systems provided rich examples of improvement projects. Respondents commented about what they had done to redesign services and to improve the quality of care and how they knew that these efforts were successful. Projects range from improving clinical

care (such as improving diabetes or asthma care), to improving administrative or service aspects of care (such as scheduling or reducing delays).

When asked about the context for quality improvement efforts, respondents frequently cited time and financial constraints and lack of organizational support for improvement.

> *The amount of change in staff is huge. Staff changes are as frequent as every month. Second, building our team and dealing with the administration that deals with 20 physicians has also been tough. . . . One hand, they say "work as a team," and on the other hand, they don't let the team meet or work together. . . . The last barrier is still having a paper-based medical record. This is the primary source of information. There is definitely a lag time before all the information is there.*

One site noted the need for improvement teams to be anchored in the micro-system.

> *We did something wrong the first time. We created an ad hoc team to lower infection rates. They brought the [suggestions for] change back to the unit. The unit didn't want to make the changes. The improvement team was "off-line." . . . Our goal is to make a unit that creates improvements.*

Respondents were asked if the micro-system uses any guidelines, protocols, or expert systems to help clinicians get up-to-date information. Most micro-systems have guidelines and protocols in place and cited many instances of their adaptation, use, and development. However, most reported difficulty in integrating the guidelines and protocols into the daily work of the micro-system.

> *There are a lot of guidelines in most institutions, but the way they are implemented destroys their usefulness. For example, the diabetes guidelines are 40 pages. As a physician, I look at them and decide on the two to three most important things that should be done, and I work on getting those done consistently. Work on the others later. Even this is very hard to implement consistently.*

A few of the respondents mentioned formal benchmarking arrangements with other organizations. Overall, among the sites interviewed, there appears to be a lack of a formal mechanism for learning about best practices and for sharing new information.

Patient Safety. With the recent publication of the Institute of Medicine's report, *To Err is Human*,[28] national attention has been focused on medical errors and patient safety. One part of the micro-systems interview asked participants to describe what happens in their micro-system when someone makes an error. It also asked about the major sources of error or harm, the extent to which there is a blame free culture, and procedures that had been implemented to improve patient safety. Medication errors and follow-up of abnormal lab results were the most frequently mentioned sources of error. Several respondents described formal mecha-

nisms that were in place. For those without a formal mechanism, talking about errors appeared to be more difficult.

> *It's hard to talk about "error" because it is culturally not acceptable for fear of litigation. But we try.*

Several respondents recognize the importance of a systems approach to reducing errors.

> *If something bad happens, it seems to me then the system has set the person up for failure. When you gather the data, it almost never is what it seems to be. We had a patient who wasn't doing well. The physician ordered lidocaine. The nurse gave the patient a whole amp of epinephrine. We all thought "how stupid." But when we started looking at the medications they were beside each other in almost identical boxes. Still, she shouldn't have made the mistake, but you could see how it could happen the way we had things set up.*
>
> *The system can be an advocate. It can be a reminder that a mammogram needs to be done, that there is a system in place to make sure it happens, that things go well. A system can also empower the medical assistant to insist that a patient be seen, even if it means clashing with a provider.*

Leadership and Management: Lessons for Replication

The last section of the interview was a set of questions related to leadership and replication, including: the role of the macro-system, financial structures for payment and rewards that would be ideal for improving the quality of care, key factors to success—the key lessons for others who would like to replicate what had been done, the major barriers to replicating this elsewhere, and how barriers had been overcome.

Most micro-systems function within a larger system, or "macro-system." It is possible that micro-systems are successful only in certain organizational environments. On the other hand, a micro-system could fail because of its organizational environment. Respondents were asked to provide examples of helpful and toxic ways the macro-system affected the care they provided. Respondents provided examples of supportive macro-systems—that is, supportive in providing resources or in creating the environment or culture for the micro-system's work. However, the tension between the micro- and macro-system was evident in other responses.

> *They have been very supportive in terms of wanting to do cutting edge work. The priority for the system is patient care. They identified areas where CQI teams were needed. They supported us financially too. They have paid close attention to the results. They have identified ___ care as an area where they want a center of excellence. It is a priority of the system.*
>
> *The administration is a barrier. Sometimes I wish that they would just open the door and get out of the way.*

Respondents were asked to comment on what they would consider to be an ideal financial structure for improving the quality of care. Among the respondents asked this ques-

tion, a common response was to have some sort of capitated system, as suggested in the following comment.

> *To encourage improvement, you need a structure that makes you responsible for a defined population—some sort of capitated system. In a couple of sections here, the payment scheme is fee-for-service—this makes people less involved in the team. The incentive is to maximize their own profits. This hurts improvement efforts.*

This section of the interview was of special interest to the IOM Committee on Quality of Health Care. Because it has been difficult to deploy improvements either within or across organizations,[29,30] we were particularly interested in what micro-system respondents would tell us about how to replicate what they were accomplishing.

Many of those interviewed expressed clear ideas about how they were reorganizing practices, their principles for doing so, and their commitment to an ongoing process. Respondents described their early limited successes or outright failures. We heard what had and had not been successful,

> *If you can have those three things in place before you start¾the right team, the senior leader support, and the financial issues resolved¾you can replicate what we have done. What we are doing is not undoable in other places. In many cases it's just common sense.*
>
> *It is helpful to have a clear sense of goals, a philosophy of the service. Line everything else up with that. Funding must be aligned somehow to make the model possible. It is helpful to have some leaders who are in the micro-system all the time working on the administrative and organizational support of the model of care. We get visitors a lot. . . . They are interested in how everyone involved understands the goal of care, the high level of communication. Productivity expectations, but paid on salaries, are helpful for improvement. Plus recognition for those working on improvements. There isn't a hierarchy of how much opinions are valued. Everyone's opinions are valued. The meetings and care plans are done for a thought out reason. It isn't by accident that this is how we got here. It would help to have supervision from someone who has done the model. Our model has been replicated. Mentoring has helped. There needs to be a connection over time—someone to talk to about difficulties and barriers as they occur. Talk it through with someone who has been there. It's hard to set up a model just by reading about it.*

Respondent answers about requirements for replication could be grouped into six "lessons for replication":

1. Executive and governance-level support for innovation and improvement efforts,
2. Strong, focused, and sustained clinical leadership,
3. Collaboratively functioning multidisciplinary clinical teams,
4. Explicit attention to the development of systems of care,
5. Good information systems that made measurement of their performance possible, and
6. A focus on the needs of patients.

Sections below explain each of these factors and include tables with illustrative verbatim comments.

Executive and Governance-Level Support for Innovation and Improvement Efforts. Most micro-systems function within a larger system, or "macro-system." In this study, the macro-system was generally a hospital or health plan. Micro-system leaders repeatedly cited the support of senior executive management as a *sine qua non* to their ability to succeed (Table 5). Respondents cited support of their efforts at innovation as critical, whether by setting direction, demonstrating interest and attending to the results, by providing financial and administrative resources, or the "space" for innovation despite sometimes strong external financial pressure. Support included a willingness to set aside time for the micro-system leaders and members to work on improvement rather than their having to carve it out of other clinical responsibilities. In such micro-systems, the aim(s) of the micro-system are consistent with the aims of the larger "macro" system.

Strong, Focused, and Sustained Clinical Leadership. A second area that emerged very clearly as leaders articulated how their work might be replicated was the need for strong clinical leadership at the micro-system level combined with a clear sense of purpose or aim that guides the work (Table 6). Respondents cited a high level of energy, focus, credibility, commitment, patience, and inclusiveness as important to success. Where aims are clear, they are communicated across micro-system boundaries, "When I walk in a room, everyone thinks, 'diabetes.' "

Collaboratively Functioning Multidisciplinary Clinical Teams. Respondents cited the importance of collaborative work both for clinical care and for improvement efforts (Table 7). They emphasized the need for quality improvement work to be based within the team, the need to recognize the contributions that all members of the group could make, with various members taking leadership roles for specific improvement activities. They also described new or expanded roles and the need for coaching and training new members of the micro-system in their work relationships.

Explicit Attention to the Development of Systems of Care. Respondents often cited their micro-system's investment in improving their systems of care, and they identified such work as being as critical to their micro-system as one-on-one patient care (Table 8). This investment

TABLE 5 Importance of Executive and Governance-level Support for Innovation and Improvement Efforts

Type of Micro-System	Comments
Spine center	They provided space, money, people, and a chance to make my vision a reality.
Breast care center	They have been very supportive of cutting edge work. They identified areas where CQI teams were needed. They supported us financially, too. They have paid close attention to the results. They have identified breast care as an area where they want a center of excellence. It is a priority of the system.
Advance care planning team	We had the commitment from top administrators—the presidents from four systems set up the task force. The task force was to talk about ways to collaborate to improve healthcare. We set as a goal that at least 50 percent of adults in our community would have an advance care plan before a crisis and that the program we implemented to do this would be accepted by the community. The endorsement from the administrators made the task force much easier…. I met very little resistance. My organization, in particular, put a lot of importance on this and asked me to put a lot of time in it. I wasn't just asked to work it in to my other responsibilities.
Ophthalmic center	We can make changes quickly and are free to make investments and commit resources to change. We recently created a management services division here. We help other clinics and care sites to do marketing, quality improvement in patient flow, etc. The larger organization provided us with some resources to allow us to do this.
Endoscopy unit	The top leadership support must be there—if the CEO is directly obstructing you, just pack your bags and leave.
Emergency department	The hospital system has shown great effort in helping us out with patient restraint protocols. Restraint management has been an area where they have excelled and this has made the ER a safe place to work. They are also helping us out in quality end-of-life issues and identifying how cultural differences necessitate individualized care.
Hospital cardiac care service	The VP of Medical Staff has worked with the physicians. The Chief of Staff was supportive of disease management. The 12 chiefs work closely with our department. If they are given numbers they don't like, the VP of Medical Staff will not let them get by with that. They have to work to improve it.
Newborn intensive care	Someone at the leadership level has to be committed to good quality. You must keep the stimulus there to be the best. Leadership must think of ways to encourage, support change, and think of ways to change.

Continued

TABLE 5 Importance of Executive and Governance-level Support for Innovation and Improvement Efforts—*Continued*

Type of Micro-System	Comments
Primary care	There has to be a high degree of commitment—from administration and also from someone willing to do the work, collect the data. There has to be a commitment of resources, both human and financial.
Diabetic management program	Senior management support is critical because it consumes system resources. At various times they have pushed back and said we were just doing individual quality improvement projects. We prevailed in saying that this is system-wide disease management, not just individual quality improvement projects. If you can have three things in place before you start—the right team, the senior leader support, and the financial issues resolved—you can replicate what we have done.
Treatment of severe mental illness	They have a sense overall of an organization trying to learn, develop, and improve. They provide training for managers that places a high value on communication. If changes are made they are well advertised within the group. There is some interaction between micro-systems. We know what is going on in the other micro-systems.

comes in the form of resources, such as time, money, and training, but also as an investment in creating the culture of the micro-system. For example, a respondent from a neonatal intensive care unit said, "We charged the entire operating structure of the unit with improvement." Various approaches were described, including taking people "off-line" to focus on their processes of care, standardizing techniques and protocols and measuring their effect, trying small scale ("rapid-cycle") changes using small samples, and applying engineering concepts from other industries, such as continuous flow concepts for scheduling and care.

Good Information Systems. We were interested in the extent to which electronic medical records, knowledge servers, decision support tools, continuous electronic patient-clinician communication, and consumer informatics had been incorporated into the work of the micro-systems. Respondents were asked both about clinical information systems to support individual care (Table 9a) and systems to provide information about their performance to use as a basis of improvement (Table 9b). Although some micro-systems reported use of information technologies to support individual patient care—most community-based practices as well as much of clinical practice within hospitals did not have integrated data systems, knowledge servers, or decision support tools to use for real-time clinical practice nor for improving the quality of care for their patient population.

TABLE 6 Importance of Strong, Focused, and Sustained Clinical Leadership

Type of Micro-System	Comments
Treatment of severe mental illness	It is helpful to have a clear sense of goals, a philosophy of the service. Line everything else up with that.
Integrated geriatric care	You have to have energetic and powerful leadership that believes that this is the right thing to do. They really have to be willing to take this on as a mission—understand and embrace it. First you have to believe in it. Then, you have to be committed—a commitment to follow it through to the end, not just to get started.
Hospital cardiac service	You need to have the leadership in place—have the vision, be able to articulate it, and have the passion to carry it through. You also have to have a high level of credibility.
Geriatric care, large medical center	Dedication, hard work, and patience to organize, implement, and stay committed is vital.
Neonatal intensive care unit	Our culture was, "Of course babies get infections. They are not well to begin with." But other sites saw an infection as a failure, not an entitlement. All the way to the bedside the unit knew that infection was a failure. That philosophy has to permeate the organization.
Diabetic management group	What we do well is communicate the importance of diabetes care— up to the senior leaders of the organization; across to other providers' and out, to the community. We are advocates for our own work. Whenever I walk into a room, people think "diabetes."
Primary care	Our principle is that all of today's work is done today. We have adopted the principle: If you call today, we will see you. If your own doctor is here, she'll see you.
Advance care planning team	The focus of this micro-system is improving advance care planning. This is a joint effort of two [competitive] health systems. We assist and encourage adults to do advance care planning and then make sure written plans are available and followed.
Intensive care unit	An RN and I work as a team, almost one person. She has a unique ability to communicate with people like I've never seen before. She makes people enthusiastic and is able to interrelate with everyone. My strength is my credibility.
Breast care center	To replicate this model you need . . . agreement among whoever is involved that these are our common goals, processes, roles; a shared vision—we will need to change the system to get there

Continued

TABLE 6 Importance of Strong, Focused, and Sustained Clinical Leadership—*Continued*

Type of Micro-System	Comments
Ophthalmic center	Care givers need to be diligent, make fast changes. Many gains are only achievable with a leap of faith. Sometimes, it's a lonely feeling to believe in quality improvement, but you try and make a difference by being persistent. A leader has to accept the insecurity and ambiguity that goes with the job. It takes guts to lead.
Cardiac thoracic surgery practice	You need to have good leadership. Without MDs as part of the leadership, you aren't going to get anywhere. Quality improvement can't be directed from administration. It has to start with the first step. For us it was agreeing to show up at the OR on time. Then we decided to work on something else. The biggest barrier is the first step.
Spine center	When things are successful it is because someone had a vision. I've watched what has happened to the program I started somewhere else. The longer I've been away, the more it has fallen apart. Computers can continue to work the same way, but people aren't computers. They won't work the same way once you walk away from them. You have to look for the person with the fire in their eyes. A lot of people want what we have here. You can provide the tools but only a handful of people will be able to do anything with it. I try to become unimportant—give people the tools that will enable them. You have to enable the people around you to be successful. Some of the people will take it and make it better, but if you aren't continuously improving it won't work.
Newborn intensive care	Taking care of sick babies—the quality of clinical care. The neonatology group has a commitment to being a resource to the region. We have a commitment to the health of a population. This is crucial to our success. As a resource, we provide education and review the quality of care for the whole region.

A Focus on the Needs of Patients. Respondents often prefaced their comments about how their micro-system worked with descriptions about their aims in meeting a variety of patients needs (treating the "whole patient," ensuring their dignity, the timeliness of services, attending to symptoms such as pain and to suffering, and making sure they have the information they need (Table 10).

TABLE 7 Importance of Collaboratively Functioning Multidisciplinary Clinical Teams

Type of Micro-System	Comments
Primary care	Other industries train and use people based on developing collaborative relationships. This is a particular problem for medicine and its fierce socialization process. It requires recognition, training, and a management philosophy.
Geriatric unit	I have a bias to the team approach. I am "content" oriented as opposed to "process" oriented. The latter deals with who is in charge and who gets to speak, etc. The former depends on a team of professional people who have various experiences and expertise. They respect each other and their opinion.
Primary care	The receptionist talks them through the systems of the office. They are trained to follow through specific areas of care such as screening, childhood immunization, and antenatal care, so they have one person to contact. They have become expert in their areas.
Intensive care unit	If the Respiratory Therapist notes an abnormal lab value, she is comfortable not just taking a blood sample and reporting it, but managing it. The technicians are caregivers. Expectations have changed. They [adjust] therapy to within physiological parameters. They are cross-trained so that they can take on nursing tasks, for example, starting IVs when needed. When fully trained and confident, they may tell an admitting doc that a patient is not ready to have a ventilator tube removed.
Cardiac care unit	We developed multidisciplinary rounds—everyone involved in caring for the patient. The major value is having everyone communicate directly with one another. Each person knows they may be asked about the patients and has to be prepared.
Geriatric unit in medical center	It is impossible for one individual to take care of an elderly person. Older and frail people have many health needs that can only be met by a group of dedicated individuals.
Ophthalmic center	We believe strongly in team care. Staff satisfaction is very important. Everyone is not equal, but everyone is important and has a different responsibility. I try to make sure that the clinicians know that working here requires a balance of getting to do what you want to do and of doing things as part of a team.
Primary care	We emphasize training medical assistants to a much higher level than most expect. We use two NPs extensively. Medical Assistants are trained in using technology, standardized triage functions, training patients in self-management. We are trying to "push the envelope" and rely less on credentialing and more on continually developing new skills.

Continued

TABLE 7 Importance of Collaboratively Functioning Multidisciplinary Clinical Teams—*Continued*

Type of Micro-System	Comments
Primary care	[The doctors] are worried about managing clinical conditions. They work under pressure and stress and try to find a way to control it. The myth is that they can control it with highly specified systems that raise barriers. They all claim that "my patients are sicker." I reply, "Give me your sickest patients—those with congestive heart failure, the ones on coumadin, patients with diabetes, hypertension, the old, sick people, anyone who seems to require more than the average resources and time." When they ask why I would say this, I reply, "Because I will enlist help, resources—clinical pathways, care managers." We provide these resources to the practice and should never charge [or penalize] the doctors for this help. The doctors have not learned yet how to enhance the team with other kinds of providers—health education, behavioral medicine, physical therapy, pharmacy.
Integrated geriatric care	It has to be collaborative in nature. You have to find the people with the clinical competencies, but then train them. You have to train people to work in a different way. This is the only place you see true integration of acute and long term care. In the first three months after hiring people we provide in-services on team work, resolving conflicts, working together.
Cardiac care unit	I've already mentioned the importance of support from high, senior management. It is critical. Second, is support of the nursing staff. They drive this, they are the core group who are there 24 hours a day. They are crucial to making change. Third, the doctors must be willing to give up some of their autonomy and to be a part of a team. You can't bring someone in from outside to do this. It has to be someone who is there and well respected.
Hospice	The nurses aides are members of the team. Include them, listen to them.
Treatment of severe mental illness	It is helpful to have some leaders who are in the micro-system all the time working on the administrative and organizational support of the model of care. Everyone involved understands the goal of the care, and there is a high level of communication. Productivity expectations, salary, plus recognition of those working on improvements are helpful. There isn't a hierarchy of how much opinions are valued—everyone's opinions are valued. The meetings and care plans are done for a thought out reason. It isn't by accident that this is how we got here.

TABLE 8 Importance of Explicit Attention to the Development of Systems of Care

Type of Micro-System	Comments
Behavioral health care	In a given week we are spending about 100 person-hours on [the work of] teams. People are being paid to spend their time doing this, not just during their lunch hour. Someone said, "You have to assume you'll be around here five years from now. Do you want to be doing things the same way?" Most of us don't. This requires a new attitude that results in understanding that industries must invest in change in these micro-systems. You have to tolerate pulling people off-line to work on it. This is a radically new way of thinking in medicine which traditionally views any sort of meeting as a waste of time… [and that] the only useful time is spent seeing patients. I think that unless you spend time considering how to deliver care better, much of that time seeing patients is wasted.
Primary care for underserved, minority population	The system can be an advocate. It can be a reminder that a mammogram needs to be done, that there is a system in place to make sure it happens, that things go well.
Primary care	We need to train MDs in systems. They must have a sense of accountability and a sense of the patient-doctor relationship.
Hospital endoscopy unit	I try to help people understand that we can "work smarter." You can feel rotten about how you are practicing. I tell them, "You are right—and it's going to get worse." But change is possible. We don't need a billion-dollar solution. We need a billion $1 solutions. You have to create the will to change. There's the will to change, then execution.
Behavioral health	Our philosophy is, Just Do It! A credible change agent is necessary. A change agent seems to be most effective if he/she is like the people he/she is trying to change. For some settings this means being a physician leader, but not an administrator. Find a partner to work with. They will push you and point out where you need to go. Allow the teams to do the work. Empower them to make change, spend money if necessary.
Primary care for underserved minority population	It's an incredible relief to try small changes on a small scale. It's so simple it's brilliant. My time is dedicated to this. A dedicated person keeps everyone connected. The team makes use of the strengths of the individual team members. We had been managing indigent diabetic patients for years and didn't think we could do any better. The providers believed that these people are so hard. But the patients responded to the changes we made. You have to craft something that is doable. You have to look for the simplicity in complex things.

Continued

TABLE 8 Importance of Explicit Attention to the Development of Systems of Care—*Continued*

Type of Micro-System	Comments
Small hospital specializing in a few procedures	Although there are small, minor differences, every surgeon who joins the staff, regardless of seniority, starts by assisting, then being assisted in 150 cases before being left on his own. If we are not completely confident he has mastered the technique, supervision is extended another 100 cases. The secret of success is in everyone using the same technique. The total cost is 50–60 percent of a general hospital. It decreases complications and is more cost effective.
Women and newborn service	It takes a major commitment to do what we are trying to do. It is very expensive. But once someone has done this, and there is a model out there of data driven quality improvement, the cost of replication will decrease. We have commercial vendors involved in some of our projects who will develop and sell these techniques. So, we are just one success story away.
Emergency department	There has been a process of radical reengineering around customer voice. There has been process improvement and rigorous cycle time analysis. The outcomes we measure include cost, quality of life, patient satisfaction. The quality of life is important not only for patients, but also for providers. We are able to show through our fast track program for less urgent patients that total time from beginning to end has dropped from 92 to 47 minutes. Cycle time between the arrival of a patient to a doctor seeing that patient has dropped from 32 to 18 minutes. The "decision to admit" on the floors of the hospital has dropped in cycle time from 3.5 hours to 1 hour. We have also reduced pharmacy cycle time. We have bedside registration. Each room receives a portable computer rolled in on a cart. Computer orders for lab and pharmacy are made from the bedside. In terms of clinical data, we have reduced time for getting a lab result from 66 to 16 minutes. The reengineering approach included forming a task force. We needed a baseline measurement of how we were doing. We compared this to a registry which included state norms, hospital norms, etc. We then used a clever theoretical construct created by the NIH which centers around subintervals. We borrowed the 4Ds concept: "door, data, decision, delivery." We introduced multi- processing or "parallel processing." We looked at the four sub-intervals to see where we could improve care. Using parallel processing, we have empowered and educated our nurses. If "data" are needed for a "decision" to be made, a nurse can go ahead and order an EKG, CBC, or chest x-ray. We have done a similar thing with antibiotic prescription and care for patients with pneumonia.

Continued

l

TABLE 8 Importance of Explicit Attention to the Development of Systems of Care—*Continued*

Type of Micro-System	Comments
Emergency department—*Continued*	Our pain management program is trying to increase the team's sensitivity to the quality of care at the end of life. We have also focused on stroke management, noise management in the hospital, etc. We have embraced the concept of "real time tracking." We have developed a radar screen that has 8 simultaneous processes continuously monitored. Each process is depicted in 15 minutes cut of data for the last 4 hours. We get information on the census in the ER, the status of the patients, the x-ray cycle, etc. We know where in the process not only the patient is, but where the system is. Each process measured is summarized on the screen by graphs. All we have to do to obtain data is touch the screen. The graphs are equipped with goal lines, not control lines, but goal lines that are based on some sort of customer satisfaction, e.g., people don't like to wait to long, etc. The micro-system is less like a chassis and more like the human body. The key word to describe a micro-system is *homeostasis*. A micro-system is always changing and adapting, just like the human body. The most exciting thing I can tell you is that we have identified the "pathophysiology" of a micro-system. It is powerful and yet very predictable. Think about two downstream processes, x-ray cycle time and getting patients to the floor. If the downstream graphs go out of control, there are predictable changes in the system. Occupancy in the ER goes up, the number of new patients in the ER goes down. The number of free beds in the ER goes down, and the cycle time between arrival to a bed goes up for a patient. Eventually, every measurement goes up. What is the intervention? A series of algorithms built into people's behavior. When we obtain three consecutive 15 minute intervals going in the wrong way, we realize that something needs to be done. Other micro-systems use a 1-size-fits-all approach with monthly quality improvement meetings or something similar. We try to intervene early. For x-ray cycle time, we dropped from 72 to 23 minutes. We reengineered processes so that the ER docs see x-rays first, that old x-rays are quickly taken away, that twice as many x-rays and techs are present in the ER. When we are very busy, our x-ray techs call up other techs off duty at home and tell them to come in. They do it automatically, without asking management. We say, "There are three ways of responding and reengineering: a bad way, a good way, and a world-class way."

TABLE 9A Importance of Good Information Systems for Individual Patient Care

Type of Micro-System	Comments
Diabetic management	I can show diabetics a graph of their HgA1-C and comment on how it has dropped along with their weight which is graphed on the same screen. I can also refer them to web sites, for example, if they are interested in alternative care, acupuncture, asthma management. One thing I have been concerned about is how to communicate using the computer without losing contact [while you put information into the computer]. By having the medical assistant enter the information, I can invite them to tell the whole story, and I can listen, so it actually increases communication.
Primary Care	When a patient comes to the office with a new problem (say headache), he/she would be handled in a standardized way. He or she is given an extensive questionnaire using the Knowledge Coupler®. The medical assistant takes them through all the steps. When I come in, almost everything has been done, but the patient is invited to tell his or her story again. I don't need to take a lot of notes but can embellish on what is there. I can listen. We can then go over the options for care, looking at the screen together. I share the degree of uncertainty I feel. The patient leaves with a copy of my note. At that point, all the work is done. There is no dictation to be done, and I have had time to deal with the problem. I also explain to the patient that we will need a more comprehensive database that includes information about their health habits, family history. The patient returns for this, and we create a problem list. The important thing about this whole process is that it is standardized. I use the same rational approach for each patient and don't prematurely reach conclusions or forget to ask or record some things. I've been using what is close to a paperless EMR since 1993. We continually look for ways to use technology to help us become more sophisticated and integrated. . . The electronic medical record (EMR) does drug-drug interaction alerts. When the patient leaves the office, he/she gets a printout of their medication list. We try to make maximum use of information technology. We are trying to create as paperless an office as possible. We have summaries of patient records (problems, current medications, consult records) that can be called up on laptops for remote access.

TABLE 9B Importance of Good Information Systems for Improving Care

Type of Micro-System	Comments
Emergency Department	We have developed a radar screen that has eight simultaneous processes continuously monitored. Each process is depicted in 15 minutes cut of data for the last four hours. We know where in the process not only the patient is, but where the system is. Each process measured is summarized on the screen by graphs. All we have to do to obtain data is touch the screen. When we obtain three consecutive 15 minute intervals going in the wrong way, we realize that something needs to be done.
Spine center	We use a value compass. We can query a database at any time for individual patients, but also for all patients we serve. We are also hooked up to 26 other centers. We can look at data by the point of service or longitudinally. We measure functional status, health status, work measures, treatment, who you have seen (type of provider), age, sex, height, weight, SF36, satisfaction, clinical comorbidities, smoking, cost of lost work over time.
Primary care	The development of an instrument panel of measures has been very important, then feeding this back to the staff has really stimulated our thinking.
Emergency department	We can track process length through our real time “flight simulator” system. By touching the screen, we instantly know such things as arrival to bed, bed to nurse, arrival to doctor, aggregated cycle times.
Cardiac care unit	Databases are important—you have to make that investment. We communicate regularly and give progress reports. You have to make sure that you keep the data concurrent. Then the internal resources must be in place—the statisticians, the people who are working with the data. An electronic medical record would cut down on the need for some of the databases that we’ve bought.
OB-Gyn practice	Work with providers who are very interested in evidence-based outcomes, look at results, and apply results using continous quality improvement. You have to look at the most important outcomes. Analyze something important to you and important to patients, too.
Primary care	Information management has been the lubricant to improvement. I think that is key to our success. We have a seamless flow of communication. Our information system has allowed us to move through many barriers.
Breast care center	You need population-based clinical information systems with data. We were lucky that there was enough money in our health care system back then to create an automated clinical data system. In 1985 , the leadership put in the personnel, the money, some vision, and created something good.

Continued

TABLE 9B Importance of Good Information Systems for Improving Care—*Continued*

Type of Micro-System	Comments
Critical care unit	The bottom line is risk-adjusted mortality. The centerpiece of this is participation in Project IMPACT, a national database supported by the Society for Critical Care Medicine. It uses 3 predictive models of mortality: MPM, APACHE-II, and Simple Acute Physiology Scores. All three use physiologic parameters to generate scores of likely mortality. We do a quarterly download to compare themselves over time and to other, similar institutions. The database produces 4-quadrant scatter grams of their patients with predicted mortality on one axis and resource consumption on the other. When we began we included 100 percent of patients. Now we are satisfied with the internal validity and track a 50 percent random sample. We track mortality, admission and discharge rates, LOS, readmit to ICU and reintubation rates. With the pressure to move patients out of the CCU, this helps us know if changes that affect efficiency are affecting quality of care. Although admissions are up and the LOS down significantly, our reintubation rate is very low. Thus [we know that] increased through put is not adversely affecting patients.
Cardiac care unit	We use two data bases: one of the Society of Thoracic Surgeons and another of the American College of Cardiac Interventions. We used to look at care case-by-case. Now we look at the aggregate data to determine where there is room for improvement based on the benchmark. We look at a group of cases and identify patterns. For example, we looked at emergent patients with CABG [coronary artery bypass grafts] following angioplasty. We abstracted the charts and created a verbal summary by practitioner. We also discussed the results in the M&M [morbidity and mortality rounds]. We collect data on which protocols are being used, by how many physicians, and what percentage of time. We also collect data on outcomes, such as how well we are able to control glucose levels. We give quarterly reports to the Chiefs of Surgery Cardiology. Our rates have improved dramatically. CABG has decreased 50 percent; PTCA [percutaneous transluminal coronary angioplastyl complications have decreased by 75 percent; return to the operating room following CABG has decreased by 50 percent. We do a utilization reports and variance reports. We can drill down to look at financial data.
Breast care center	We have created a generic model regardless of the specific disease. 1) assess the population, 2) stratify the risk—who do we focus on first, 3) assess the individual, 4) set goals and develop a care plan, 5) deliver and coordinate care, and 6) monitor and evaluate care. For each of these steps we have had to identify the roles of the care team. We have found that the roles of the care team may have to change.

Continued

TABLE 9B Importance of Good Information Systems for Improving Care—*Continued*

Type of Micro-System	Comments
Newborn intensive care	How do we do against some comparison? We participate in a regional network. There are 300 participants—everyone contributes data. We can compare how we do with very low birth weight (<1,500 g) babies. We can compare our outcomes to similar institutions such as other level III nurseries in a teaching institution, and outcomes are adjusted.
Primary care	We have an information technology project team. It includes receptionists, nurses, and others who are involved. Formerly we tracked morbidity and mortality in detail using 10-year's accumulated statistics. This was condition-specific—for example, neurological conditions, cardiovascular disease. These data were collected automatically for the national database and allowed comparisons among practices.

TABLE 10 Importance of a Focus on the Needs of Patients

Type of Micro-System	Comments
Primary care	In health care, what we sell is a relationship. But then [when patients want to be seen] we put up a barrier in the form of "we think you'll get better if you just wait." If they come in for what we think is an "inappropriate" appointment, so what? First, they'll find a way to get in anyway. Second, it destroys the relationship. Third, it is an opportunity to do other things—preventive care, to explain how they might handle the problem themselves the next time, and an invitation to them to call me. Build systems around what people want, and you can't lose. . . . Patients want a relationship. They want someone whom they can trust. When you try to "manage demand" you teach them not to trust you.
Hospice	I'll tell you what is critical: that the CEO focuses on patient needs and expectations. That is fundamental to what is important to me—that the focus be on the individual—a complex person. You try to do the best you can for them. It seems odd to say, but that is what is fun. The rest is just dials. We did focus groups with families and learned that four key things are important (1) the organization and delivery of care; (2) shared medical decisionmaking; (3) treating each person as an individual; and (4) attending to those who care for and love the dying person.
Diabetic management program	You have to educate the patient, then let them work through the process. When one person is truly present to another person, something happens. I remember being with a patient one day and connecting with that person. I thought, "Take off your shoes you are sitting on holy ground." If you are not there for the patient, you might as well be a technician.
Primary care	We take seriously the whole patient. We see our role as primary care. A problem isn't solved until the patient agrees that it is.
Newborn intensive care (NICU)	The preconception of NICUs is highly technical and that families aren't part of it. We want to astound them—full participation of families—no barriers to access, no barriers to information.
Diabetic management	Patients are treated with dignity. We've changed the mindset. We've made them realize that they are in charge. Traditionally, a patient would come in, the doctor would say, "You need to lose 50 pounds and have a blood sugar level of 110." The patient would leave, feel at fault, and a wall would go up. Now I tell people, "No one can ever fool you about your diabetes again."
Heart failure management team	We treat the patient as a whole. We look at more than just the cardiovascular problem. When a person comes in, all organ systems are checked. We talk to the patients about psychological and social support. We carry many patients to end-of-life care. We are with them until hospice care and sometimes even beyond hospice. We tell them about durable power of attorney, medications, shopping, eating less saturated

Continued

TABLE 10 Importance of a Focus on the Needs of Patients—*Continued*

Type of Micro-System	Comments
Heart failure management team—*Continued*	fat, increasing activity, the importance of family, independence, etc. We do all of this during the first visit. We always put things in writing or print it out for them. We highlight key words and phrases, like what an ACE inhibitor is supposed to do. We explain what is happening to them and what the medications will do in "laymen's" terms. We are in touch with all the patients. The secretary calls all the patients at least once a month. We ask basic questions during this phone call. When patients come in, they get a sheet of questions we want them to answer as well as their recommendations on how we can improve the care we give them. We ask them questions like, "Do you understand your medications?" or "Do you feel like you are in control?" or "Are you comfortable with what is happening in your life?" or "Are you a source of happiness to your friends?"
Breast care center	In 1990, a group of clinicians met to improve diagnostics of breast screening. At that time it took about a month for follow-up of abnormal results on a mammogram. . We identified "sleepless nights" as what we wanted to improve. We started streamlining the process. We got together primary care, radiology, and surgery. We had physicians and nurses from different areas. The team decreased the process to a few days—we went from 2 to 4 weeks (from abnormal test result) to 3–7 days, on average.
Pain management service	At first, the nurses didn't want the pain scales in the room because they thought that it would be worse for the patient if we brought it to their attention, but we know that just isn't the case. We graph pain on the vital sign sheet just below temperature. We have a place on the vital sign sheet to document pain and whether the pain management is effective. But really you have to listen to patients, to have a conversation with the patient about what level of pain is acceptable. A post-surgery patient should be able to breathe deeply and get up and walk and do more for themselves each day. A terminally-ill patient should be able to eat and visit with people. When a person has pain that is a 5 or more we have to talk with them to understand what that means. The nurse is learning and the patient is learning too that this is not about how much pain can you stand.
Primary care	We measure success from the patient perspective as the match rate—the likelihood that a patient see his/her own doctor versus a teammate, an NP, or is diverted to an ER. When we began it was 47 percent. Now it is 75 percent. Given that the average doctor is only in the center 72 percent of the time, this is terrific. We decided to rebuild the system based on what patients want. We learned: 1. Patients want to choose their own primary care doctor. 2. They want access to that doctor. 3. They want to be treated with dignity and respect-which means not having to wait all day.

Continued

TABLE 10 Importance of a Focus on the Needs of Patients—*Continued*

Type of Micro-System	Comments
Primary care—*Continued*	Patients don't want to go to an urgent care clinic. When they are sick they want to see "my doctor." The reason they needed to go to the urgent care clinic was because of the backlog of appointments which made it increasingly unlikely they would see their doctor. I call this the "urgent care death spiral." The only way to solve this is to get rid of the backlog. We knew that the number of patients seen daily were about the same as those calling to be seen. But of those who called, some were seen the same day as an urgent visit, and those who could wait were given routine appointments. Now we adopted the principle: If you call today, we will see you. If your own doctor is here, she'll see you. We closed the urgent care clinics and distributed the urgent care doctors to the various offices. We decided it was a big mistake to divide people into the streams: well, acute, and chronic because: a) the patient doesn't see him/herself that way—they divide themselves by their doctor; b) wellness, acute illness, and chronic care are dynamic-needs. All three exist at various times and often simultaneously; c) it is a waste of time to try to get them into the right category, and we don't get it right anyway; d) it increases work in the system because all the urgent care clinic does is acute care and they have to make another appointment for chronic and wellness care; and e) it turns nurses and appointment staff into antagonists of patients who have to fit into the correct category of urgent or not be allowed to come in. In the old system, we had a steady state-constant input and output and a "lake of waiting" in the middle. This system eliminated the "lake." We used a carrot and stick approach: the carrot: you get to take care of your own patients. The stick: You have to take care of your own patients. The number of patient visits went down by 8 percent. Using this system all our preventive care numbers went up—pneumovax, pap smears, mammograms.

II. Cross-Case Analysis—Themes Related to Effective Micro-System Performance

Using cross-case analysis, we identified several common themes that appeared repeatedly during the interviews. Each micro-system can be arrayed on each scale along a spectrum of "low" to "high." Table 11 lists each factor and the percentage of micro-systems for which that theme was raised during the interview. In the table, the themes are arranged from the highest to the lowest percentage of micro-systems in which they appeared.

Integration of Information

Micro-systems vary on how well information from a variety of sources is integrated into the daily work of the micro-system and the role that technology plays in integrating information among clinician, patients, and other members of the micro-system. Some micro-systems have developed advanced systems, but providing useful, timely, and accurate information is a huge task for micro-systems, and even in these high performing micro-systems, the potential of information technology has not, for the most part, yet been tapped.

> *If you were a patient you would experience care differently here compared to the care you might receive elsewhere. You would be given a touchpad computer when you come in for your visit for filling out all the intake information. Your picture would be taken digitally. All this would happen, and I would see it, before you see me. I would explain what your responses mean.*
>
> *Most of the information is there; you have to find a way to harness it. Really all that is needed is a simple system to get back information quickly. Computers, lines, high tech come to mind but it doesn't have to be that way. Talking is a way to communicate too. Information technology doesn't have to be an elaborate system.*

Table 12 provides several verbatim responses from the interviews that illustrate low and high levels of integration of information.

Measurement

Effective micro-systems measure their own performance and use that information to modify the care of individual patients and their processes of care. Part of the work of the micro-system is the development of a set of measures that are appropriate for its own goals. Although all the micro-system are measuring some outcomes, many lack measures that are useful for their daily work. As one Table 10 respondent said, "At the local level I don't get the measures that I need and the measures that I get at the regional level aren't at the level I need." It may be that recognition of the need and type of useful measures and finding ways to gather those data are important for high performance. Table 13 provides examples of low and high levels of measurement.

TABLE 11 Summary of Micro-System Framework

Low	High
Integration of information	
Information free environment	**Information is key, technology may be very helpful**
"We don't have control over the information that we need."	"I can show diabetics a graph of their HgA_{1c} and comment on how it has dropped along with their weight which is graphed on the same screen."
Measurement	
Absence of a set of useful measures	**Micro-system routinely measures processes and outcomes, feeds data back to providers, makes changes based on data**
"We have data on demograhics and length of stay, however, we don't have data on outcomes of care."	"We have developed a radar screen that has eight simultaneous processes continuously monitored."
Interdependence of care team	
Providers and staff function as individuals, No clear way of sharing information or communicating	**Care provided by a multidisciplinary team, Information is key to the relationship**
"Often physicians have difficulty working with non-physician providers, giving them the control."	"We developed multidisciplinary rounds—everyone involved in caring for the patient."
Supportiveness of the larger system	
Larger organization's actions perceived as "toxic" to the micro-system	**Micro-system views larger organization as helpful**
"If we have to practice like the rest of the system, we feel that we'll be practicing 'mediocre' care."	"They have identified breast care as an area where they want a center of excellence. It is a priority of the system."
Constancy of purpose	
Lack of a clear, consistent aim	**Integration of the aim throughout the micro-system**
"The original aim was that we would practice the best medicine we could, understanding that we couldn't be as financially successful. Now some of the physicians are compromising for the financial aspects."	"Those other sites saw an infection as a failure, not entitlement. All the way to the bedside the unit knew that infection was a failure. The philosophy has to permeate the organization."
Connection to community	
No clear connection to community beyond current patient population	**Micro-system is a resource to the community, community is a resource to the micro-system**
"The only way we get information about the community is from the managed care organization."	"I invite the peer support groups that are in the community to educate the residents."
Investment in improvement	
Training, resources not available	**Resources made available for improvement (training, $$, time)**
"We don't know how to improve the system. We have closets full of good ideas but don't know how to implement them."	"The Quality Council's goal will be to provide guidance and facilitation. 'Yes, that project meets our overall goals, what resources do you need?'"
Alignment of role and training	
Health professionals not expected to work within the limits of their education, certification(overqualified)	**Health professionals expected to work at the upper limits of education, training**
"I want to be more involved in the care process."	"When fully trained and confident they may tell an admitting doc that a patient is not ready to have a ventilator tube removed."

TABLE 12 Micro-System Examples of Integration of Information

Integration of information	
Low	**High**
Information free environment	**Information is key, Technology may be helpful**
"We don't have control over the information that we need. We need to be able to define who our panels are — we can't do that ourselves. Control of information is a barrier. Change will be more rapid in the teams as we have more control over the information."	"I can show diabetics a graph of their HgA1-C and comment on how it has dropped along with their weight which is graphed on the same screen. I can also refer them to web sites, for example, if they are interested in alternative care, acupuncture, asthma management. One thing I have been concerned about is how to communicate using the computer without losing contact [while you put information into the computer]. By having the medical assistant enter the information, I can invite them to tell the whole story, and I can listen, so it actually increases communication."
"If you aren't going to have the same nurse working with the patient then you have to have better communication. Patients get the best care when you have health care workers who communicate very well and collaborate very well. One of the biggest problems I see is physicians not talking to each other. Also, so many nurses work part-time, varying shifts. We struggle with getting them to communicate. It's hard to get them to put equal emphasis on communicating, documenting, teaching and the physical tasks that need to be done before the end of the shift. You don't get the same negative feedback from your coworkers if you aren't teaching the patient as you do if you leave some of the physical tasks undone at the end of the shift. A nurse will prioritize and get every thing done before the end of the shift, but they don't look at the patient's care plan and do the teaching that needs to be done before discharge."	"The team that takes care of patients is a working group that meets daily for 45-60 minutes. We discuss the status of all the patients and we brainstorm treatments as well as discharge planning there. All patients are listed on this blackboard that is used to organize information on the care process for each of the patients."
"At 7 p.m. one evening a person was giving care to a patient in a hospital who was receiving cancer treatment. The patient wanted an advance directive—if my heart stops, I don't want CPR. The person told the nurse at the unit desk about this request and asked that the nurse please tell the doctor. The doctor never heard this. At 6 am the next morning, the patient had a cardiac arrest and a code was called. 20 minutes into a code the request was seen in the patient's record that the patient didn't want this to happen. We saw that there was not a clear responsibility to report the request to the nurse, to report to the MD. The physician always decides whether an order will be written or whether to go talk to the patient before writing the order. The system worked a lot of the time, but it wasn't consistent."	"Sharing information with patients is the biggest safeguard (against medical error). The electronic medical record (EMR) does drug-drug interaction alerts. When the patient leaves the office, he/she gets a printout of their medication list. Once in a while a patient will call later and say, 'I was looking over the list, and I am not taking x anymore, but Dr. So and So has put me on y.' It takes all of us. Another safeguard is that the system we use forces me to consider all the possibilities. For example, if a patient comes in with headaches and vomiting, it has a structured sequence that makes you consider the causes, including cerebral hemorrhage."

Interdependence of the Care Team Members

One element of a micro-system is the key players—the practitioners and staff who work together on a daily basis, but like the other features examined, the interdependence of the care team varied across micro-systems. Table 14 provides examples of interdependence of members of the care team. In sites with a high degree of interdependence, the existence and recognition of the importance of the team approach to care was evident in the interviews.

> *We developed multidisciplinary rounds ¾ everyone involved in caring for the patient. The major value is having everyone communicate directly with one another. Each person knows they may be asked about the patient and has to be prepared.*
>
> *We believe strongly that in team care, staff satisfaction is very important. Everyone is not equal, but everyone is important and has a different responsibility. I try to make sure that the clinicians know that working here requires a balance of getting to do what you want to do and of doing things as part of a team.*

Supportiveness of the Larger System

Supportiveness of the larger ("macro") system overlaps with other factors. In high performing micro-systems, the aim(s) of the micro-system is consistent with the aim(s) of the larger system. The interviews made clear that the larger system demonstrates that improvement is a priority by making the necessary resources available to the micro-system. Even though there is overlap with other factors, it is important to recognize the importance of the larger system for the success of the micro-system. Table 15 provides examples of such supportiveness by the larger.

> *We can make changes quickly and are free to make investments and commit resources to change. We recently created a management services division here. We help other clinics and care sites to do marketing, quality improvement in patient flow, etc. This is our entrepreneurial spirit. The larger organization provided us with some resources to allow us to do this.*
>
> *The hospital system has shown great effort in helping us out with patient restraint protocols. Restraint management has been an area where they have excelled and this has made the ER a safe place to work. They are also helping us out in quality end-of-life issues and how cultural differences of people necessitate individualized care.*

Lack of support and shared aims was cited even by some high-performing micro-systems as an impediment to the micro-system effectiveness.

> *It is a mixed message. The organization talks about team care but then subverts their vision. They put in a centralized phone system with a nurse in charge of scheduling appointments. Well, she has no way of knowing whether Doctor X and Y are on the same team.*

TABLE 13 Micro-System Examples of Measurement

Measurement	
Low	**High**
Absence of a set of useful measures	**Micro-system routinely measures processes and outcomes, feeds data back to providers, makes changes based on data**
"I think we are deficient in measuring. We are measuring the more global outcomes."	"We have developed a radar screen that has eight simultaneous processes continuously monitored. Each process is depicted in 15 minutes cut of data for the last four hours. We know where in the process not only the patient is, but where the system is. Each process measured is summarized on the screen by graphs. All we have to do to obtain data is touch the screen. When we obtain three consecutive 15 minute intervals going in the wrong way, we realize that something needs to be done."
"When it comes to collecting raw data, we have found it to be difficult. We have data on demographics, and length of stay, however we don't have data on outcomes of care. This will come soon in the future."	"We use a value compass. We can query a database at any time for individual patients, but also for all patients we serve. We are also hooked up to 26 other centers. We can look at data by the point of service or longitudinally. We measure functional status, health status, work measures, treatment, who you have seen (type of provider), age, sex, height, weight, SF36, satisfaction, clinical comorbidities, smoking, cost of lost work over time."
"Other people use surveys and other ways to benchmark. We just do it seat-of-the-pants. We figure that we will get feedback. We don't use any modern techniques to measure anything. It's very expensive. We don't have extra capital to invest in recreational data collection to prove how we are doing to someone else when we know how we are doing."	"We track our endpoints extensively and have been able to do 3-yr follow-up of 75-85% of patients. We have an annual banquet in January and invite all former patients to come. 80% of those whose surgery was in the last 2 years come to this banquet. We book a large hotel, and they are our guests. It is social but also an opportunity to do a follow-up check. We have 15 doctors doing exams. 700-800 people generally come. There is a lot of camaraderie among patients."
"Every physician says they practice excellent medicine, but you have to look at some other parameters. We look at HEDIS and NCQA. It's hard to look at other outcomes—no one knows how to do that."	"The development of an instrument panel of measures has been very important, then feeding this back to the staff has really stimulated our thinking."
"There was a problem with how to track it [data about meeting open access goals]. There were problems because the physicians weren't getting feedback on time about how they were doing working down the backlog and meeting open access goals. Then the MDs wouldn't get the incentive because they hadn't met the goals."	"We can track process length through our real time 'flight simulator' system. By touching the screen, we instantly know such things as arrival to bed, bed to nurse, arrival to doctor aggregated cycle times."

TABLE 14 Micro-System Examples of Interdependence of Care Team

Interdependence of care team	
Low	**High**
Providers and staff function as individuals	**Care provided by a multidisciplinary team**
No clear way of sharing information or communicating	**Information is key to the relationship**
"Often physicians have difficulty working with non-physician providers, giving them the control. Some physicians don't do well sharing responsibility for patient care like this."	"We developed multidisciplinary rounds—everyone involved in caring for the patient. The major value is having everyone communicate directly with one another. Each person knows they may be asked about the patients and has to be prepared."
"It's always hard when we get new clinicians. They aren't used to working with paraprofessionals in the community. We try to illustrate what works. Doctors focus on what they do in the exam room but that's not enough."	"It is impossible for one individual to take care of an elderly person. Older and frail people have many health needs that can only be met by a group of dedicated individuals."
"Finally, not all doctors like the interdisciplinary philosophy. They like to do whatever they want"	"There are just the three of us. We work very well together. M. is in charge of the office, I am in charge of the patients, and Dr. D. is the physician champion. He holds the key to resources and new patients."
"We created a phone center to handle problems with phone access. We have six people answering phones. I saw it as decentralization and didn't like that idea for the micro-system concept. My phone nurse knows my patients—she knows when a patient really needs 20 minutes instead of 10. This has been borne out with the phone center and it is still hard to get through [on the phone]."	"We believe strongly that in team care, staff satisfaction is very important. Everyone is not equal, but everyone is important and has a different responsibility. I try to make sure that the clinicians know that working here requires a balance of getting to do what you want to do and of doing things as part of a team."

Constancy of Purpose

A theme that emerged clearly in these interviews was the importance of "constancy of purpose," or aim that guides the work of the micro-system. As Table 16 illustrates, where aims are clear, they are communicated across micro-system boundaries. In contrast, lack of a clear consistent aim may be destructive of the micro-system and, ultimately, of patient care.

One respondent discussed the change in aims that his micro-system had undergone.

> *The thing that distinguished those places that are achieving excellence is the organizational culture. Our culture [used to be], "Of course babies get infections. They are not well to begin with." But other sites saw an infection as a failure, not an entitlement. All the way to the bedside the unit knew that infection was a failure. That philosophy has to permeate the organization.*
>
> *What we do well is communicate the importance of diabetes care¾ up to the senior leaders of the organization; across to other providers' and out, to the community. We are advocates for our own work. Whenever I walk into a room, people think "diabetes."*

TABLE 15 Micro-System Examples of Supportiveness of the Larger System

Supportiveness of the larger system	
Low	**High**
Larger organization's actions perceived as "toxic" to the micro-system	**Micro-system views larger organization as helpful**
"I think that there is a barrier at the institutional level. For example, the institution has launched a Clinical Consistency Program. Basically, they want every place in their system to practice the same way. However, this hurts us because we have found ways to do things efficiently here, and if we have to practice like the rest of the system, we feel that we'll be practicing 'mediocre' care. Thus, there is a philosophical barrier."	"They have been very supportive in terms of wanting to do cutting edge work. The priority for the system is patient care. They identified areas where CQI teams were needed. That is where the Breast Care team came up. They supported us financially too. They have paid close attention to the results. They have identified breast care as an area where they want a center of excellence. It is a priority of the system."
"At the system level the priorities for the system are not the same as the priorities for me in primary care."	"We had the commitment from top administrators—the Presidents from four systems set up the task force. The task force was to talk about ways to collaborate to improve healthcare. We set as a goal that at least 50 percent of adults in our community would have an advance care plan before a crisis. And that the program we implemented to do this would be accepted by the community. The endorsement from the administrators made the task force much easier. In other communities, that support may not be there. I could go to medical records and say this is what I need—and I need to report back to the 4 presidents. I met very little resistance. My organization in particular put a lot of importance in this and asked me to put a lot of time in it. I wasn't just asked to work it in to my other responsibilities."
"The corporate policy for open access was a barrier and facilitator at the same time. The way corporate defined open access wasn't really open access and they set incentives based on their definition. Some people had different views about what open access was. For us, it was 'doing today's work today.' For corporate, it was 'if your schedule is open 75% a week out you will get a bonus'."	"We can make changes quickly and are free to make investments and commit resources to change. We recently created a management services division here. We help other clinics and care sites to do marketing, quality improvement in patient flow, etc.. This is our entrepreneurial spirit. The larger organization provided us with some resources to allow us to do this."
"It is a mixed message. The organization talks about team care but then subverts their vision—they put in a centralized phone system with a nurse in charge of scheduling appointments. Well she has no way of knowing whether Doctor X and Y are on the same team. If a patient of Dr. X cannot go to Dr. X because he is on vacation, the nurse may send the patient to Dr. Z though Dr. Y is on Dr. X's team. So instead of the patient going to Dr. Y, they go to Dr. Z."	"The hospital system has shown great effort in helping us out with patient restraint protocols. Restraint management has been an area where they have excelled and this has made the ER a safe place to work. They are also helping us out in quality end-of-life issues and how cultural differences of people necessitate individualized care."

Connection to Community

High performing micro-systems define the boundaries of caring for a population of patients quite broadly; that is, they are connected to the community in a way that allows the micro-system to serve as a resource for the community. An unanticipated finding of this study was that for several of the sites, the micro-systems had discovered that the community was a resource for the micro-system as well. Connection to community (as described in the examples in Table 17) represents a fruitful relationship between the micro-system and the community that extends well beyond the clinical care of a defined set of patients.

> *It's always hard when we get new clinicians. They aren't used to working with para-professionals in the community. We try to illustrate what works. MDs focus on what they do in the exam room, but that's not enough.*

> *Forty percent of our patients are self-pay. We use a sliding fee schedule. Our minimum fee is usually eight dollars. Sometimes the patient asks us to waive this. In January, Social Services started asking them to use "time dollars"—that's part of our MORE (member organized resource exchange) time dollar exchange. What are you willing to do for your neighbors? Some people don't have any ideas, so we show them a list of things people do—reading to children, etc. If they agree to pay their bill that way, someone will get in touch with them to follow-up. This has really been a shift in thinking—for staff as well as patients. It's easier for the staff person to just waive the $8 fee.*

Investment in Improvement

High performing micro-systems make improvement a priority by making an investment. Examples of this dimension are shown in Table 18. This investment comes in the form of resources, such as time, money, and training, but also as an investment in creating the culture of the micro-system. For example, a respondent from a neonatal intensive care unit said, "We charged the entire operating structure of the unit with improvement."

> *In a given week we are spending about 100 person-hours on teams. People are being paid to spend their time doing this, not just during their lunch hour. Someone said, "You have to assume you'll be around here five years from now. Do you want to be doing things the same way?" Most of us don't. This requires a new attitude that results in understanding that industries must invest in change in these micro-systems. You have to tolerate pulling people off-line to work. This is a radically new way of thinking in medicine which traditionally views any sort of meeting as a waste of time. Traditionally, the view is that the only useful time is spent seeing patients. I think that unless you spend time considering how to deliver care better, much of that time seeing patients is wasted.*

TABLE 16 Micro-System Examples of Constancy of Purpose

Constancy of purpose	
Low	**High**
Lack of a clear, consistent aim	**Integration of the aim throughout the micro-system**
"There is some divergence in the practice. The original aim was that we would practice the best medicine we could, understanding that we couldn't be as financially successful. Now some of the physicians are compromising for the financial aspects. They are spending less time with patients, care is not as complete."	"What we do well is communicate the importance of diabetes care—up to the senior leaders of the organization; across to other providers' and out, to the community. We are advocates for our own work. Whenever I walk into a room, people think diabetes."
"At the department level there are barriers. We try to make changes across departments because in the community we don't want to treat patients differently because of the department they go to for care (pediatics versus internal medicine or family practice). The barrier is to get agreement for everyone to make the change after one group pilots it. Every group doesn't need to pilot it before making the change."	"Our principle is that all of today's work is done today."
"I feel strongly that if we could have more time with patients for coaching, behavioral changes, and attitude changes we could improve diabetes care. Nobody wants to do anything if it isn't reimbursed. Wherever the $ goes that is where the service goes. Now there isn't adequate time or resources for teaching patients in any setting. Patients are so sick now when they are in the hospital, they are often too sick for any teaching. So we end up teaching the family members. God help the person who doesn't have a family member at home to help them."	"The focus of this micro-system is improving advance care planning through systems of healthcare. This is a joint effort of 2 healthcare systems. They assist and encourage adults to do advance care planning and them make sure written plans are available and followed. These 2 healthcare systems are competitors—competing for the same patients."
"There are various ways that health care workers let patients know that we are busy—don't tell us that you are having a problem because we don't have time to deal with that. For a lot of nurses the reason for being a nurse was to relieve pain and suffering. But then we send the message that we don't have time to help you."	"A lot of our work is around controlling chronic illness, addressing the co-mordities, maintaining quality of life. We want the patient to maintain community residence for as long as possible. This is an HMO—we are the payor—if the patient goes to a nursing home we pay for that care and monitor the care. It makes sense for us, financially and philosophically, to maintain the community residence as long as possible. The best thing we can do is keep them out of the nursing home."

Alignment of Role and Training

Within the multidisciplinary team, several sites mentioned an alignment of role and training. That is, they described a deliberate effort to match the team member's education, training, and licensure with their role. Although several sites reported that this led to increased staff satisfaction and lower turnover, they acknowledged that some staff were uncomfortable working in an expanded role. As one respondent noted, "Casualties move on to other parts of the hospital."

TABLE 17 Micro-System Examples of Connection to Community

Connection to community	
Low	**High**
No clear connection to community beyond current patient population	**Micro-system is a resource to the community, community is a resource to the micro-system**
"Patient surveys are done periodically (so far we have only done two). We have one page exit interviews. We haven't changed a lot based on these surveys."	"There has been a strong consumer movement recently on creating peer support centers. These are not run by our group but by consumers. We refer people to them and then we participate by providing some of the educational seminars. I invite the peer support groups in that are in the community to educate the residents. It really is an eye-opener for the residents. I think that as physicians a lot of us don't have any idea what it is like to live with a mental illness. And none of the education teaches that. The peer support centers let people with the illness teach the residents about it."
"The only way we get information about the community is from the managed care organization."	"The neonatology group has a commitment of being a resource to the region. We have a commitment to the health of a population. This is crucial to our success. As a resource, we provide education and review the quality of care for the whole region."
"The community used to look at us as leaders. But the hospital was taken over by a large system. So we aren't community leaders anymore. We need the healthcare dollars to come to the community and then we decide how to take care of the community. The trustees of the hospital have no idea about healthcare or affecting change."	"40 percent of our patients are self-pay. We use a sliding fee schedule. Our minimum fee is usually $8. Sometimes the patient asks us to waive this. In January, Social Services started asking them to use 'time dollars'—that's part of our MORE (member organized resource exchange) time dollar exchange. What are you willing to do for your neighbors? Some people don't have any ideas, so we show them a list of things people do—reading to children, etc. If they agree to pay their bill that way, someone will get in touch with them to follow-up. This has really been a shift in thinking—staff as well as patients. It's easier for the staff person to just waive the $8 fee."

Micro-systems without a high level of alignment of role and training (60 percent of the sites) did not provide examples that indicate that this is an area they have addressed. However, micro-systems that emphasized this function, noted its potential contribution to the overall functioning of the micro-system (Table 19).

> *The receptionist talks them through the systems of the office. They are trained to follow through specific areas of care such as screening, childhood immunization, and antenatal care, so they have one person to contact. They have become expert in their areas.*
>
> *If the Respiratory Therapist notes an abnormal lab value, she is comfortable not just taking a blood sample and reporting it, but managing it. The technicians are caregivers. Expectations have changed. The ones that stay are good*

at adjusting therapy to within physiological parameters. They are cross-trained so that they can take on nursing tasks, for example, starting IVs when needed. When fully trained and confident, they may tell an admitting doc that a patient is not ready to have a ventilator tube removed.

CONCLUSIONS AND DIRECTIONS FOR FURTHER RESEARCH AND POLICY

Limitations of This Research

There are limitations to all sampling strategies and to qualitative research, in particular. The strength of this method was that the sample selection used input from a pool of recognized experts in the organization, delivery, and improvement of health care. Even with a pool of recognized experts, it is reasonable to expect that some high performing micro-systems were overlooked. It was also possible that less than high performing micro-systems were included. In fact, a concern was how to ensure that the micro-systems included in the

TABLE 18 Micro-System Examples of Investment in Improvement

Investment in improvement	
Low	**High**
Training, resources not available	**Resources made available for improvement (training, $$, time)**
"One change was to get people to carry medication cards in their wallets. We talked about it for 10 minutes or so and decided to do it. But it didn't work. We don't know how to implement it. We don't know how to flowchart. We don't know how to improve the system. We have closets full of good ideas but don't know how to implement them."	"We have a manager for staff development. She works on skill building and coaches the teams in how we get along. It's important to assign the role of staff development to someone."
"Our micro-system is a prisoner of our macro-system. If it isn't important for the macro-system, we have no incentive to do it and improvement hasn't been a priority."	"We put together a guidance team and the idea was that this team would tell us what to work on. But I saw most of the good ideas coming from the front lines. The front line needed to be empowered to make the changes. So, now the guidance team will become the quality council. It will have membership from each of the three teams. Changes that teams want to work on will be presented to the Quality Council—'this is what we want to do, we want to use this method.' The Council's goal will be to provide guidance and facilitation. 'Yes, that project meets our overall goals, what resources do you need?' "
"We look at the data and say, 'what can we do to make this better . . .' but there is so much pressure to reduce the time we see with patients and see more patients every day. Now there is pressure from the organization to see patients at 10 minute intervals. They are going to start to tie incentives to that. Each physician will have to decide how to deal with that - more money, less hours, etc."	"Remember that even when it seems you have accomplished something, new people come who were not party to the original plans. Before you know it, you've fallen back. We used to think that people would learn the systems by osmosis. Now, they have a formal induction system to explain and show people how the systems should work."

Continued

TABLE 18 Micro-System Examples of Investment in Improvement—*Continued*

Investment in improvement	
Low	**High**
Training, resources not available	**Resources made available for improvement (training, $$, time)**
"We started looking at the data because we had a high rate of wound infection after CABG. We brought together all the different people and looked at all the different issues over 2 years. We found that there is a strong correlation between diabetes and infection, which the national data shows too. We decided that we should work on managing blood sugars before, during, and after surgery. As it turns out, there are so many primary care providers referring patients—we couldn't agree on a way to work on blood sugars before surgery and they didn't want to invest the resources that would be necessary to do this. We couldn't get any primary care providers to work with us on this because working on improvement impacts their productivity, which impacts how much they are paid. Even though it was clear what needed to be done, they chose the easier way and started working on just the peri-operative phase. Two years later we found that the staff wouldn't make the changes because they wouldn't buy into what we wanted to do. And the leaders had forgotten why they ever bought into it to begin with. As it turned out, some of the physicians were offended because we came to them with these changes and they weren't involved with planning the changes. But they had forgotten that when we started all this they didn't want to be involved because they didn't have the time to do it. I am sick and tired of hearing that people are too busy to work on this. When I was younger and less experienced I believed it, but I don't won't to hear that anymore."	"In a given week we are spending about 100 person-hours on teams. People are being paid to spend their time doing this, not just during their lunch hour. Someone said, 'You have to assume you'll be around here 5 years from now. Do you want to be doing things the same way?' Most of us don't. This requires a new attitude that results in understanding that industries must invest in change in these micro-systems. You have to tolerate pulling people off-line to work. This is a radically new way of thinking in medicine which traditionally views any sort of meeting as a waste of time. Traditionally, the view is that the only useful time is spent seeing patients. I think that unless you spend time considering how to deliver care better, much of that time seeing patients is wasted."

study were high performing or successful micro-systems, and probes were included in the interview to assess what evidence micro-systems might offer to validate statements about their level of performance. We did not, however, seek validation from documents or other written materials. Although the intent of the sampling strategy was to study high performing micro-systems, a very small number of apparently negative cases were useful for comparison. More importantly, as expected, each site had some areas of very strong performance and other areas that were undistinguished, and they formed a natural cross-case comparison group. Although the sites were selected because of expert opinion, the database is limited by being self report. It is possible that the leaders of the micro-systems had an interest in making their micro-system appear to be better than it is, and we did not have any independent verification of their assertions. For this reason, we did not make any judgments about the validity of respondents' assertions and have limited the analysis to descriptive summaries and themes based on the respondents' own words.

TABLE 19 Micro-System Examples of Alignment of Role and Training

Alignment of role and training	
Low	**High**
Health professionals not expected to work within the limits of their education, certification (overqualified)	**Health professionals expected to work at the limits of education, training**
"The system wants me to simply be a 'broker.' They want me to just do my CHF part and then make referrals. I want to be more involved in the care process."	"The receptionist talks them through the systems of the office. They are trained to follow through specific areas of care such as screening, childhood immunization, and antenatal care, so they have one person to contact. They have become expert in their areas." "We emphasize training medical assistants to a much higher level than most expect, use 2 NPs extensively. MAs trained in using technology, standardized triage functions, training patients in self-management. As a group they stay with the practice for long periods. We are trying to 'push the envelope' and rely less on credentialing and more on continually developing new skills." "The system can be an advocate. It can be a reminder that a mammogram needs to be done, that there is a system in place to make sure it happens, that things go well. A system can empower the medical assistant to insist that a patient be seen, even if it means clashing with a provider." "If the Respiratory Therapist notes an abnormal lab value, she is comfortable not just taking a blood sample and reporting it, but managing it. The technicians are caregivers. Expectations have changed. The ones that stay are good a adjusting therapy to within physiological parameters are cross trained so that they can take on nursing tasks, starting IVs when needed. When fully trained and confident they may tell an admitting doc that a patient is not ready to have a ventilator tube removed."

A second limitation of this study was that the interviews were not tape-recorded to provide a raw data "gold standard" for later reference. For this reason, we went to considerable effort to ensure the quality of note taking as described in the methods section, and we obtained respondents' consent to follow-up with them to clarify notes. Follow-up was necessary in only a few instances. The notes were voluminous and rich in detail.

A third limitation is that for most of the interviews, one respondent represented each of the forty-three micro-systems. A more comprehensive assessment would include interviews with at least one person from each of the key roles within the micro-system, including patients. Such tradeoffs in qualitative analysis between breadth and depth are inevitable,[31] but

given that this was an exploratory study, we decided to include as many micro-systems as possible with follow-up in later studies.

Research currently underway will expand on this work by taking a more comprehensive look at individual micro-systems and the outcomes of care provided to determine if high performing micro-systems achieve superior results for patients.

Directions for Further Research

This research has been exploratory in that it is the first systematic look at health care micro-systems. The power of the research is that it gave a voice to individual micro-systems and provided a way to explore them while creating constructs that may be generalizable to other micro-systems. It has begun the work of defining and characterizing health care micro-systems. The greater value of this analysis will be to go beyond the findings of this research to develop tools to help existing micro-systems improve and to replicate and extend the achievements of these micro-systems.

The basic concept of health care micro-systems—small, organized groups of providers and staff caring for a defined population of patients—is not new. The key components of micro-systems (patients, populations, providers, activities, and information technology) exist in every health care setting. However, current methods for organizing and delivering health care, preparing future health professionals, conducting health services research, and formulating policy have made it difficult to recognize the interdependence and function of the micro-system.

Further analysis of the database would likely yield additional themes. All can be the basis of hypothesis testing for continued work. For example, further work might establish criteria of effectiveness and test whether the features identified as the eight themes are predictive of effectiveness. More refined or additional questions might clarify aspects of the general themes that are critical. More intensive data gathering, for example, of multiple members of the micro-system, including patients could validate results and expand our understanding of these micro-systems.

Two questions were central as we undertook this study: (1) would the term micro-system be meaningful to clinicians in the field? (2) Would they participate and give us detailed enough information to draw inferences? The answers to both questions were clearly: Yes.

Overall, we discovered that the idea of a *micro-system* was very readily understood by all we interviewed. They had no difficulty in identifying and describing their own micro-systems and, when appropriate because they directed several (such as several intensive care units), differentiating among them in terms of their characteristics.

The study was assisted in its work by an extremely able and distinguished steering group and Subcommittee whose reputations in the field unquestionably enabled us to secure the participation of nearly all who were invited despite our requesting an hour and a half of a busy clinician’s time. Many of those interviewed willingly went on for a longer than the al-

lotted 90 minutes and sent us additional materials. Some who were interrupted by urgent clinical business rescheduled time to complete the interviews.

Although this was a selected—not a randomly sampled—group, and there was clearly great enthusiasm and of innovative work going on at the grass-roots level. Many of those interviewed expressed clear ideas about how they were reorganizing practices, their principles for doing so, and their commitment to an ongoing process. Respondents described their early limited successes or outright failures. We heard what had and had not been successful as they tried to disseminate their practices throughout their organizations. We believe there is much that could profitably learned and shared beyond the individual sites that has not been yet been pulled together by a unifying conceptual framework or effective mechanism for deploying what is being learned.

We were struck by two findings in particular: First, the importance of leadership at the macro-system as well as clinical level; and second, the general lack of information infrastructure in these practices. Micro-system leaders repeatedly stressed the importance of executive and governance-level support. This support was singled out repeatedly as a *sine qua non* to their ability to succeed. It was also apparent that although some steps have been taken to incorporate the explosion of information technologies that are being deployed for managing patient information, free-standing practices as well as much of clinical practice within hospitals have only begun to integrate data systems, use them for real-time clinical practice, or as information tools for improving the quality of care for a patient population. The potential is enormous, but as yet, almost untapped. They appear to be at a threshold of incorporating information technologies into daily practice. The potential created by the development of knowledge servers, decision support tools, consumer informatics[32] continuous electronic patient-clinician communication, and computer-based electronic health records puts most of these micro-systems almost at “time zero” for what will likely be dramatic changes in the integration of information for real-time patient care and a strong baseline for future comparison.

As research on micro-systems moves forward, it will be important to transfer what has been learned from research on teams and organizations to new research that will be conducted on micro-systems. For example, research that will be helpful includes information about the different stages of development and maturity of the organization, creating the organizational environment to support teams, socializing new members (clinicians and staff) to the team, environments that support micro-systems, the characteristics of effective leadership, and how micro-systems can build linkages that result in well-coordinated care within and across organizational boundaries.

IOM Quality of Care Study

This study was intended to provide more than a database for research, however. It was undertaken to provide an evidence base for the IOM Committee on the Quality of Health Care in America in formulating its conclusions and recommendations. Because that committee was charged with the formulation of recommendations about changes that can lead to threshold improvement in the quality of care in this country, its members believed that it was extremely important to draw not only on their expertise and the literature but also on the best evidence it could find of excellent performance and to do so in a systematic way as exempli-

fied by this study. As that study was not limited by type of health care, the goals of such a project necessitated drawing from a wide range of sites serving a variety of patient populations. It also suggests a sample size that for qualitative analytic methods was quite broad but not unwieldy. The number of sites interviewed—43—served these purposes well. We had several of each "kind" of micro-system (e.g., primary care, critical care) but they varied in location, composition, and in their own approaches to organizing and delivering care, thus providing a very rich database of observation. That report, which is expected to be published in early 2001, will use the responses and analysis described in this technical report to underpin its recommendations about how health care micro-systems, macro-systems, and other organizational forms that have not yet emerged, can improve their performance.

REFERENCES

1. Bertalanffy, Ludwig von. General System Theory." Pp 1–10 in *General Systems: Yearbook of the Society for the Advancement of General Systems Theory*, 1. Ludwig von Bertalanffy and Anatol Rapoport, eds., 1956.
2. Institute of Medicine. *To Err is Human. Building a Safer Health System*. LT Kohn, JM Corrigan, MS Donaldson, eds. Washington, DC: National Academy Press, 2000.
3. Scott, Richard W. *Organizations: Rational, Natural, and Open Systems*. Englewood Cliffs, NJ: Prentice Hall, 1981.
4. Boulding, Kenneth. General Systems Theory: The Skeleton of Science. *Management Science* 2:197–208, 1956.
5. Quinn, James B. *Intelligent Enterprise.* New York*:* Free Press, 1992.
6. Frontiers of Health Services Management 15(1), 1998, passim.
7. Nelson, Eugene C., Batalden, Paul B., Mohr, Julie J., et al. Building a Quality Future. *Frontiers of Health Services Management* 15:3–32, 1998.
8. Nelson, Eugene C., Batalden, Paul B., Mohr Julie J., et al. "Building a Quality Future." *Frontiers of Health Services Management* 15: 3–32, 1998.
9. Kaluzny, Arnold D. "Design and Management of Disciplinary and Interdisciplinary Groups in Health Services: Review and Critique." *Medical Care Review* 42(1): 77–112, 1985.
10. Cebul, Randall D. "Randomized, Controlled Trials Using the Metro Firm System." *Medical Care* 29: JS9–JS18, 1991.
11. Neuhauser, Duncan. "Parallel Providers, Ongoing Randomization, and Continuous Improvement." *Medical Care* 29: JS5–JS8, 1991.
12. Neuhauser, Duncan. "Progress on Firms Research." *International Journal of Technology Assessment in Health Care* 8: 321–324, 1992.
13. Patton, Michael Q. *Qualitative Evaluation and Research Methods.* Newbury Park*:* Sage Publications, 1994.
14. Center for the Evaluative Clinical Sciences. Dartmouth Medical School. The Quality of Medical Care in the United States: A Report on the Medicare Program. Dartmouth Atlas of Helath Care, 1999.
15. Guba, Egon G. *Toward a Methodology of Naturalistic Inquiry in Educational Evaluation*. Los Angeles, University of California, Los Angeles, Center for the Study of Evaluation, 1978.
16. Guba, Egon G. and Lincoln, Yvonna S. Effective Evaluation: Improving the Usefulness of Evaluation Results Through Responsive and Naturalistic Approaches. San Francisco, Jossey-Bass, 1981.
17. Denzin, Norman K. *Interpretive Interactionism*. Newbury Park, Sage Publications, 1989.
18. Patton, Michael Q. *Qualitative Evaluation and Research Methods.* Newbury Park*:* Sage Publications, 1994.

19. Geertz, Clifford. *The Interpretation of Cultures*. New York, Basic Books, 1973.
20. Denzin, Norman K. *Interpretive Interactionism*. Newbury Park, Sage Publications, 1989.
21. Patton, Michael. Q. *Qualitative Evaluation and Research Methods. Newbury Park:* Sage Publications, 1994.
22. Miles, Mathew B. and A. Michael. Huberman. *An Expanded Sourcebook: Qualitative Data Analysis*. Thousand Oaks, London, Sage Publications, 1994.
23. Ragin, Charles C. *The Comparative Method: Moving Beyond Qualitative and Quantitative Strategies*. Berkeley, University of California Press, 1987.
24. Miles, Mathew B. and A. Michael. Huberman. *An Expanded Sourcebook: Qualitative Data Analysis*. Thousand Oaks, London, Sage Publications, 1994.
25. Miles, Mathew B. and A. Michael. Huberman. *An Expanded Sourcebook: Qualitative Data Analysis*. Thousand Oaks, London, Sage Publications, 1994.
26. Miles, Mathew. B. and A. Michael. Huberman. *An Expanded Sourcebook: Qualitative Data Analysis*. Thousand Oaks, London, Sage Publications, 1994.
27. Rogers, Everett M. *Diffusion of Innovations*. New York, Free Press, 1995.
28. Institute of Medicine. *To Err is Human. Building a Safer Health System*. LT Kohn, JM Corrigan, MS Donaldson, eds. Washington, DC: National Academy Press, 2000.
29. Blumenthal, David and Kilo, Charles M. A Report Card on Continuous Quality Improvement. *Milbank Q* 76:625–648, 1998.
30. Shortell, Stephen M., Bennett, Charles L., and Byck, Gayle. Assessing the Impact of Continuous Quality Improvement on Clinical Practice: What It Will Take to Accelerate Progress. *Milbank Q* 76:593–624, 1998.
31. Patton, Michael. Q. *Qualitative Evaluation and Research Methods. Newbury Park:* Sage Publications, 1994.
32. Eysenbach, Gunther. Consumer Health Informatics. *BMJ* 320: 1713–1716, 2000.

APPENDIX A

Example of Thin and Thick Description for Qualitative Analysis

THICK DESCRIPTION

I was interested in end of life care, but it really started as an interest in pain and pain management. . . . We put together a pain steering committee. Physicians weren't convinced that pain and pain management was an issue. They wanted us to do more baseline data gathering, which was fine, but we just confirmed what others had found. We had to convince them that this was an issue for us, too. We had to get through that before we could design any interventions. I struggled with nurses and physicians to get them to appreciate work that had been done elsewhere and not reinvent the wheel. We got to the point where we had all this data but we weren't doing anything. A lot of the steering group members started to drop out because they couldn't see any value in what we were doing. It's hard for smaller departments to give the people and the time to work on projects. This was making it hard for our steering committee to be interdisciplinary. . . . We worked on getting the physicians involved in the process.

We started out with a pilot unit . . . but the first few months were really hard because they thought they really did a good job with pain management already. We tried to emphasize that it wasn't that they weren't doing a good job, but they were very resistant, almost angry. It took a long time for them to see that we were not criticizing them. It was hard to convince them that they could improve without insulting them. But the fact was that we weren't managing pain very well. There are various ways that health care workers let patients know that we are busy—"Don't tell us that you are having a problem because we don't have time to deal with that." For a lot of nurses the reason for being a nurse was to relieve pain and suffering. But then we send patients the message that we don't have time to help you. Now, we have pain scales in every room in the hospital. The nurses didn't want the pain scales in the room because they thought that it would be worse for the patient if we brought it to their attention, but we know that just isn't the case. We graph pain on the vital sign sheet just below temperature and . . . document whether the pain management is effective.

A lot of the nurses get stuck on getting a number—that may be hard for a patient. So I get them to listen to what the patient says about the pain, not just a number. We can look at

the pain rating, but also look at what the patient is doing and is able to do. The patient needs to understand that there are things that we can do, but sometimes we can't eliminate all pain. The pain scales have #1–10, but they also have word attached to the scale: 2 = mild, 5 = moderate, 8 = severe, 10 = worse possible. So if a patient gives words, a number can be attached and it can be graphed.

We work on non-pharmacologic as well as pharmacologic interventions. A conversation with the patient assesses what level of pain is acceptable. A post-surgery patient, for example, should be able to breathe deeply and get up and walk and do more for themselves each day. A terminally-ill patient should be able to eat and visit with people. When a person has pain that is a 5 or more we have to talk with them to understand what that means. The nurse is learning and the patient is learning too so that they understand that this is not about how much pain can you stand. . . . You have to make it easy to do the right thing. It has to be easy to manage pain.

We developed some algorithms—we worked on them for about a year and a half. Putting them out on the unit won't be enough. The algorithm can jog someone's memory, but they have to have a good foundation about what to do. I'm trying to develop pain resource nurses—nurses on every unit that are knowledgeable about pain, collect data, and work to improve pain management. I'm meeting a lot of resistance to do this, but we have to get this down to the people who are doing this every day. Otherwise they aren't going to buy into the changes. . . . We have a strategic plan and goals around pain management. Without that focus, the daily, weekly, and monthly issues will start to take over. Eventually pain will only get attention when something bad happens. . . . Patients get the best care when you have health care workers who communicate very well and collaborate very well. One of the biggest problems I see is physicians not talking to each other. . . .

THIN DESCRIPTION

After difficulty getting nurse and physician involvement, the site has focused on responsiveness to patients' pain. Site has pain algorithms, an interdisciplinary steering committee that sets goals, and wall charts to use in asking patients about their pain. Pain is charted as a vital sign and has become fairly well accepted, but pain management will need constant attention. Site is trying to develop a pain resource nurse. Intra- and cross-discipline communication identified as a problem.

APPENDIX B

Letter of Invitation

Date

Internal Address

Dear Participant,

I am writing to ask you to participate in a study to analyze characteristics of exemplary health care micro-systems. By the term micro-system, I mean a small, organized unit with a specific clinical purpose, set of patients, technologies and practitioners who work directly with these patients. A micro-system may be part of a larger organization and is embedded in a legal, financial, and regulatory environment.

This study is part of the Institute of Medicine's Quality of Health Care in America Project, which began in June 1998. The goal of the QHCA Project is to provide leadership, strategic direction and analytic tools that will contribute to a major improvement in quality in the health care industry during the next decade. Within the QHCA Project, The Subcommittee on Building the 21st Century Health Care System, which I chair, has been assembled to identify key characteristics and factors that enable or encourage providers, health care organizations, health plans and communities to continuously improve the quality of care.

The Survey of Health Care Micro-systems is funded by a grant from the Robert Wood Johnson Foundation. The Steering Group for this study includes Paul Batalden, M.D.; Gene Nelson, D.Sc.; Tom Nolan, Ph.D.; Steve Shortell, Ph.D.; and me. Over the next two months we will be asking a carefully selected group of micro-systems about their level of performance, patient experience, use of information and information technology, investment in improvement, and leadership and management. We would like to include your micro-system in our study.

Your participation will involve completing the attached pre-interview survey and taking part in a 90-minute telephone interview. Someone from the IOM staff will be calling you in the next few days to determine if you are interested in participating in the study and, if so, to schedule a telephone interview. I hope you will agree to join our study. Responses to the interview will be confidential. The committee will use the information from the study to make recommendations in its final report.

Sincerely,

Donald M. Berwick, M.D., M.P.P.

Enclosures:
Pre-interview survey
IOM Brochure
Roster of members: Committee on Quality of Health Care in America
Subcommittee on Building the 21st Century Health Care System

APPENDIX C

Rosters

COMMITTEE ON QUALITY OF HEALTH CARE IN AMERICA

WILLIAM C. RICHARDSON (*Chair*), President and CEO, W. K. Kellogg Foundation, Battle Creek, MI

DONALD M. BERWICK, President and CEO, Institute for Healthcare Improvement, Boston

J. CRIS BISGARD, Director, Health Services, Delta Air Lines, Inc., Atlanta

LONNIE R. BRISTOW, Past President, American Medical Association, Walnut Creek, CA

CHARLES R. BUCK, Program Leader, Health Care Quality and Strategy Initiatives, General Electric Company, Fairfield, CT

CHRISTINE K. CASSEL, Professor and Chairman, Department of Geriatrics and Adult Development, Mount Sinai Medical Center, New York City

MARK R. CHASSIN, Professor and Chairman, Department of Health Policy, The Mount Sinai School of Medicine, New York City

MOLLY JOEL COYE, Pricewaterhouse Coopers Senior Fellow, Institute for the Future, Menlo Park, CA

DON E. DETMER, Dennis Gillings Professor of Health Management, University of Cambridge, UK

JEROME H. GROSSMAN, Chairman and CEO, Lion Gate Management, Boston

BRENT JAMES, Executive Director, Intermountain Health Care, Institute for Health Care Delivery Research, Salt Lake City, UT

DAVID McK. LAWRENCE, Chairman and CEO, Kaiser Foundation Health Plan, Inc., Oakland, CA

LUCIAN LEAPE, Adjunct Professor, Harvard School of Public Health

ARTHUR LEVIN, Director, Center for Medical Consumers, New York City

RHONDA ROBINSON-BEALE, Executive Medical Director, Managed Care Management and Clinical Programs, Blue Cross Blue Shield of Michigan, Southfield

JOSEPH E. SCHERGER, Associate Dean for Clinical Affairs, University of California at Irvine College of Medicine

ARTHUR SOUTHAM, Partner, 2C Solutions, Northridge, CA

MARY WAKEFIELD, Director, Center for Health Policy and Ethics, George Mason University

GAIL L. WARDEN, President and CEO, Henry Ford Health System, Detroit

BUILDING THE 21ST CENTURY HEALTH SYSTEM SUBCOMMITTEE

DONALD M. BERWICK (*Chair*), President and CEO, Institute for Healthcare Improvement, Boston

CHRISTINE K. CASSEL, Professor and Chairman, Department of Geriatrics and Adult Development, Mount Sinai Medical Center, New York City

RODNEY DUECK, HealthSystem Minnesota, Mound, MN

JEROME H. GROSSMAN, Chairman and CEO, Lion Gate Management, Boston

JOHN E. KELSCH, Consultant in Total Quality, Cary, NC

RISA LAVIZZO-MOUREY, Director, Institute on Aging, Chief, Division of Geriatric Medicine, and Sylvan Eisman Professor of Medicine and Health Care Systems, University of Pennsylvania, Philadelphia

ARTHUR LEVIN, Director, Center for Medical Consumers, New York City

EUGENE C. NELSON, Professor of Community and Family Medicine, Dartmouth Medical School and Director of Quality Education, Measurement and Research, Dartmouth-Hitchcock Medical Center, Lebanon, NH

THOMAS NOLAN, Associates in Process Improvement, Silver Spring, MD

GAIL J. POVAR, Cameron Medical Group (Private Practice), Silver Spring, MD

JAMES L. REINERTSEN, Chief Executive Officer, CareGroup, Boston

JOSEPH E. SCHERGER, Associate Dean for Clinical Affairs, University of California at Irvine College of Medicine

STEPHEN M. SHORTELL, Blue Cross of California Distinguished Professor of Health Policy and Management and Professor of Organization Behavior, School of Public Health, University of California at Berkeley

MARY WAKEFIELD, Director, Center for Health Policy and Ethics, George Mason University

KEVIN WEISS, Director, Center for Health Services Research, Rush Primary Care Institute, Chicago

APPENDIX D

Pre-Interview

INSTITUTE OF MEDICINE PRE-INTERVIEW SURVEY OF MICRO-SYSTEMS

Please fax both sides of this survey to Molla Donaldson, Institute of Medicine, Fax: 202-334-3862. E-mail: mdonalds@nas.edu. Phone 202-334-2184. If you prefer e-mail, we can send this to you as an attachment.
Optional: Name of person completing this survey (*please print)*

Phone: Title:

If you would like to discuss more than one micro-system during the interview, please include a survey for each.

1. Your Micro-system
What is the clinical focus of your micro-system (for example, primary care, cardiothoracic surgical care, hospice care) (*Check as many as apply*) _ Primary care _ Specialty care _ Condition-specific (e.g., back, OB) _ hospital unit (e.g., ICU) _ Other, please specify:
Please provide a 1 to 3-sentence description of your micro-system—who belongs to it, how it is organized, what does it do? Please feel free to attach a diagram.
What are the number and specialty mix of physicians working in your micro-system?
How many and what type of non-physician practitioners does your micro-system include (for example, PAs, NPs, nutritionists, psychologists)?
What is the composition of the rest of the staff of the micro-system (for example, nurses, technicians, office staff)?
Does your micro-system include medical students, residents, or other trainees? If so, please indicate what kind and how many. _ No _ Yes, please specify: How often are they present?
Does your micro-system use any volunteers? _ No _ Yes, please describe how you use volunteers.
How would you describe the micro-system's patient population/practice location? Please check all that apply. Primarily: _ acute care _ chronic care _ palliative care **OR**: _ mixture of preventive, acute, chronic, palliative Age: _ pediatric _ adolescent _ working-age adult _ elderly/geriatric Other: _ minority _ underserved _ long-term care _ safety net Practice Location: _ urban _ suburban _ rural _ frontier

Pre-Interview—*Continued*

About how many patients does your micro-system care for?
/ Day, week, year, etc.

Is your micro-system embedded in a larger organization such as a hospital or hospital system, chain, academic medical center, staff model HMO, or integrated delivery system?
_ No _ Yes, please provide the organization's name:

What sort of organization is this?

2. Reimbursement Mix

Please provide the approximate proportion of patients in each reimbursement category:

____ % FFS% ___ Prepaid ___ % Uninsured or self-pay (Total = 100%)

____ % Commercial ___ Medicare ___ % Medicaid ___ Uninsured or self-pay (Total = 100%)

Has this reimbursement mix been changing in the last year? If so, how?

Do you expect the reimbursement mix to change in the coming year? If so, how?

How is compensation for the physicians in your micro-system determined? (*Check as many as apply*)

_ FFS/fee schedule _ salary _ capitation _ bonus _ witholds
Are formulas based on:
_ panel size _ productivity _ patient satisfaction _ clinical performance
_ financial performance _ other?, *please specify*:

3. Computer-based Information Technology

Most offices have computer-based billing information, but we are particularly interested in this section in **computer-based clinical information**. Does your micro-unit have computer-based patient records?

__ No, Patient records are paper-based **(If No, Please skip to section 4 below)**
__ Yes, Patient records and financial systems are computer based, but separate
__ Yes, Patient records and financial systems are to some extent or entirely integrated

If you answered **yes** above, is the clinical information system linked to any data sources outside the micro-system, such as laboratories, pharmacies, or ER? __ No __ Yes, *please specify*:

Does the clinical information system include direct data input by patients _ No _Yes
(e.g., blood glucose levels or blood pressure measurements)?

Our computer-based information system is used for: *Please check all that apply*
_generating reports about the practice _ real-time patient care _ clinical decision support (e.g., reminders, drug-drug warnings)

4. Other

Do patients interact with clinicians by e-mail? _ No _ Yes
Using web-based resources? _ No _ Yes

Continued

Pre-Interview—*Continued*
Who (or what organizational unit) makes information technology decisions for your micro-system?
Who (or what organizational unit) makes human resource policy decisions for your micro-system (hiring, assigning support staff, etc.) ?
Who would you consider to be the leader of this micro-system?

Please fax both sides to Molla Donaldson, IOM: Fax: 202-334-3862, Phone: 202-224-2184

APPENDIX E

Telephone Interview

Interviewee: **Interview Date:**
Site: **Today's Date:**
Notes by:
Interviewer (if different from author of these notes):

1. What are the main issues or themes that struck you during the interview?

Verbatim comment from interview:	**General theme:**
•	
•	
•	
•	
•	

2. Impressions and Surprises

3. Are any clarifications needed?

4. What additional questions or follow-up do you have for this site?

5. Did this interview give you any ideas for additional/revised codes? (see general themes listed above.)

Introduction (5 minutes) and recap of purpose and plan

Thank you for agreeing to participate today (tonight). I am _____ (name--speak slowly and clearly), and I am working with the IOM committee. We are scheduled for an hour and a half today (tonight), but may not need all of that time. In any case, we will not ask you to go beyond that time.

Let me start by telling you a little bit about the Institute of Medicine and about this study of health care **micro-systems** that you have agreed to participate in.

The IOM is part of the National Academy of Sciences. It is a non-governmental, not-for-profit organization that was chartered by Congress to give advice on health policy.

We recently received funding from the Robert Wood Johnson Foundation to explore characteristics of healthcare micro-systems. This is part of a larger study of the quality of healthcare in America. Your micro-system has been nominated as one in which we might be especially interested in learning more about. By the term "micro-systems" we mean small, organized groups of clinicians and staff working together to provide care for a defined set of patients.

The purpose of the study is to help us gain a better understanding of what makes micro-systems more effective.

During our interview, I will be asking you about what your micro-system is particularly successful at doing.

I will also be asking about:

- what characteristics you believe are important for us to know about,
- how patients may experience it differently from other systems,
- how you go about making improvements,
- what sorts of barriers you have run into, and
- how you have overcome them.

During the interview I will be taking notes. We will summarize the findings in the committee report. We will be sending you a copy of the report when we it is available. The information you give me will be confidential. If for some reason we would like to identify a particular site by name in the report as an example, we will specifically ask your permission to do so.

PAUSE FOR QUESTIONS AND COMMENTS (before I go on, do you have any questions you'd like to ask about this?)

Before we start the interview, let me review information about your micro-system. As I understand it, your micro-system is:

Is that right? If no:

ALSO CLARIFY ANYTHING ON PRE-SURVEY THAT IS UNCLEAR

I. LEVEL OF PERFORMANCE AND CONCEPT, MODEL, OR MAP OF MICRO-SYSTEM

What does your micro-system do very well? How is it different from others that treat similar patients? Can you give me some examples?

What is your micro-system particularly successful at? What makes your micro-system special? How is it different from others that treat similar patients? Can you give me some examples?

1. How do you define success in _____?(what they identified as doing well)

2. From what I hear you saying, you define success along several dimensions . . .(repeat them for clarification) How do you know you are achieving this? What sorts of data are you collecting about (list the dimensions)

3. If I were a patient at _____ how would I experience it differently?

4. If I were a clinician at _____ I would I experience differently from another micro-system that cares for similar patients?

5. Working Culture--How would you describe the day-to-day work environment for those in the micro-system? What does it feel like to work at ?

6. People sometimes says that it has become increasingly hard to be a professional nowadays. Can you point to some examples of what your micro-system has done in this area, for example, to support professional ethics, encourage peer feedback or skill development?

Optional: if newly developed program or processes: How long has the micro-system been working this way? How is it different now from an earlier time?

II. PATIENT EXPERIENCE, CONTROL, AND INVOLVEMENT

If you think about a new patient with a health problem could you walk me through a year's experience (or an episode of care) starting when they first come as a patient?

FOLLOW-UP QUESTIONS

1. Have you put in place any special patient scheduling processes, for example, some practices have gone to open access systems?

2. How do you assess patients their needs and health risks? Are there particular surveys or other ways you have developed to do this?

3. How do patients get information about their health condition? For example, some clinicians give patients booklets, articles, web sites, or have health education groups they send patients to.

4. Sometimes patients have health problems such that they are referred to a number of specialists and find the information they get confusing, information is lost, or they are not sure who is in charge or where to ask questions. Are there particular ways you have addressed this coordinating issue in your micro-system?

5. If a patient has an **unusual** problem that requires expertise from people in a number of disciplines outside your micro-system, do you have any ways of bringing that expertise together?

6. Are you able to tell how long it takes a patient to move through your micro-system to definitive diagnosis and treatment? For example, a breast care center might track how long it usually takes for a woman who has a breast lump to be scheduled for a visit, receive a definitive diagnosis and therapy. Are you able to identify the sources of delay?

7. Optional Probe: Have you set objectives about what you is believe to be a timely process?

8. Are there any incentives that reward management and staff for meeting and exceeding patient expectations?

9. **Optional**: I would like to ask you now about the community in which the micro-system practices.

9a. Are there things you do seek input from the community about their health needs?

9b. Are there things you do to keep the community aware of your results and what you are doing?

III. INFORMATION/INFORMATION TECHNOLOGY

This section can be used to probe responses given on the pre-interview survey. Answers will determine whether to ask additional questions.

On the pre-survey interview you indicated that your information system . . . . Do I have that right? If no . . ..

FOLLOW-UP QUESTIONS

1. Is you information system home grown, vendor-supplied? Is it supported by the larger organization or is it free-standing in your micro-system?

IV. INVESTMENT IN IMPROVEMENT

Can you tell me what sort of things your micro-system has done to redesign your services and to improve the quality of care? Can you give me some examples of specific projects to improve quality, reduce cost or waste?

FOLLOW-UP QUESTIONS

1. In what ways were they successful? Are there specific levels of performance you can point to? Are there changes over time that you have been able to document?

2. What are the barriers to making change? How have you overcome them? (or are trying to)?

3. **Optional**: How is everyone made aware of these results? For example, how do others (patients? clinicians? referring or referral physicians?) learn about your results?

4. **Optional**: Do you have any internally or externally funded quality-related research or quality improvement projects underway now? What are their objectives? What has been learned?

5. Within the micro-system have there been any specific efforts devoted to leadership training, such as creating effective teams, conflict management, change management, or the like?

Expert Systems, Knowledge-based medicine

1. We hear a lot about guidelines, protocols, and expert systems to help clinicians get up-to-date information. Do you use any such systems? What do you think would be ideal in helping your own practice?

2. **Optional**: How do you and others in the micro-system access and incorporate emerging clinical evidence? What triggers changes in clinical practice? (e.g., guidelines are issued, literature)

3. Optional: How do you identify "best practice" sites and processes?

4. Optional: How is new information shared among clinicians and incorporated into clinical practice?

Error and Patient Safety

I'd like to ask now about medical error and patient safety. What happens in your micro-system when someone makes an error--for example, abnormal lab results are not seen, or the wrong dose of medication is given?

FOLLOW-UP QUESTIONS

1. Examples. Try to go beyond the mechanics of dealing with the error to the culture of safety or blame

2. Probe the extent to which there is there a blame-free culture, comfort in identifying and addressing errors, and efforts to learn from error. What would a nurse say, a technician?

3. **Optional**: Have you instituted any procedures to improve patient safety (e.g., standardize, simplify, training in teams, simulation, error reporting and investigation)?

4. What do you believe are the major sources of error or harm?

5. **Optional**: Do you have any information about rates of error or harm?

V. LEADERSHIP AND MANAGEMENT/ IMPROVING CARE DELIVERY

1. Can you give me some examples of particularly

- helpful ways in which (name of larger org) affects the care provided by the micro-system?

- toxic ways in which (name of larger org) affects the care provided by the micro-system?

FOLLOW-UP QUESTIONS

2. When you think about payment, what sorts of financial structures for payment and rewards do you believe would be ideal for improving the quality of care? For example, what mix of fee-for-service and capitation might be optimal?

Finally, I'd like to ask what you think it would take to replicate what you are doing? What do you think are the key factors to your success¾the key lessons for others who would like to replicate what you have done?

3. What are the major barriers to replicating this elsewhere? What barriers have you overcome?

Clarification of any points (5 minutes)
Anything that I need to clarify for my own notes?

As I write-up my notes, I may need to contact you later to clarify points or ask additional questions. Is that ok with you?

Closing comments and thanks (2 minutes)
Thank you.