Practice-Based Learning and Improvement:

A Clinical Improvement Action Guide

SECOND EDITION

Joint Commission Resources

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Chapter 7

Sustaining and Extending Clinical Improvements: A Health System's Use of Clinical Programs to Build Quality Infrastructure

Brent C. James, Joel S. Lazar

The aim of this book is transformation of the style of American management. Transformation of American style of management is not a job of reconstruction, nor is it revision. It requires a whole new structure, from the foundation upward. —W.E. Deming[1(p. ix)]

Successful optimization of health care delivery requires not only that we strive continually to improve the processes and outcomes of our daily work but also that we build in strategies to sustain those improvements once achieved and that we extend successes to other work settings inside and outside our own organization. Many practitioners of improvement have seen their initial successes fail to take hold in the long term, or fail to spread to other colleagues and practice sites. Such failure of sustainability has immediate consequences for patient care. Less obviously, but also importantly, enthusiasm for future quality improvement initiatives might diminish as well.

Inspired by Deming's transformation of American management, many health care leaders are trying to transform American medicine as well. Here, too, a whole new structure is required, "from the foundation upward." If our goal is to successfully promote quality in health care systems and to sustain it, new models of both frontline care and organizational infrastructure must be designed, tested, and refined. This chapter offers an extended case study of one health care system that has created and implemented such a model.

The quality management pioneer, Joseph Juran, identified three core elements of a comprehensive quality-based strategy (the "Quality Trilogy"):[2]

1. Quality design (or quality planning) identifies the needs of individuals who are served by the organization and establishes strategies to meet those needs through development of better products and services.
2. Quality improvement generates methods to continually reassess prioritized targets and innovatively refine product and service delivery.
3. Quality control builds improved services into usual operations, via core data flow and management infrastructure, to sustain ongoing processes.

Previous chapters in the present book have focused especially on the first two components of Juran's Quality Trilogy. Indeed, the generation of change ideas and concepts (Chapters 2 and 6), the use of Clinical Improvement Worksheets and Clinical Value Compasses (Chapters 3 and 4), and the process of benchmarking (Chapter 5) are all practices of quality design and improvement. We have suggested, as well, that improvement works best when it is built into daily work flow processes. This latter feature does indeed contribute to Juran's third component, quality control, but in isolation it does not ensure that such control will be sustained in the long term.

The current chapter reviews the experience of one regional health system, Intermountain Healthcare, as it has endeavored during the past decade to sustain early improvements and to build a sophisticated quality management program that integrates design, improvement, and control of best-care processes. Readers will note that the present discussion shifts our perspective from previous chapters' presentations, but attention remains focused on a common theme. Whereas we previously introduced basic concepts and exercises, which we then illustrated with specific case examples, here we let the case discussion itself take center stage, and we augment this narrative with sidebar references to core quality principles addressed earlier in the volume. Our purpose is to demonstrate what the whole system looks like when basic improvement ideas are integrated seamlessly in advanced applications.

We shall see that although quality improvement (QI) and innovation are often generated at the frontline microsystems of care, quality design and control (that is, the planning, maintenance, and extension of improvements over time) often depend on committed mesosystem support as well. Intermountain's data communication systems and quality management infrastructure have promoted improvements in both system performance and patient outcomes. In addition, the integration of quality design, improvement, and control has enabled this organization to generate reliable new clinical knowledge from frontline care delivery experiences and to rapidly deploy new research findings across care delivery locations.

A Case Study: The Intermountain Healthcare System and the Clinical Program Approach

Intermountain Healthcare is an integrated, nonprofit health system serving the needs of Utah and southeastern Idaho residents. The system includes 21 hospitals, 100-plus outpatient clinics, and 26,000 employees (including 1,250 core physicians and approximately 2,000 associated physicians)[3] Intermountain was an early innovator and adapter of formal QI methods, and the system documented several early successes.[4,5] Although these experiences confirmed that Deming's process management methods could be applied to health care delivery, they also highlighted a major challenge: Initial results were difficult to sustain and even more difficult to extend beyond local settings. Success in one location did not lead to widespread adoption, even among Intermountain's own facilities.

Since the quality movement's inception, most care delivery organizations have focused exclusively on improvement. Few systems, however, have built a comprehensive quality framework that integrates this improvement work with preplanning design and postdevelopment control. In 1996, Intermountain began to implement such an integrated program across its many inpatient and outpatient practices. The program depends on effective communication between frontline (microsystem) units of care—where new change ideas are generated and implemented on the basis of needs and experiences of patients and clinical staff—and systemwide quality management infrastructure (mesosystem)—where larger-scale resources support and coordinate frontline efforts. (*See* Sidebar 7-1, below, for further discussion of microsystems and mesosystems of care.)

At the microsystem level, Intermountain's therapeutic strategies depend heavily on a new "shared baselines"

SIDEBAR 7-1. Core Quality Principle: Microsystems and Mesosystems of Care

As discussed in Chapter 1, microsystems are the small, naturally occurring frontline units that provide most clinical care to most people. These units are characterized in terms of functional processes, patterns of communication, and the skill sets of each participant.[1] "Collections" of frontline clinical microsystems form mesosytems of care that might serve patients with specific needs, integrating sequential processes and supporting parallel clinical units across the care continuum.

Intermountain Health's Clinical Programs, described in the current chapter, combine microsystem principles and practices with Deming's original idea to "organize everything around value-added high-priority work processes."[2] This organization permits geographic extension of value-based microsystem structures, yielding new forms of mesosystem support that are greater than the sum of their parts. By focusing on the high-priority activities common to local sites, Intermountain's Clinical Programs build value-based infrastructure across frontline microsystems with similar caregiving and outcome tracking needs.

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1. Nelson E.C., et al.: Microsystems in health care: Part 1. Learning from high-performing front- line clinical units. *Jt Comm J Qual Improv* 28:472–493, Sep. 2002.
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approach to care delivery. This model evolved during early QI projects as a mechanism to functionally implement evidence-based medicine:[6] All health professionals associated with a particular clinical work process (for example, physicians, nurses, pharmacists, therapists, technicians, administrators) come together as a functional team. Participants build an evidence-based, best-practice guideline, fully understanding that it will not perfectly fit any one patient in the real care delivery setting. The team blends this guideline into clinical work flow, using standard order sets, clinical worksheets, and other similar tools. On implementation, health professionals adapt their shared common approach to the needs of each individual patient. Across more than 30 implemented clinical shared baselines, 5% to 15% of the content of a shared baseline is typically modified by Intermountain's physicians and nurses to meet the specific needs of a particular patient. The presence of such baselines makes it "easy to do things right,"[7] that is, according to clinical guidelines, while relying on practitioners' expertise to manage exceptional circumstances. This approach also contributes to efficiency, as skilled clinicians can focus their attention on a subset of critical issues, trusting that the remainder of the care process is reliable. These same shared baselines also facilitate structuring of the electronic data system, greatly enhancing the effectiveness of automated clinical information. Arguably, shared baselines are the key to successful implementation of electronic medical record systems. (*See* Sidebar 7-2, below, for discussion of shared baselines as a form of high-leverage change concept.)

At the mesosystem level, Intermountain has designed a clinical program model that clarifies and rationalizes a self-aware, self-sustaining quality infrastructure, connecting functionally related clinical units from across the care continuum. Construction of the mesosystem featured the following four major elements:

1. Key process analysis
2. An outcomes tracking system, which measures and reports accurate and timely medical, cost, and patient satisfaction results
3. An organizational structure to use outcomes data to hold practitioners accountable and to enable measured progress on shared clinical goals
4. Aligned incentives to harvest some portion of resulting cost savings back to the care delivery organization. (This last feature is often overlooked in quality systems but it is essential to achieve sustained buy-in from participants. Although in many instances better quality can demonstrably reduce total care delivery costs, current payment mechanisms direct most such savings to health care payers rather than to providers who have actually achieved the cost reductions.)

SIDEBAR 7-2. **Core Quality Principle: Change Concepts**

Intermountain Healthcare's "shared baseline" derives from Womack, Jones, and Roos' powerful concept of "mass customization,"[1] a process through which infrastructure for change is built directly into work operations. Performance variation is tracked and analyzed routinely within this system, and is fed back into a learning model that regularly supports new strategies for change. Although both the Womack, Jones, and Roos concept and Intermountain's clinical adaptation were developed before the Langley, et al.,[2] term change concept, the principle of shared baselines serves precisely this idea-stimulating role within Intermountain's organization.

As described in Chapter 6, change concepts are general categories or approaches to change that stimulate more specific improvement ideas. The utility of such concepts resides in their capacity to generate broadly applicable solutions that remain specific in their implementation. The high-leverage change concept of shared baselines or process standardization facilitates both work flow efficiency and quality monitoring, while justifying and structuring Intermountain's electronic medical record. A single idea thus promotes multiple ideas, with impacts on quality design, improvement, and control that are manifest throughout the clinical system.

References

1. Womack J., Jones D., Roos D.: *The Machine That Changed the World*. New York City: Harper Collins, 1991.
2. Langley G.J., et al.: *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance.* San Francisco: Jossey-Bass, 1996.

In the remainder of this chapter, we address the first three of these clinical program elements, with special attention to care process models (CPMs), which link well-defined population-based mesosystem structures with clinical processes at the front line of care.

Key Process Analysis: Identifying and Analyzing the Fundamental Work of a Health System

The Institute of Medicine's prescription for reform of U.S. health care noted that an effective system should be organized around its most common elements.[8] Each year for four years, Intermountain attempted to identify high-priority clinical conditions for coordinated action through expert consensus among senior clinical and administrative leaders using formal Delphi methods. Despite a seemingly successful consensus process, however, leaders remained focused primarily on their own departmental priorities, and meaningfully coordinated action was not achieved. In 1996, Intermountain therefore moved from expert consensus to objective measurement, in which analytic methods would be used to identify and prioritize frontline work processes.

To facilitate this complex task, Intermountain's strategic clinical planners subdivided Intermountain's operations into four large classes:

1. Work processes centered around specific clinical conditions
2. Clinical work processes that are not condition-specific but that support clinical services (for example, processes located within pharmacy, pathology, anesthesiology/procedure rooms, nursing units, intensive care units, patient safety)
3. Processes associated with patient satisfaction
4. Administrative support processes (for example, billing, human resources, informatics)

Within each category, the analytic team attempted to identify all major work processes that produced value-added results. (*See also* Sidebar 7-3, below, for discussion of process analysis.)

Intermountain planners then prioritized the work processes. To illustrate, within clinical conditions, the planning team performed the following actions:

1. Measured the number of patients affected
2. Estimated clinical risk to the patient. Intensity of care served as a surrogate for clinical risk, with care intensity measured as cost per case. This produced results that had high face validity with both frontline clinicians and administrative leadership.
3. Measured base-state variability within a particular clinical work process by calculating the coefficient of variation, based on intensity of care (cost per case)
4. Used Batalden and Nelson's concept of clinical microsystems (*see* Chapter 1 of this volume and Sidebar 7-1, page 96) to identify specialty groups that routinely worked together on the basis of shared patients and shared processes for managing those patients.[9,10] This was a key element for organizational structure.
5. Used expert judgment to identify underserved populations (the ethical principle of social justice) and to balance the roll-out across all elements of the Intermountain care delivery system

Among more than 1,000 initial inpatient and outpatient condition-based clinical work processes, only 104 of

SIDEBAR 7-3. **Core Quality Principle: Process Analysis**

As discussed in Chapter 2, the work of quality improvement—and also quality design and control—begins with thoughtful identification and clarification of all clinical and administrative processes that are pertinent to actual patient care. This reflective activity might be initiated via survey of participating "players" or via detailed mapping of local processes. When key elements have been identified, formal analytic assessment of service frequency, intensity, and cost is essential to establish a common agenda that all participants can follow. Intermountain Healthcare has used all these approaches, most especially analytic assessment, to better characterize its own fundamental work processes. The result is deep understanding (in both quantitative and qualitative terms) of clinical operations, facilitating effective resource utilization, quality planning, and project prioritization. (*See* text of current chapter for specific details.)

these processes accounted for almost 95% of all of Intermountain's care delivery. Instead of the traditional 80/20 rule (that is, the Pareto principle, which stipulates that about 80% of results arise from about 20% of all causes), Intermountain saw a 90/10 rule. Patient results and costs of operations were massively concentrated within a relatively small number of high-priority clinical processes. Intermountain then addressed these processes in priority order to achieve the most good for the most patients, while freeing resources to enable traditional, one-by-one care delivery plans for uncommon clinical conditions.

Outcomes Tracking: Developing a Data System to Support Care Delivery and to Monitor Outcomes

Intermountain had tried twice before to start a formal program for clinical management supported by data monitoring and feedback. The effort failed each time, with significant financial and staffing consequences. When asked to make a third attempt, the Intermountain planning team first performed a careful "autopsy" on the first two attempts. This investigation revealed that on each previous attempt, clinicians had indeed stepped forward to take the lead on clinical management. In each case, however, Intermountain's planners uncritically assumed that these new clinical leaders could simply use the same administrative, cost-based data to manage clinical processes as had traditionally been used to manage hospital departments and to generate insurance claims. On careful examination, the administrative data contained gaping holes relevant to clinical care delivery. Moreover, the data were organized for facilities management, not patient management. New sets of measures more appropriate to clinical care were required.

One of the first activities of the National Quality Forum (NQF) on its creation in 1999 was to convene an expert panel (a Strategic Framework Board; SFB) to develop formal, evidence-based methods for the identification of valid measurement sets in clinical care.[11] The SFB found that outcomes tracking systems work best when designed around, and integrated into, frontline care delivery. Although frontline–integrated data systems can "roll up" into accountability reports for clinicians, clinical practice groups, hospitals, regions, care delivery systems, states, and the nation, the opposite is not true: data systems designed "top down" for national reporting usually cannot generate "bottom up" information flow necessary for process management and improvement at the point of care.[12] Such top-down systems often compete for limited frontline resources, damaging care delivery at the patient interface.[13]

Intermountain adopted the NQF's data system design method. This approach begins with an evidence-based, best-practice guideline, laid out for care delivery (the shared baseline model, as described). Such baselines permit identification and testing of a comprehensive set of medical, cost, and satisfaction outcome measures, and enable generation of corresponding reports designed for clinical process management and improvement. The reports lead to a list of data elements and coding manuals, which in turn generate "data marts" within an electronic data warehouse. The result is an integrated medical record system that can merge patient registries with decision support tools, facilitating both point-of-care intervention and aggregated outcomes tracking. (*See also* Sidebar 7-4, page 100, for discussion of outcome measurement.)

The production of new clinical outcomes tracking data represented a significant investment for Intermountain. Therefore, addressing clinical work processes in priority order, as determined by key process analysis (described above), was critical. Initial progress was swift. For example, in 1997 Intermountain completed outcomes tracking systems for their two biggest clinical processes. Pregnancy, labor, and delivery represented 11% of Intermountain's total clinical volume. Ischemic heart disease represented another 10%. At the end of the year, Intermountain had a detailed clinical "dashboard" in place for approximately 21% of the system's total care delivery. The data system was designed for frontline process management, which was then rolled up into region- and system-level accountability reports. Today, outcomes data cover almost 80% of Intermountain's inpatient and outpatient clinical care. Such data are immediately available through internal Web sites, with data lag times under one month in all cases, and a few days in most cases.

Organizational Structure: Building Relationships to Manage and to Improve Care Delivery Across the Care Continuum by Establishing Clinical Programs

When Intermountain started to develop new clinical programs, about two-thirds of their core physicians were community-based, independent practitioners. The structural reality of regional care necessitated a system of organization that heavily emphasized shared professional values, backed up by aligned financial incentives. (Notably, the program's early success relied exclusively on shared profes-

SIDEBAR 7-4. Core Quality Principle: Balanced Outcomes Measurement

We emphasize repeatedly in this volume the critical role of outcomes measurement in directing and refining quality performance. As primarily described in Chapter 4, the Clinical Value Compass maps patient outcomes in the important domains of clinical status, functional capacity, satisfaction against need, and (direct and indirect) costs.[1,2] Leaders at Intermountain Healthcare have used a similar classification scheme, combining the two value compass "directions" of clinical and functional status in a single "medical" domain. This becomes one corner of a conceptual triangle (rather than a four-directional compass), whose other two points are (as in the Clinical Value Compass) satisfaction and cost.[3–5] Of course, the precise labeling of different axes is less important than the broadly inclusive conception of outcomes that the Clinical Value Compass and Intermountain's own tracking system have in common. In both cases, identification and monitoring of a balanced set of outcomes enables clinicians to design, implement, and sustain meaningful improvements that all stakeholders can recognize as important.

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1. Nelson E.C., et al.: Improving health care, Part 2: A Clinical Improvement Worksheet and users' manual. *Jt Comm J Qual Improv* 22:531–548, Aug. 1996.
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sional values; financial incentives evolved quite late in the process and were always modest in size.)

The microsystem focus of the key process analysis (as described previously) provided the core organizational structure. Families of related processes, called clinical programs, identified care teams that routinely worked together, even though they often spanned traditional subspecialty boundaries (Figure 7-1, page 101). These related care teams represented the informal clinical mesosystem that took steps to organize and formalize. (*See* Sidebar 7-1, page 96, for discussion of microsystems and mesosystems of care.) Intermountain hired part-time physician leaders for each clinical program in each of its three major regions (Urban North, Urban Central, and Urban South), each region a network of outpatient practices and small community hospitals, organized around a large tertiary medical center. Physician leaders were required to practice actively within their clinical programs, to have the respect of their professional peers, and to complete formal training in clinical quality improvement methods through Intermountain's internal clinical improvement training program. (This "Advanced Training Program in Clinical Practice Improvement" is now open to external medical leaders, through Intermountain's collaboration with the Institute for Healthcare Improvement. Information is available at http://www.ihi.org/IHI/Programs/ConferencesAndTraining/AdvancedTrainingProgram.)

Recognizing that the bulk of clinical process management efforts rely on clinical staff, not just physicians, Intermountain also hired full-time "clinical operations administrators." Most of these clinical operations leaders (who support the clinical program leaders) are experienced nurse administrators. The resulting leadership dyad—a physician leader and a nursing/support staff leader—meets each month with every local team in its clinical program. They present and review patient outcomes and performance results, with attention to peer and national benchmark comparisons. (*See also* Chapter 5 on clinical benchmarking.) Attention is given to systemwide clinical improvement goals, tracking progress, identifying barriers, and discussing possible solutions. Within each region, all clinical program dyads meet monthly with their administrative counterparts (regional hospital administration, finance, information technology, insurance partners, nursing, and quality management). They review current clinical results, track progress on goals, and assign resources to overcome implementation barriers at the local level.

FIGURE 7-1. **Schematic of Clinical Program Organizational Structure**

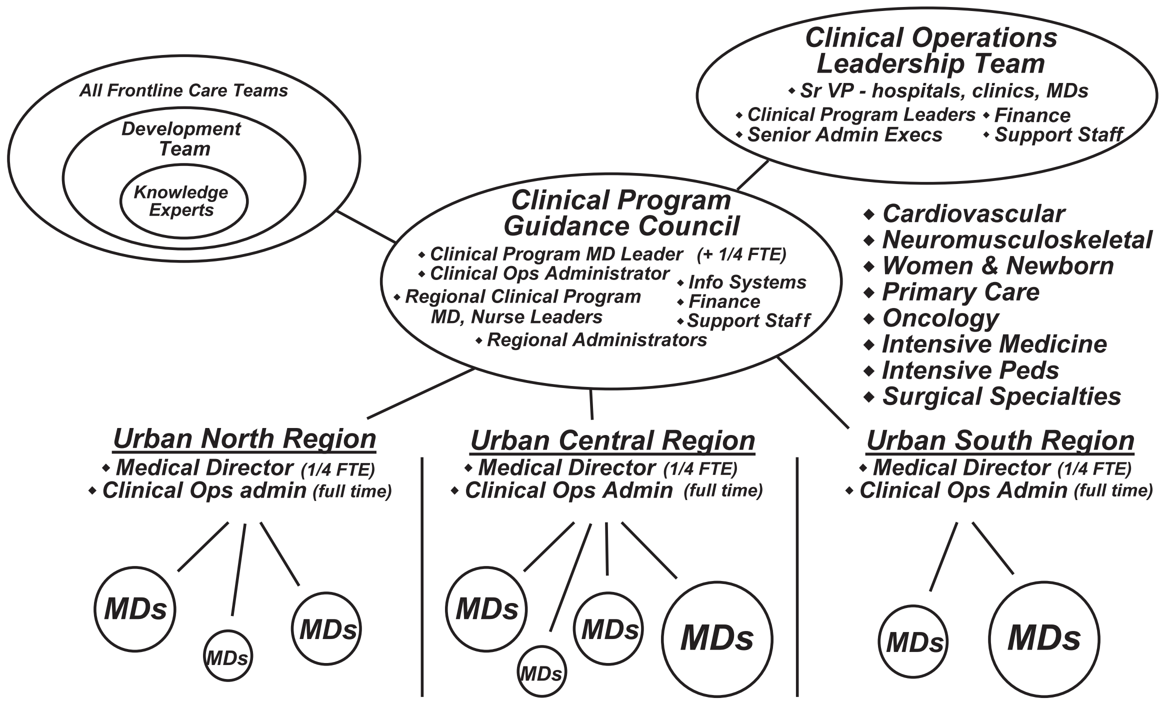

Figure 7-1. Clinical Programs identified care teams, such as primary care practices, endocrinology practices, and inpatient medical unit, that routinely worked together. These related care teams represented the informal clinical mesosystem that took steps to organize and formalize.

In addition to their regional activities, all leaders within a particular clinical program (from across the entire Intermountain system) meet together monthly as a central guidance council. One of the three regional physician leaders is funded for an additional part-time role to oversee and coordinate the systemwide effort. Each system-level clinical program also has a separate, full-time clinical operations administrator. Finally, each guidance council is assigned at least one full-time statistician and at least one full-time data manager to help coordinate clinical outcomes data flow, produce outcomes tracking reports, and to perform special analyses. This structure coordinates a large part of Intermountain's existing staff support functions, such as medical informatics (electronic medical records), electronic data warehouse, finance, and purchasing, to assist the clinical management effort.

By design, each guidance council oversees a set of condition-based clinical work processes, as identified and prioritized during the aforementioned key process analysis step. Each key clinical process is managed by a development team (Table 7-1, pages 100–101), which reports to the guidance council. Development teams meet each month. The majority of development team members are drawn from frontline physicians and clinical staff, geographically balanced across the Intermountain system, who have hands-on experience with the clinical care under discussion.[1] Development team members carry the team's activities—analysis and management system results—back to their frontline colleagues to seek their input and to help with implementation and operations. Each development team also has a designated physician leader, as well as "knowledge experts" drawn from each region. knowledge experts are usually specialists associated with the team's particular care process. For example, the Primary Care Clinical Program includes a Diabetes Mellitus Development Team (among others). Most team members are frontline primary care physicians and nurses

TABLE 7-1.
Intermountain Clinical Program and Development Teams*

Clinical Program / Development Teams / CPMs	Date started
Clinical Program	
Development Teams	Date started
CPMs	
Cardiovascular	
IHD Development Team	Jan. 1998
AMI	
CHF Development Team	Jan. 2001
CV Surgery Development Team	Jan. 1998
Fast-track extubation	
Intra- and post-op glucose control	
Cardiac Meds Development Team	Jun. 1999
Hypertension Development Team	Aug. 2002
Supply chain (purchasing, recalls, etc.)	
Billing	
Neuromusculoskeletal	
Total hip arthroplasty	
Total knee arthroplasty	
Low back pain	
Physical therapy	
Surgical Specialties	
Pain Services Development Team	Sep. 2006
General Surgery Development Team	Jan. 2007
Surgical Support Services Development Team	Feb. 2007
Women & Newborns	
OB Development Team	
Elective induction (emergency C-section rates)	
Delivery-associated maternal injuries	
Neonatal bilirubin testing and treatment	
NICU Development Team	
Dysfunctional Uterine Bleeding Development Team	
Intensive Medicine	
Critical Care Development Team	Mar. 2003
Medical evaluation teams (RRTs)	
Central line sepsis	
Ventilator-associated pneumonia	
Blood glucose control	
Trauma Development Team	Apr. 2004
Traumatic brain injury	
Emergency Care Development Team	Nov. 2004
Febrile Infant	
AMI	
Sepsis	

TABLE 7-1. (continued)

Intermountain Clinical Program and Development Teams*

Pneumonia	
Transport Development Team	Sep. 2004
Hospitalist Development Team	Feb. 2006
Inpatient pneumonia	
Inpatient DVT prevention and treatment	
Stroke Development Team	Jan. 2005
Intensive Pediatrics (started 2006—doing key process analysis)	
Bronchiolitis	
Intensive Behavioral (not yet started)	
Oncology	
Breast Cancer Development Team	May 2002
Breast-conserving treatment	
Axillary note dissection	
Sentinel node biopsy	
Mammography Development Team	Aug. 2004
Prostate Cancer Development Team	Mar. 2005
Neuro-oncology Development Team	Mar. 2005
Medical Oncology Development Team	Aug. 2005
Radiation Therapy Development Team	Mar. 2004
Primary Care	
Community Health & Prevention Development Team	Jan. 1999
Preventive Care Guidelines and Tools (child, adolescent, adult; general disease screening)	
Immunizations (child, adolescent, adult, employee, pandemic planning)	
Obesity	
(adult, child, and adolescent)	
Tobacco	
Nutrition and activity	
Asthma Development Team	Jul. 1999
Diabetes Development Team	Jan. 1999
Lower Respiratory Infection Development Team	Jan. 2000
Community-acquired pneumonia	
Antibiotic use in bronchitis	
Otitis Media/Pediatric Respiratory Development Team	
Chronic Anticoagulation Development Team	Apr. 2001
Mental Health Integration Development Team	Jan. 1999
Depression	

* Start-up dates and individual Care Process Models (CPMs) are individually listed. When a development team (e.g., CV Surgery) has more than one CPM, or when the main CPM is not obvious from the development team's title, further notations are provided. IHD, ischemic heart disease; AMI, acute myocardial infarction; CHF, congestive heart failure; CV, cardiovascular; OB, obstetrics; C-section, Cesarean section; NICU, neonatal intensive care unit; RRTs, rapid response teams; DVT, deep vein thrombosis.

who see diabetes patients in their practices every day. The knowledge experts are diabetologists, drawn from each region.

A new development team begins its work by generating a CPM for its assigned key clinical process. Intermountain's central clinical program staff provide a great deal of coordinated support for this effort. A CPM development process contains five sequential elements:

1. The knowledge experts generate an evidence-based, best-practice guideline for the condition under study, with appropriate links to the published literature. They share their work with the development team, which in turn shares it with their frontline colleagues, asking, "What would you change?" Through iterations of mutual feedback and refinement, the shared baseline practice guideline stabilizes over time.
2. The full development team converts the practice guideline into clinical work flow documents suitable for use in direct patient care. This step is often the most difficult in the CPM development process. Good clinical flow can enhance clinical productivity, rather than adding burden to frontline practitioners. The aim is to make evidence-based best care the lowest-energy default option, with data collection integrated into clinical work flow.

   The core of most chronic disease CPMs is a "treatment cascade." Treatment cascades start with disease detection and diagnosis. The first (and most important) "treatment" is intensive patient education, enabling the patient to become the primary disease manager. The cascade then steps sequentially through increasing levels of treatment. A frontline clinical team moves down the cascade until it achieves adequate control of the patient's condition, while modifying the cascade's shared baseline as dictated by individual patient's needs. The last step in most cascades is referral to a specialist.
3. The team next applies the NQF outcomes tracking system development tools, producing a balanced dashboard of clinical, cost, and satisfaction outcomes. (*See* Sidebar 7-4, page 100, for discussion of balanced outcomes measurement.) This effort involves the electronic data warehouse team, which designs clinical registries that bring together complementary data flows with appropriate preprocessing.
4. The development team works with Intermountain's medical informatics groups to blend clinical work flow tools and data system needs into automated patient care data systems.
5. Central support staff help the development team build Web-based educational materials for both care delivery professionals and the patients they serve.

A finished CPM is formally deployed into clinical practice by the governing guidance council, through its regional physician/nurse leader dyads. The development team's role changes at that point. The team continues to meet monthly to review and update the CPM. The team's knowledge experts have funded time to track new research developments. The team also reviews care variations as clinicians adapt the shared baseline. It closely follows major clinical outcomes and receives and clears improvement ideas that arise among Intermountain's frontline practitioners and leaders.

As a result of this dynamic structure, Intermountain's CPMs tend to change quite frequently. Knowledge experts have an additional responsibility to share new findings and changes with their frontline colleagues. They conduct regular continuing education sessions, targeted at both practicing physicians and nonphysician staff. (Technically, this is called "academic detailing;" it is one of the few continuing education methods demonstrated to change clinical practice). Education sessions cover the full spectrum of the coordinated CPM. They review current best practice (the core evidence-based guideline), relate it to clinical work flow, show delivery teams how to track patient results through the outcomes data system, tie the CPM to decision support tools built into the electronic medical record, and link it to a full set of educational materials for patients and care delivery professionals.

Chronic disease knowledge experts also run the specialty clinics that support frontline care delivery teams. Continuing education sessions usually coordinate the logistics of that support. Finally, the knowledge experts coordinate specialty-based nurse care managers and patient trainers.

A CPM in Action: Diabetes Mellitus

Through its health plan and outpatient clinics, Intermountain supports more than 20,000 patients diagnosed with diabetes mellitus. Among approximately 800 primary care physicians who manage diabetic patients, one-third are employed within the Intermountain Medical Group, whereas the remainder are community-based, independent physicians. All physicians and their care delivery teams—regardless of employment status—interact regularly with the Primary Care Clinical Program medical directors and clinical operations administrators. They have access to regular diabetes continuing education sessions. Three endocrinologists (one in each region) act as knowledge experts on the Diabetes Development Team. In addition to conducting diabetes training, the knowledge experts coordinate specialty nursing care management (diabetic educators) and supply most specialty services.

Each quarter, Intermountain sends a set of reports to every clinical team managing diabetic patients. The reports are generated from the Diabetes Data Mart (a patient registry) within Intermountain's electronic data warehouse. The packet includes a Diabetes Action List. The action list summarizes every diabetic patient in the team's practice, listing testing rates and levels of control for standard clinical quality indicators such as glycolated hemoglobin (HA1C), low-density lipoproteins, blood pressure, urinary protein, dilated retinal exams, and pedal sensory exams. The report flags any care defect, as reflected either in test frequency or level of control. Frontline teams review the lists, then either schedule flagged patients for office visits, or assign them to general care management nurses at the local clinic. Although Intermountain puts Diabetes Action Lists out every quarter, frontline teams can generate them on demand. Most teams do so every month (*See* again Sidebar 7-4, page 100, on outcomes measurement).

In addition to action lists, frontline teams can access patient-specific patient worksheets through Intermountain's Web-based Results Review system. Most practices integrate the worksheets into their work flow during chart preparation. The worksheet contains patient demographics, a list of all active medications, and a review of pertinent history and laboratory results focused around chronic conditions. For diabetic patients, it will include test dates and values for the last seven HA1Cs, low-density lipoproteins, blood pressures, urinary proteins, dilated retinal examinations, and pedal sensory examinations. A final section of the worksheet applies all pertinent treatment cascades, listing recommendations for immunizations, disease screening, and appropriate testing. It will flag out-of-control levels, with next-step treatment recommendations. (Technically, this section of the worksheet is a passive form of computerized physician order entry).

The standard quarterly report packet also contains sections comparing each clinical team's risk-adjusted performance with its peers. A fourth report tracks progress on quality improvement goals and links them to financial incentives. Finally, a separate summary report goes to the team's clinical program medical director. In meeting with the frontline teams, the clinical program leadership dyad often shares methods used by other practices to improve patient outcome performance, with specific practice flow recommendations (true benchmarking when combined with the peer comparison reports). Figures 7-2 (page 106) and 7-3 (page 107) show system-level performance on representative diabetes outcomes measures, as pulled in real time from the Intermountain outcomes tracking system. Primary care physicians supply almost 90% of all diabetes care in the system. As the last step in the diabetes treatment cascade, Intermountain's diabetes knowledge experts tend to concentrate the most difficult patients in their specialty practices. As a result, they typically have worse outcomes than their primary care colleagues.

Discussion and Conclusion

Using Routine Care Delivery to Generate Reliable Clinical Knowledge

Evidence-based best practice faces a massive evidence gap. The healing professions currently have reliable evidence (Level I, II, or III randomized trials, robust observational designs, or expert consensus opinion using formal methods)[14] to identify the best patient-specific practice for only a small minority of care delivery choices.[15] Bridging this gap will strain the capacity of any conceivable research system.

Intermountain designed its clinical programs to rationalize, optimize, and improve care delivery performance. The resulting organizational and information structures make it possible to generate robust data regarding treatment effects as a by-product of demonstrated best care. In this context, CPMs have several major virtues. They do the following:

- Embed data systems that directly link outcome results to care delivery decisions
- Deploy organized care delivery processes throughout the system
- Function as effectiveness "research engines" that are built systemwide into frontline care delivery

At a minimum, CPMs routinely generate Level II information (robust, prospective observational time series) for all key clinical care delivery processes. Because frontline care is supported by, and in turn supports, a data-rich and protocol-friendly infrastructure, all clinical care changes get tested. Changes such as newly published

FIGURE 7-2. Percentage of Intermountain Healthcare System Diabetic Patients with Glycolated Hemoglobin (HA1C) > 9%, June 1999–March 2006

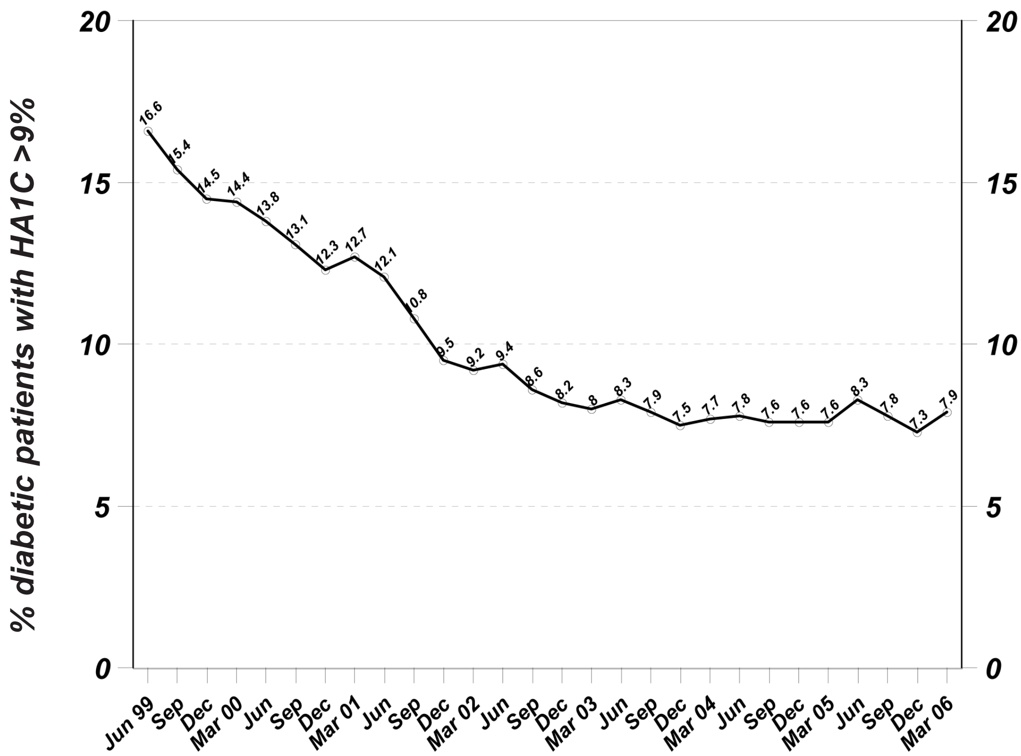

Figure 7-2. This figure represents data for more than 20,000 patients. National guidelines recommend that all patients with diabetes be managed to HA1C levels < 9%, and, ideally, to levels < 7%.

treatments in the medical literature, new medications, a new organizational structure for an intensive care unit, or a new nurse-staffing policy implementation, for example, can all generate robust information regarding their effectiveness.

As needed, development teams extend the scope of existing evidence as part of routine care delivery operations. For example,

- The Intermountain Cardiovascular Guidance Council developed robust observational evidence regarding discharge medications for patients hospitalized with ischemic heart disease or atrial fibrillation (Level II-2 evidence).[16]
- The Mental Health Integration Development Team used the Intermountain outcomes tracking system to conduct a prospective nonrandomized controlled trial (Level II-1 evidence) to assess the best practice for the detection and management of depression in primary care clinics.[17,18]
- The Lower Respiratory Infection Development Team ran a quasi-experiment that used existing prospective data flows to assess rollout of their community-acquired pneumonia (CAP) CPM (Level II-1 evidence).[19,20] This led to a randomized controlled trial to identify best antibiotic choices for outpatient management of CAP (Level I evidence).[21] With embedded data systems and an existing shared baseline care protocol that spanned the Intermountain system, the clinical trial was completed in less than three months. The largest associated expenses were Institutional Review Board oversight and data analysis—costs that Intermountain underwrote, based on a clear need to quickly generate and then to apply appropriate evidence to real patient care.

FIGURE 7-3. **Percentage of Intermountain Healthcare System Diabetic Patients with Lipid (Low-Density Lipoprotein/LDL) < 100 mg/dl, December 1999–March 2006**

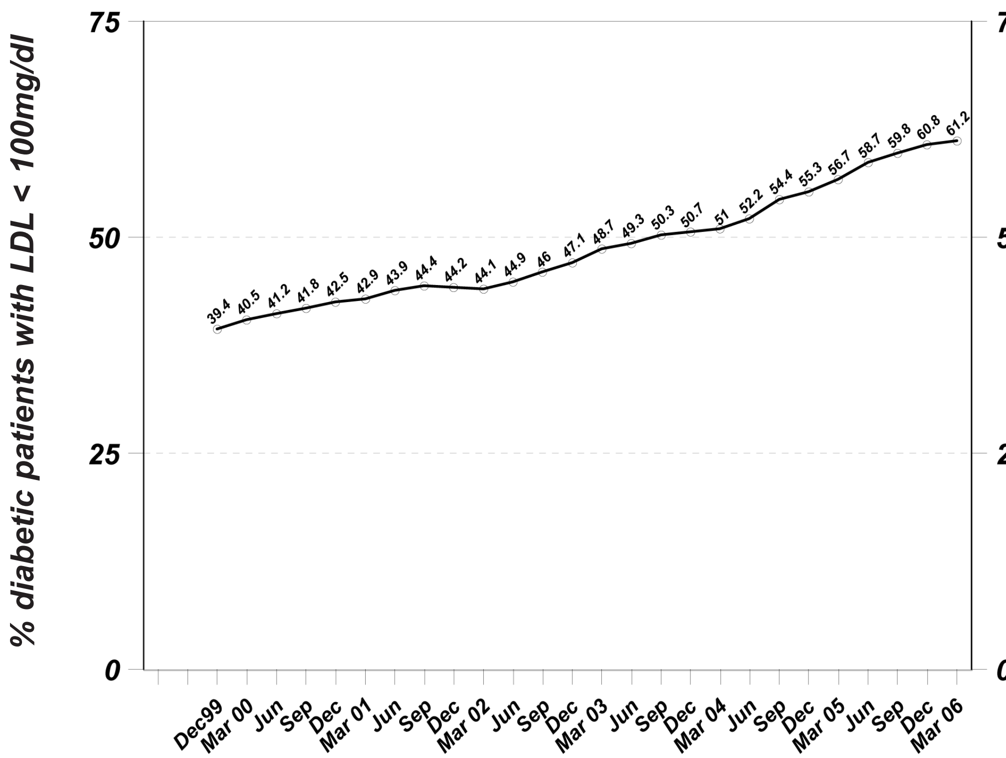

Figure 7-3. This figure represents data for more than 20,000 patients. National guidelines recommend that all patients with diabetes be managed to LDL levels < 100 mg/dl.

Conclusion

By linking frontline (microsystem) care processes to organizational (mesosystem) information capacity and management infrastructure, Intermountain Healthcare enriches its quality improvement initiatives with quality control mechanisms that sustain improvements over time and that extend these improvements across an entire regional system of care. Such a program requires substantial organizational investment, but the returns on this investment are substantial as well. Patient outcomes are demonstrably improved, and service delivery is both effective and efficient. Clinicians feel supported in their provision of daily care and are motivated to engage in, and to sustain, the work of learning from practice and improving practice. Within Intermountain, when a physician says "in my experience," it means measured results, not individual anecdote in the form of a physician's subjective recall across patient groups over time (a practice with well-known significant limitations). In addition, by embedding effectiveness research within routine care processes, the organization can generate and rapidly deploy new clinical knowledge. Improvements in patient outcome, system performance, and practice-based research thus support each other, promoting best care for each patient "here in the room," while generating evidence on best care for patients in general.

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Practice-Based Learning and Improvement: *A Clinical Improvement Action Guide,* SECOND EDITION

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