CHAPTER 2

The Health Care Interdisciplinary Context: A Focus on the Microsystem Concept

Julie K. Johnson, MSPH, PhD

LEARNING OBJECTIVES

After completing this chapter, the reader will be able to:

1. Understand the microsystem as a conceptual model for organizing care.
2. Understand the theoretical underpinnings of the microsystem.
3. Define the essential elements of a microsystem.
4. Describe research that has identified high performing microsystems.
5. Describe one method for assessing the functioning of a microsystem.
6. Explore the potential link between microsystems and patient safety.

KEY TERMS

Clinical microsystem
Organizational construct
Systems theory
Systems thinking
Complex adaptive systems
Learning organizations
Leadership

INTRODUCTION

Health care is provided in complex environments with intricate webs of relationships. These relationships represent the multiple interactions with people, information, technology, culture, and the physical environment in which patient care is provided. The organization of health care can be described in many different ways, for example a clinic, a clinical department within a hospital, an inpatient ward, or an intensive care unit, among others. Of course, all these are accurate organizational descriptions and provide some insight into the types of care processes and providers in each area. Another framework to describe how health care is organized is the clinical microsystem. The clinical microsystem, as an organizational construct, is a systems approach for providing clinical care that is based on theories from organizational development, leadership, and quality improvement.

A clinical microsystem can be defined as the combination of a small group of people who work together in a defined setting on a regular basis—or as needed—to provide care and the individuals who receive that care (who also can be recognized as part of a discrete subpopulation of patients). Based on this definition, the essential elements of the microsystem include a designated group of specific patients, clinicians and support staff, information and information technology specialists, and care processes. The clinical purpose and its setting define the essential components of the microsystem. For example, a microsystem that provides pediatric cardiovascular surgical care has a very specific purpose that outlines the required components to accomplish the purpose. The purpose of the microsystem also identifies the patient population eligible to receive care (e.g., pediatric patients with cardiovascular problems that need surgical repair) as well as

the clinicians (surgeons, anesthesiologists, cardiologists, and nurses) and other service providers. This type of microsystem looks quite different from a microsystem that has the mission of providing outpatient care. Microsystems evolve over time as they respond to the needs of their patients and providers as well as to external pressures such as regulatory and accreditation requirements.

A clinical microsystem is often embedded in a larger organizational context. For example, several microsystems may exist within an outpatient clinic and hundreds of microsystems may exist within a hospital.

Microsystems exist everywhere but their levels of functioning vary. One contributing factor is the ability of individual caregivers to recognize their efforts as part of a microsystem. Previous research on clinical microsystems (described later in this chapter) has identified 10 success factors, as summarized in Table 2-1 (Mohr, 2000). Every clinical microsystem possesses each of these factors in varying degrees. A high-performing microsystem, (i.e., a microsystem that consistently and reliably achieves the best outcomes for its patients) would rate the highest on each of these factors.

As a functioning unit, the microsystem has clinical as well as business aims, linked processes, and a shared information and technology environment. It produces services and care that can be measured as performance outcomes. The microsystem construct explicitly demonstrates the care giving system. It builds on systems theory by recognizing that "important systems' characteristics include the system-environment boundary, input, output, process, goal-directedness, and interaction of the elements of the system" (Bertalanffy, 1968).

Systems, in general, often bring up images of "well-oiled machines." However, healthcare systems are often cumbersome, unwieldy, unfriendly, and opaque to their users, who are the patients, physicians, nurses, and staff who frequent the microsystem. Healthcare systems are best described as complex adaptive systems. As such, they are a collection of individuals who are free to act in ways that are not totally predictable. Their organizational boundaries are "fuzzy"; their membership changes and their members simultaneously can be members of other systems. Furthermore, given the complexity of these systems, the actions of individuals are interconnected so that the action of one changes the context for all the others (Plsek & Greenhalgh, 2001). The clinical microsystem is a complex adaptive system, and as such it must: (a) do the work, (b) meet member needs, and (c) maintain itself as a functioning clinical unit.

Table 2-1. Characteristics of High Performing Microsystems

Microsystem Characteristic	Definition
1. Leadership	The role of leaders is to maintain balance while reaching collective goals, and to empower individual autonomy and accountability through building knowledge, respectful action, reviewing, and reflecting.
2. Organizational support	The larger organization looks for ways to support the work of the microsystem and coordinate the hand-offs between microsystems.
3. Staff focus	There is selective hiring of the best qualified employees. An orientation process is designed and implemented to fully integrate new staff into an organization's culture and work roles. Expectations of staff are high regarding performance, continuing education, professional growth, collaboration, and networking.
4. Education and training	All clinical microsystems are responsible for the ongoing education and training of staff and for aligning daily work roles with training competencies. Academic clinical microsystems have the additional responsibility of training students.
5. Interdependence	The interaction of staff is characterized by trust, collaboration, a willingness to help each other, appreciation of complementary roles, respect, and recognition that each staffer contributes individually to a shared purpose.
6. Patient focus	The primary concern is to meet all patient needs: caring, listening, educating, responding to special requests, innovating to meet patient needs, and smooth service flow.
7. Community and market focus	The microsystem is a resource for the community and the community is a resource for the microsystem. The microsystem establishes excellent and innovative relationships with the community.

(continues)

Table 2-1. Characteristics of High Performing Microsystems (continued)

Microsystem Characteristic	Definition
8. Performance results	Performance focuses on improving patient outcomes, avoiding unnecessary costs, streamlining delivery, using data feedback, promoting positive competition, and engaging in frank discussions about performance.
9. Process improvement	An atmosphere for learning and redesign is supported by the continuous monitoring of care, use of benchmarking, frequent tests of change, and a staff that has been empowered to innovate.
10. Information and information technology	Information is the key connector for staff to patients, staff to staff, and needs with actions to meet those needs. Technology facilitates effective communication. Multiple formal and informal channels are used to keep all system members fully informed, provide a forum for member input, and ensure that everyone is in the loop on important topics.

In its *Crossing the Quality Chasm* report, the Institute of Medicine identified multiple layers of the healthcare system that influence the ability to improve care (Berwick, 2002):

- the patients' experience;
- the functioning of the microsystem;
- the functioning of the organizations that house or otherwise support microsystems; and
- the environment (e.g., policy, payment, and regulation) that shapes the behavior, interests, and opportunities of the organizations.

Efforts at each of the different levels of the healthcare system—patient, microsystem, macroorganization, environment—and the interactions between them can positively influence the ability to achieve patient safety and quality of care objectives. Figure 2-1 illustrates the interactions of these elements.

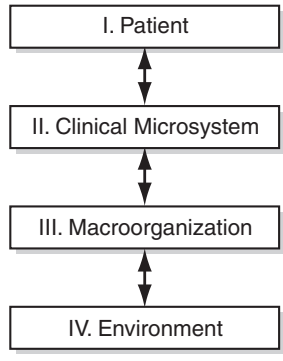

FIGURE 2-1. The chain effect in improving healthcare quality and patient safety.

ROOTS OF THE CLINICAL MICROSYSTEM CONCEPT

The conceptual underpinnings of the clinical microsystem are based on ideas developed by Deming (1986), Senge (1990), Wheatley (1992), and others who have applied systems thinking to organizational development, leadership, and quality improvement.

Bertalanffy (1968), founder of the mathematical Theory of Systems, defined a system as a set of interacting, interrelated, or interdependent elements that work together in a particular environment to perform the functions that are required to achieve the system's aim. The importance of understanding systems as interrelated parts of a whole cannot be overstated. Comprehending the assembly of the system as a whole can inform the work of those who are trying to create successful, interdependent systems (Batalden & Mohr, 1997). Learning to see interrelationships rather than linear cause and effect chains as well as grasping the phenomenon of change as a process, rather than a snapshot, is essential for understanding systems (Senge, 1990). Systems have certain rules (or principles) that help us predict how they will behave (Ackoff, 1974; Ackoff, 1994).

- The whole has one or more defining functions
- Each part can affect the behavior or properties of the whole
- Each part is necessary but alone is insufficient to carry out the defining function of the whole

- Behavior and properties of one part of the system depend on the behavior and properties of at least one other part of the system

Systems thinking is the cornerstone of how "learning organizations" view their world (Senge, 1990). Learning organizations are those that measure outcomes and strive for improvement. Many fields outside health care, including education, telecommunications, and aviation, use systems theory to better serve their clients, understand applicable research, improve outcomes, and ensure quality and safety. Recognizing feedback from the system and then using that feedback for design and redesign of services is an inherent element of systems thinking.

The seminal idea for the clinical microsystem stems from the work of James Brian Quinn (Quinn, 1992). Quinn analyzed the world's best-of-best service organizations, such as FedEx, Mary Kay Cosmetics, McDonald's, Scandinavian Airlines, and Nordstrom's. He focused on determining what these extraordinary organizations were doing to achieve high quality, explosive growth, high margins, and wonderful reputations with customers. He found that these leading service organizations organized around, and continually engineered, the front-line relationships that connected the needs of customers with the organization's core competency. Quinn termed this front-line activity that embedded the service delivery process the "smallest replicable unit" or the "minimum replicable unit." This smallest replicable unit, what we call the microsystem, is the key to implementing effective strategy, information technology, and other critically important aspects of intelligent enterprise.

STUDY OF HIGH-PERFORMING MICROSYSTEMS

Qualitative research methods have been used to understand processes and outcomes of care in designing and redesigning care around the clinical microsystem (Galvan, Bacha, Mohr, & Barach 2005; Barach & Johnson, 2006). In the late 1990s, under the aegis of the Institute of Medicine (IOM) and with funding by the Robert Wood Johnson Foundation, Mohr (2000) and Donaldson & Mohr (2000) investigated high-performing clinical microsystems. This research was based on a national search for the highest-quality clinical microsystems. Forty-three clinical units were identified using theoretical sampling, and their leaders were interviewed using a

semistructured interview protocol. The results of the interviews were analyzed to determine the characteristics that seemed to be most responsible for enabling these microsystems to be effective. The results suggested that eight dimensions were associated with high quality of care:

1. integration of information;
2. measurement;
3. interdependence of the care team;
4. supportiveness of the larger system;
5. constancy of purpose;
6. connection to community;
7. investment in improvement; and
8. alignment of role and training.

These eight factors became a framework for evaluating clinical microsystems. Each dimension can be thought of on a continuum that represents the presence of the characteristic in the microsystem.

The Dartmouth study (funded by the Robert Wood Johnson Foundation to continue and build on the IOM study) was based on 20 case studies of high-performing clinical microsystems and included on-site interviews with every member of each microsystem, plus analysis of individual microsystem performance data (Nelson et al., 2002; Nelson et al., 2003; Godfrey, Nelson, Wasson, Mohr, & Balden, 2003; Wasson, Godfrey, Nelson, Mohr, & Batalden, 2003; Batalden et al., 2003; Mohr et al., 2003; Koskik & Espinosa, 2003; Huber et al., 2003; Batalden, Nelson, Edwards, Godfrey, & Mohr, 2003). As a result of this work, the dimensions of high-performing microsystems have been further refined and expanded to include two additional categories. Table 2-1 lists the dimensions of high-performing microsystems and provides an operational definition of each. For example, increased awareness of the small front-line work unit as a microsystem also means recognizing the characteristics that contribute to the unit's identity and being mindful of the reliability of these characteristics.

ASSESSING PERFORMANCE OF THE MICROSYSTEM

Several tools and techniques are available for microsystems that wish to engage in self-assessment based on microsystem characteristics. The success characteristics emerged from the analysis of the coded interview transcripts;

they reflect how members of high-performing microsystems describe their work and how it was done. Consequently, they provided the framework for a microsystem-specific analysis of performance, which is the basis of the Microsystem Assessment Tool (MAT; Appendix 2-1). The MAT is designed to help understand microsystems and how those functioning within them can improve their performance (Mohr & Batalden, 2002; Mohr, Batalden, and Barach, 2004). It addresses the nature of the interaction between the microsystem and the parent organization, and offers considerable insight into the functioning of a microsystem. The MAT is designed to be used quickly and easily by microsystem members to evaluate their own front-line units.

Additionally, there is a series of "toolkits" and "workbooks" to provide a path forward for assessing one's microsystem. Workbooks are available for different types of clinical microsystems including:

- Primary care practices
- Specialty practices
- Cystic fibrosis programs
- Brain trauma programs
- Inpatient care units
- Emergency departments

Each workbook uses a standard approach to conduct a full assessment of a microsystem based on the "5 P" method, which includes assessments of the different aspects of a clinical microsystem: purpose, patients, professionals and staff, processes, and patterns of performance (outcomes, values, beliefs, and practices). The workbooks, which are available electronically at http://www.clinicalmicrosystem.org/ include a variety of methods and tools to evaluate each respective aspect of a microsystem.

LEADERSHIP FOR PATIENT SAFETY IN THE MICROSYSTEM

The clinical microsystem—as a unit of research, analysis, and practice—is an important level at which to focus patient safety and quality improvement interventions. It is at this system level that most patients and caregivers meet, and it is at this level that real changes in patient care can be made.

Safety is a property of the clinical microsystem that can be achieved only through a systematic application of a broad array of process, equipment,

organization, supervision, training, simulation, and teamwork changes. Table 2-2 builds on the research of high-performing microsystems and provides specific actions that can be further explored. This list provides an organizing framework and a place to start applying patient safety concepts to microsystems.

Table 2-2. Linkage of Microsystem Characteristics to Patient Safety

Microsystem Characteristics	Steps Linked to Improved Patient Safety
1. Leadership	• Define the quality and safety vision of the organization • Identify the existing constraints within the organization • Allocate resources for plan development, implementation, and ongoing monitoring and evaluation • Build in microsystems participation and input to plan development • Align organizational quality and safety goals • Engage the Board of Trustees in ongoing conversations about the organizational progress toward achieving safety goals • Promote and recognize prompt truth-telling about errors or hazards • Certify helpful changes to improve safety
2. Organizational support	• Work with clinical microsystems to identify patient safety issues and make relevant local changes • Put the necessary resources and tools into the hands of individuals
3. Staff focus	• Assess current safety culture • Identify the gap between current culture and safety vision • Plan cultural interventions • Conduct periodic assessments of culture • Celebrate examples of desired behavior (e.g., acknowledgement of an error)

(continues)

Table 2-2. Linkage of Microsystem Characteristics to Patient Safety (continued)

Microsystem Characteristics	Steps Linked to Improved Patient Safety
4. Education and training	• Develop patient safety curriculum • Provide training and education of key clinical and management leadership • Develop a core of staff with patient safety skills who can work across microsystems as a resource
5. Interdependence of the care team	• Build PDSA* into debriefings • Use daily huddles to debrief and to celebrate identifying errors
6. Patient focus	• Establish patient and family partnerships • Support disclosure and truth around medical error
7. Community and market focus	• Analyze safety issues in community and partner with external groups to reduce risk to population
8. Performance results	• Develop key safety measures • Create feedback mechanisms to share results with Microsystems
9. Process improvement	• Identify patient safety priorities based on assessment of key safety measures • Address the work that will be required at the microsystem level
10. Information and information technology	• Enhance error reporting systems • Build safety concepts into information flow (e.g., checklists, reminder systems)

*PDSA (Plan-Do-Study-Act).

CONCLUSION

The microsystem concepts have evolved from systems theory and primary research on characteristics of high-performing clinical units. Specific interventions can be implemented to embed quality and safety into a microsystem. Table 2-2 offers several suggestions related to each of the microsystem

characteristics that might serve as a guiding framework to be adapted and used by individual microsystems. Leaders should promote safety as a priority for the organization, but they should allow individual microsystems to create innovative strategies for improvement.

Simply bringing individuals together to perform a specified task does not automatically ensure that they will function as a team. Effective teamwork depends on the willingness of clinicians from diverse backgrounds to cooperate toward a shared goal, to communicate, to work together effectively, and to improve. Each team member must be able to: (a) anticipate the needs of the others, (b) adjust to each other's actions and to the changing environment, (c) monitor each other's activities and distribute workload dynamically, and (d) have a shared understanding of accepted processes and how events and actions should proceed. Microsystems with clear goals and effective communication strategies can adjust to new information with speed and effectiveness to enhance real-time problem solving. Individual behaviors change more readily on a team because team identity is less threatened by change than are individuals. Behavioral attributes of effective teamwork including enhanced interpersonal skills can extend positively to other clinical arenas.

Turning a clinical unit into an effective microsystem requires substantial planning and practice. There is a natural resistance among many to moving beyond individual roles and accountability towards a team mindset. One can promote and facilitate this commitment by using the following guidelines:

1. Foster a shared awareness of each member's tasks and role on the team through cross-training and other team training modalities
2. Train members in specific teamwork skills such as communication, situation awareness, leadership, follower-ship, resource allocation, and adaptability
3. Conduct team training in simulated scenarios with a focus on both team behaviors and technical skills
4. Train team leaders in the necessary leadership competencies to build and maintain effective teams
5. Establish and consistently utilize reliable methods of team performance evaluation and rapid feedback

As we continue to move beyond conceptual theory and research to the application of new understandings and concepts in clinical settings, the

emerging fields of chaos theory, complexity science, complex adaptive systems, and lean production have influenced how these concepts have been applied to improving microsystems (Plsek & Greenhalgh, 2001; Plsek & Wilson, 2001; Arrow, McGrath, & Berdahl, 2000; Peters, 1987). The result is an ongoing process of continuous quality improvement that is enhanced by collaboration among microsystems and their researchers to share information, successes, and best practices. (Updates on these efforts are available at http://clinicalmicrosystem.org [Trustees of Dartmouth College, 2008].)

DISCUSSION QUESTIONS

1. Describe a clinical microsystem with which you are familiar. What is the aim of the microsystem and what are its core elements?
2. What are the types of strategies you might use to help a clinical microsystem move toward a higher level of functioning?
3. How might the organizational construct of a clinical microsystem change the role of the senior leaders of an institution, such as a hospital?

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APPENDIX 2-2

Microsystem Assessment Tool

Characteristics and Definition	Descriptions			
Leadership				
1. **Leadership:** The role of leaders is to balance setting and reach collective goals, and to empower individual autonomy and accountability through building knowledge, respectful action, reviewing, and reflecting.	☐ Leaders often tell me how to do my job and leave little room for innovation and autonomy. Overall, they don't foster a positive culture.	☐ Leaders struggle to find the right balance between reaching performance goals and supporting and empowering the staff.	☐ Leaders maintain constancy of purpose, establish clear goals and expectations, and foster a respectful positive culture. Leaders take time to build knowledge, review and reflect, and take action about microsystems and the larger organization.	☐ Can't rate

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Characteristics and Definition	Descriptions			
Leadership				
2. Organizational support: The larger organization looks for ways to support the work of the microsystem and coordinate the hand-offs between microsystems.	☐ The larger organization isn't supportive in a way that provides recognition, information, and resources to enhance my work.	☐ The larger organization is inconsistent and unpredictable in providing the recognition, information, and resources needed to enhance my work.	☐ The larger organization provides recognition, information, and resources that enhance my work and makes it easier for me to meet the needs of patients.	☐ Can't rate
Staff				
3. Staff focus: There is selective hiring of the right kind of people. The orientation process is designed to fully integrate new staff into culture and work roles. Expectations of staff are high regarding performance, continuing education, professional growth, and networking.	☐ I am not made to feel like a valued member of the microsystem. My orientation was incomplete. My continuing education and professional growth needs are not being met.	☐ I feel like I am a valued member of the microsystem, but I don't think the microsystem is doing all that it could to support education and training of staff, workload, and professional growth.	☐ I am a valued member of the microsystem and what I say matters. This is evident through staffing, education and training, workload, and professional growth.	☐ Can't rate

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Characteristics and Definition	Descriptions			
Staff				
4. Education and training: All clinical microsystems have responsibility for the ongoing education and training of staff and for aligning daily work roles with training competencies. Academic clinical microsystems have the additional responsibility of training students.	☐ Training is accomplished in disciplinary silos (e.g., nurses train nurses, physicians train residents, etc.) The educational efforts are not aligned with the flow of patient care, so that education becomes an "add-on" to what we do.	☐ We recognize that our training could be different to reflect the needs of our microsystem, but we haven't made many changes yet. Some continuing education is available to everyone.	☐ There is a team approach to training, whether we are are training staff, nurses, or students. Education and patient care are integrated into the flow of work in a way that benefits both from the available resources. Continuing education for all staff is recognized as vital to our continued success.	☐ Can't rate

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Characteristics and Definition	Descriptions			
Staff				
5. Interdependence: The interaction of staff is characterized by trust, collaboration, willingness to help each other, appreciation of complementary roles, respect, and recognition that all contribute individually to a shared purpose.	□ I work independently and I am responsible for my own part of the work. There is a lack of collaboration and a lack of appreciation for the importance of complementary roles.	□ The care approach is interdisciplinary, but we are not always able to work together as an effective team.	□ Care is provided by an interdisciplinary team characterized by trust, collaboration, appreciation of complementary roles, and a recognition that all contribute individually to a shared purpose.	□ Can't rate

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Characteristics and Definition	Descriptions			
Patient				
6. Patient focus: The primary concern is to meet all patient needs: caring, listening, educating, and responding to special requests, innovating to meet patient needs, and smooth service flow.	☐ Most of us, including our patients, would agree that we do not always provide patient-centered care. We are not always clear about what patients want and need.	☐ We are actively working to provide patient-centered care and we are making progress toward more effectively and consistently learning about and meeting patient needs.	☐ We are effective in learning about and meeting patient needs: caring, listening, educating, responding to special requests, and smooth service flow.	☐ Can't ate
7. Community and market focus: The microsystem is a resource for the community; the community is a resource to the microsystem; the microsystem establishes excellent and innovative relationships with the community.	☐ We focus on the patients who come to our unit. We haven't implemented any outreach programs in our community. Patients and their families often make their own connections to the community resources they need.	☐ We have tried a few outreach programs and have had some success, but it is not the norm for us to go out into the community or actively connect patients to the community resources that are available to them.	☐ We are doing everything we can to understand our community. We actively employ resources to help us work with the community. We add to the community and we draw on resources from the community to meet patient needs.	☐ Can't rate

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Characteristics and Definition	Descriptions			
Performance				
8. Performance results: Performance focuses on patient outcomes, avoidable costs, streamlining delivery, using data feedback, promoting positive competition, and frank discussions about performance.	☐ We don't routinely collect data on the process or outcomes of the care we provide.	☐ We often collect data on the outcomes of the care we provide and on some processes of care.	☐ Outcomes (clinical, satisfaction, financial, technical, and safety) are routinely measured; we feed data back to staff and we make changes based on data.	☐ Can't rate
9. Process improvement: An atmosphere for learning and redesign is supported by the continuous monitoring of care, use of benchmarking, frequent tests of change, and staff members who have been empowered to innovate.	☐ The resources required (in the form of training, financial support, and time) are rarely available to support improvement work. Any improvement activities we do are in addition to our daily work.	☐ Some resources are available to support improvement work, but we don't use them as often as we could. Change ideas are implemented without much discipline.	☐ There are ample resources to support continual improvement work. Studying, measuring, and improving care in a scientific way are essential parts of our daily work.	☐ Can't rate

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Characteristics and Definition	Descriptions			
Information and Information Technology				
10. Information and information technology: Information is *The* connector: (A) staff to patients, (B) staff to staff, (C) needs with actions to meet needs. Technology facilitates effective communication and multiple formal and informal channels are used to keep everyone informed all of the time, to listen to everyone's ideas, and to ensure that everyone is connected on important topics. *Given the complexity of information and the use of technology in the microsystem, assess your microsystem on the following three characteristics: (1) integration of information with patients, (2) integration of information with providers and staff, and (3) integration of information with technology.*				
A. Integration of information with patients	☐ Patients have access to some standard information that is available to all patients.	☐ Patients have access to standard information that is available to all patients. We've started to think about how to improve the information they are given to better meet their needs.	☐ Patients have a variety of ways to get the information they need and it can be customized to meet their individual learning styles. We routinely ask patients for feedback about how to improve the information we give them.	☐ Can't rate
B. Integration of information with providers and staff	☐ I am always tracking down the information I need to do my work.	☐ Most of the time I have the information I need, but sometimes essential information is missing and I have to track it down.	☐ The information I need to do my work is available when I need it.	☐ Can't Rate

(continues)

Characteristics and Definition	Descriptions			
Information and Information Technology				
C. Integration of information with technology	☐ The technology I need to facilitate and enhance my work is either not available to me or it is available but not effective. The technology we currently have does not make my job easier.	☐ I have access to technology that will enhance my work, but it is not easy to use and seems to be cumbersome and time consuming.	☐ Technology facilitates a smooth linkage between information and patient care by providing timely and effective access to a rich information environment. The information environment has been designed to support the work of the clinical unit.	☐ Can't rate

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Instructions: Each of the "success" characteristics (e.g., leadership) is followed by a series of three descriptions. For each characteristic, *please check [√]* the description that *best describes* your current microsystem and the care it delivers *or* use a microsystem with which you are most familiar.