

Designing an Ambulatory Clinical Practice for Outcomes Improvement: From Vision to Reality—The Spine Center at Dartmouth-Hitchcock, Year One

James N. Weinstein, Pamela W. Brown, Brett Hanscom, Thomas Walsh, and Eugene C. Nelson

Development of a new program for diagnosis and treatment of spine-related problems provided a unique opportunity to design and implement a new model for delivery of health care incorporating outcomes measurement and improvement. Key features include: application of microsystem thinking and interdisciplinary practice; integration of a uniform outcomes measurement tool, the Dartmouth Clinical Value Compass; and touch pad technology for data collection. This, for the first time, provided clinically meaningful point-of-service data and aggregated information for improvement. A further advantage was the ability to integrate a clinical research program within this microsystem. A multisite clinical research trial, the Spine Patient Outcomes Research Trial (SPORT), modeled on the Spine Center microsystem and funded by The National Institute of Arthritis, Musculoskeletal and Skin Diseases and the Office of Research on Women's Health, the National Institutes of Health, and the National Institute of Occupational Safety and Health, the Centers for Disease Control and Prevention, is currently underway.

Key words: back pain, Dartmouth Clinical Value Compass, feed forward, interdisciplinary practice, microsystems, model of care, National Spine Network, outcomes improvement, outcomes measurement, spine, SPORT, touch pad, technology

The significant problems we face today cannot be solved by the same level of thinking that created them.

ALBERT EINSTEIN'S insightful statement is an appropriate mantra for the health care industry today. Despite all that we have learned to improve the systems of health care and the care of individuals, we seem to be ineffective in solving the disconcerting problems that patients, clinicians, and administrators face today. A

James N. Weinstein, DO, MS, is Medical Director, The Shared Decision Making Center and The Spine Center at Dartmouth-Hitchcock, in Lebanon, New Hampshire, and Professor of Surgery and Community and Family Medicine, Center for the Evaluative Clinical Sciences, Dartmouth Medical School, in Hanover, New Hampshire.

Pamela W. Brown, MS, RN, is Health Care Consultant, The Spine Center at Dartmouth-Hitchcock, in Lebanon, New Hampshire.

Brett Hanscom, MS, is a Systems Analyst, The Spine Center at Dartmouth-Hitchcock, in Lebanon, New Hampshire.

Thomas Walsh, MS, PT, OCS, Dip. MDT, is a Physical Therapist, The Spine Center at Dartmouth-Hitchcock, in Lebanon, New Hampshire.

Eugene C. Nelson, DSc, is Director, Quality Education and Research, Dartmouth-Hitchcock Medical Center, in Lebanon, New Hampshire, and Professor of Community and Family Medicine, Dartmouth Medical School, in Hanover, New Hampshire.

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decade of cost containment, cost cutting, quality improvement, re-engineering, redesign, downsizing/lay-offs, mergers, acquisitions, and attempts at horizontal/vertical integration, have left patients and providers frustrated and depressed. Advances in surgical and medical treatments to reduce morbidity and mortality have gone nearly unnoticed and remain unappreciated by health systems in which length of stay and cost remain overarching concerns. The quick fixes heralded by each new management fad have discouraged many from even trying to find new solutions. Yet as stewards of health care, our patients, and professional colleagues, we mustn't give up; we must seek new avenues of action that will enable us to provide more meaningful information to guide us in the right direction for the right reasons. As a worker in a Madison, Wisconsin, factory put it:

If you always do what you've always done, you'll always get what you've always gotten.

The courage to try new and seemingly difficult pathways, particularly in the light of the immense pressures to manage cost, demands a clear vision, the courage to learn from one's experiences, and incredible perseverance. We are mindful of Aesop's fable of the tortoise and the hare. The fastest or the quickest isn't always the best. The path forward is often bumpier than expected, full of diversions, and obstacles. Success is often in doubt. It is not necessarily the first one out of the gate, with the latest and greatest resources, that finishes first. Like the tortoise, we must be confident, diligent in our efforts, and persevere to win, never giving in to the temptation of a quick fix.

Dartmouth-Hitchcock Medical Center (DHMC) demonstrated the courage to try new and difficult things when it approved the development and implementation of The Spine Center. The Board of Governors approved The Spine Center as a new model for providing care to a complex population of patients. Its paradigm involved innovations in design, implementation, and management of a clinical practice with the goal of improving outcomes. The Board of Governors recognized that to achieve improved outcomes of care and care delivery, i.e., improved functional status, clinical status, patient satisfaction, and decreased cost, a new way of thinking and acting would be needed. This

new model would clearly capture these desired outcomes. The proposal described a new way of thinking about clinical practice—with new structures, processes, systems, and infrastructure to make the center work. The Spine Center was designed from scratch to be a new archetype for health care. It was designed with built-in data “feed forward” and feedback features to facilitate regular and frequent periods for physician and staff reflection, enhancing their capacity to continuously improve health outcomes at the patient and practice levels. Through committed leadership and a world class staff, the center would foster values in support of the vision, and delineate specific goals and strategies for achieving the vision.

This article describes the development of The Spine Center, and summarizes the first year of operations, during which time the vision became reality. In Year One, the staff:

- steadfastly pursued the “mission” as a beacon to reach its goal;
- utilized the smallest replicable unit (SRU) model described by James Brian Quinn,¹ and the microsystems model described by Paul Batalden and Eugene Nelson² as the framing architecture for the new program;
- implemented a balanced set of outcome measures using the Dartmouth Clinical Value Compass³ concept and the National Spine Network (NSN) Health Status Survey^{®4} as a measurement tool;
- designed and implemented NSN touch pad technology to collect outcomes data as part of the clinical assessment process;
- developed a unique database and a set of standing reports to be integrated into practice to monitor individual and population outcomes;
- developed an interdisciplinary practice model bridging the expertise of the many professionals who care for individuals with back pain;
- implemented a tailored patient satisfaction survey;
- integrated research and evidenced-based practice into both clinical care and an ongoing learning process;
- influenced the greater health care delivery systems by developing a model for replication at other sites; and

- established a unique clinical research system with promise for today and for the future.

History of the Spine Center Initiative

In 1997, the Board of Trustees of Dartmouth-Hitchcock approved the proposal for a new clinical practice model, a spine center. Led by Dr. James N. Weinstein, Medical Director, Shared Decision Making Center and The Spine Center, and Professor of Surgery and Community & Family Medicine, the Center for the Evaluative Clinical Sciences (CECS) at Dartmouth Medical School, in collaboration with a multidisciplinary group of clinical leaders and the administrative leadership, the initiative was created to be a new service for DHMC. It would also serve as a model for the integration of new practice design and management concepts being developed by the Dartmouth faculty. Weinstein, a graduate of the CECS program, founder of the Spine Center at the University of Iowa Hospitals and Clinics, and the Medical Director for the new project at DHMC, worked with Eugene Nelson to draft a blueprint for the program. Space was carved out of an existing clinical area, new position descriptions were written, and, by early winter of 1997, hiring began. First hired was the systems analyst, followed by two physical therapists, an administrative assistant, and program manager. By the beginning of April the planning intensified, with a projected clinic opening date of July 27, 1999. Three members of the management staff (program manager, systems analyst, and administrative assistant) and Weinstein were invited to attend the microsystems course at the CECS, and also to be a clinical site for the students in the course. Taught by Paul Batalden and Nelson, the course engages students in application of microsystems⁵ thinking to health care systems. The course enabled those new and old to the concepts of the microsystem to embark together to implement the plan for The Spine Center.

Mission of The Spine Center at Dartmouth-Hitchcock

The mission of the Spine Center at Dartmouth-Hitchcock is to provide patient centered, comprehensive, coordinated interdisciplinary care that is cost effective, convenient, and

timely for patients with complex spine problems. We are committed to the idea of “Back to Work, Back to Play, One Back at a Time,” and “One-Stop-Shopping” is our motto.⁶

A mission statement helps to keep a group focused on what it aims to achieve and unifies the values of all those who are working together. Our mission statement provided the Spine Center team with a reason for investing time and energy into a difficult undertaking. It served as a touchpoint for evaluating decisions along the way.⁷ (The importance of mission to a clinical practice was a cornerstone of many presentations by Don Berwick in his Introduction to Quality Improvement Workshops. Berwick continually stressed the need for leaders to “touch” the mission as they worked through the day to day processes of managing care and care environments.)⁷ The mission caused us all to focus our work, and to reach for goals seemingly beyond our grasp. Of course, this mission was much easier to articulate than to accomplish. It was at once a comfort to know where we were going, and yet equally frustrating to get there. The mission also called into question our values, both collectively and individually, spurring discussions and sometimes disagreements about what those words really meant in action. Each word of this mission directed the efforts of the design team and the implementation process. It continues to frame the daily work of the team members. The mission is shared with patients and is posted in each room and at the registration desk.

Using the Microsystem Model as the Architectural Design

Most of us in the health care professions have become used to working within our profession, within a department, and within a specific place—hospital, clinic, or home. We have grown comfortable with a provider-focused system—thinking about our work and our patients from the perspective of our departments or professions. While we often say we are “patient-centered” and “team-oriented,” the departmental and professional structures we have worked within have sometimes produced needless complexity, redundancy, and barriers to communication. Frequently, in fact, conflicting goals and inconsistency

are produced. Clearly, a new paradigm for change was in order.

The microsystem and SRUs

Batalden and Nelson have developed a microsystem model for improving systems of care for populations of patients.^{2,5} A microsystem of care is comprised of a population of patients and the core processes, staff, and technology that work together, in one place, to meet the needs of that specific population group. The concept of the microsystem is rooted in the concept of the “smallest replicable unit” described by James Brian Quinn in his book, *Intelligent Enterprise*.¹ Quinn, a professor at Dartmouth, discovered that large, highly successful service organizations had implemented systems that on the surface seem contradictory—they blend generic strategies and customization to achieve both low cost and high differentiation. These successful organizations have recognized that one size does *not* fit all. The smallest replicable unit is that part of a system that is duplicable with only small variation in response to local conditions. By identifying and paying attention to detail in the SRU, these service organizations have identified core processes that can be repeated. Micro measures are developed to manage processes at one level, and then microunits can be mixed to fit local or individual needs on another level. Three service organizations using this approach are Federal Express, McDonalds, and Mrs. Fields.^{1(p.104)} Quinn further notes that it is critical to effective system design to identify the SRUs as early as possible, and that the information environment must function to enable front line suppliers to meet customers needs in a smooth and efficient manner.

Clinical care always requires differentiation, as our patients are all unique, and the services they require must be tailored to meet their unique needs. The large systems through which care is provided, that is, health systems, hospitals, and practices, are made up of many SRUs. Batalden and Nelson have proposed a model that adapts Quinn’s ideas to clinical care.^{2,5} Rather than the whole system of care, or the large organization of care, microsystem thinking focuses attention on the unit where care is delivered. By

focusing on this SRU, the microsystem model promotes the improvement of care from the inside out. This is in stark contrast to the push for lower cost and higher quality we experience from the outside, from the managed care organizations and regulatory agencies. Concurrently, microsystem thinking puts the patient’s needs and perspective at the center of the model.

Microsystem thinking is complementary to Donabedian’s model of improvement that is focused on *structure, process and outcome*.⁸ Small structural units exist to meet patient needs by carrying out health-care related processes in an efficient way to achieve desired outcomes. Focusing on systems that hone in on *patient need, process, and outcomes* can shift the center of attention to the patients. The microsystem model identifies the *key customers, their needs, and the processes* in clinical care necessary for gaining knowledge of customers and of improving outcomes.

Nelson and Weinstein, following Quinn’s advice to articulate the SRU (or microsystem) as early as possible in the design of a new service, adapted the model to the specialty practice of The Spine Center. They defined The Spine Center as a microsystem within the larger hospital and the community it serves. Further they defined the steps necessary to make that microsystem functional within the overriding macrosystem of the hospital. Processes addressed included:

- registration of patients and assignment to care providers;
- orientation of the patient to the service;
- new patient assessment;
- plan of care including:
 - acute care management,
 - chronic care management,
 - preventive care management; and
 - disenrollment from the process of care.

At the conclusion of the care episode, patients emerge with a defined health status. Patients also emerge from care with opinions about the care they received and whether or not it met their expectations and needs.

The Spine Center at Dartmouth-Hitchcock: An Attempt to Create a High Performing “Microsystem”

The Spine Center is intentionally operated as a microsystem of care. It is a potpourri of physicians, physical therapists, nurses, care managers, administrative and support staff, clinical information systems, and information technology, all brought together for the purpose of meeting patient needs for health care. Physicians from various departments and sections come together in a designated location to provide service within the Spine Center while retaining their unique departmental identities and commitments. Clinical information systems, administrative processes, and clinical processes are designed to specifically address patient needs. Figure 1 shows the high level microsystem model with discrimination specific to the Spine Center.

Development and refinement of The Spine Center microsystem was carried out by:

- *Mapping the fine structure:* The design team created detailed flow charts of the major processes within the microsystem using Inspiration™ software. As the details of each process were worked out, the fine structure map was created. These documents were then used in small group meetings to refine and clarify the process, and then to orient new staff. As problems arose in a process, the map was pulled out, re-evaluated, and improved based on discussion. For example, a fine structure map was created and posted in the clinician workroom describing the process of referring a clinic patient for a functional assessment (an interdisciplinary team assessment to determine a patient’s work or functional capacity). The new map described which patients were appropriate for referral, who initiated the referral, and the specific steps that had to be taken to set up this day-long clinical evaluation.
- *Clarifying the process:* The fine structure maps identified each very specific step in a process, and kept track of unanswered questions. Ideas

for potential changes that might be used to improve the process were also noted. A deployment map, which describes who does what, was created for some processes.

- *Gaining customer knowledge at each step of the process:* Paying attention to how patients perceive the process of care, and not just to their physical outcomes, is essential to being a patient-centered organization. Fine structure mapping helps to identify exact places in the process where patient-specific data are needed to both care for the patient and to improve care processes. For example, after implementing the new data collection process, mapping helped to identify when in the process to measure patient satisfaction with the data collection method chosen by the team.
- *Specifying the measures and monitors for key process steps:* Some process steps were further analyzed to determine what measures should be collected at particular points to better manage the care in real time or to feed forward for use in subsequent phases of care delivery.
- *Identifying “Change Ideas and Concepts”:* Langley, et al. described 70 generic improvement ideas and concepts that had been shown to be effective.⁹ We used the list to generate ideas about what could be done to improve the process. It was particularly helpful in the early development stage as the staff was getting to know the processes themselves and were looking for ways to design the process effectively the first time.
- *Developing a short list of important improvement issues:* There are always more things to improve than a group can possibly tackle at one time. Using the map strategy in our meetings kept the group focused and helped to prioritize improvement ideas.

From Multidisciplinary to Interdisciplinary Care

Caring for patients with acute and chronic spinal conditions requires the expertise of many disciplines.

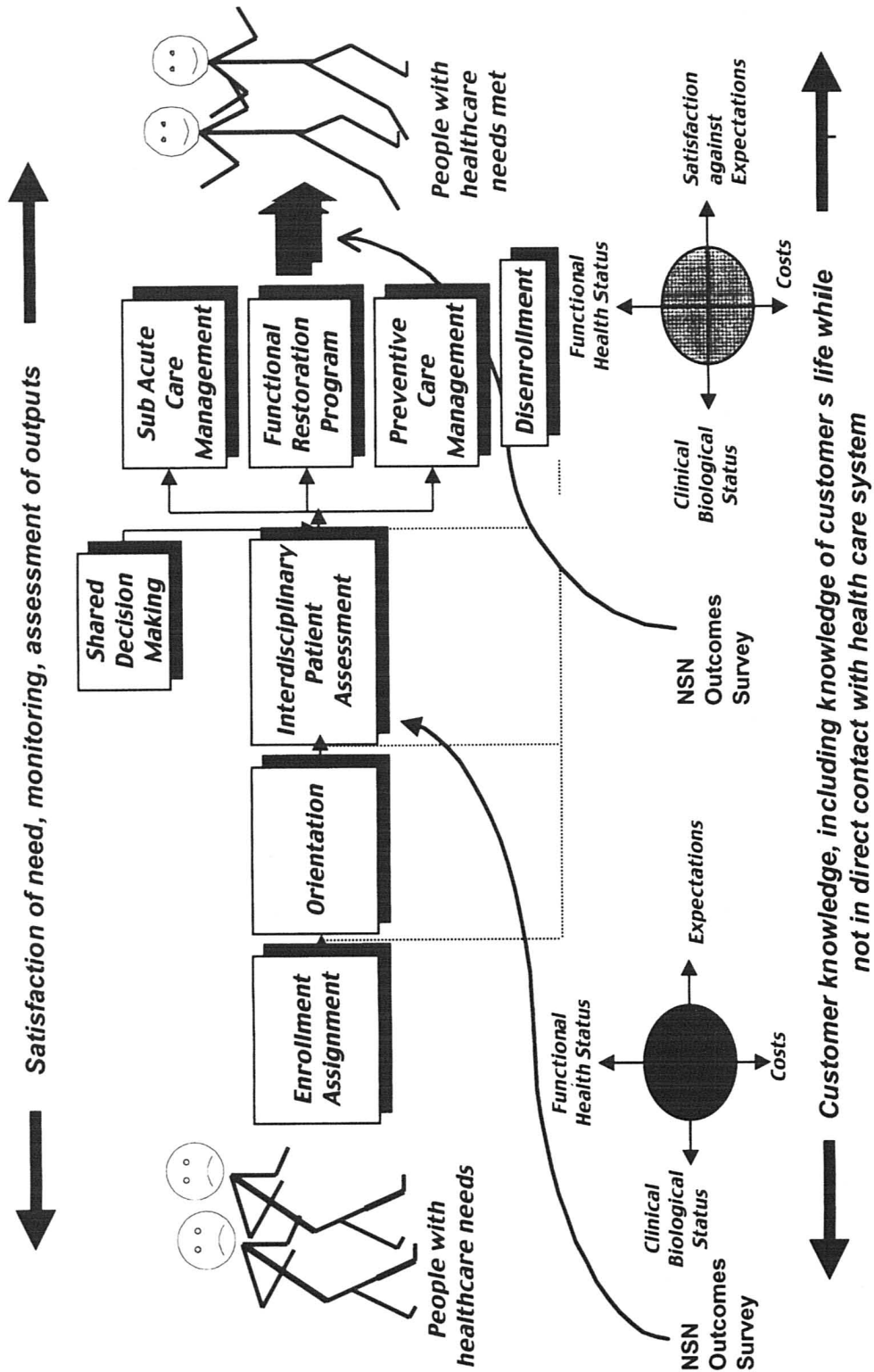


Figure 1. The Spine Center Microsystem. Source: Reprinted from P. B. Batalden and E.C. Nelson, "Continually Improving the Health and Value of Health Care for a Population of Patients: The Panel Management Process." *Quality Management in Health Care* 5, no. 3 (1997): 41-51. Adapted by Pamela Brown and James Weinstein, Dartmouth-Hitchcock Medical Center, Lebanon, New Hampshire.

It is not unusual for spine patients to consult many different clinicians representing both traditional and nontraditional health care approaches. A myriad of different care providers (e.g., primary care physicians, pain specialists, surgeons both in orthopedics and neurosurgery, medical subspecialists such as neurologists and rheumatologists, physical therapists, psychologists, chiropractors, massage therapists, nurses, social workers, and care managers, as well as support staff) are called on by chronic back pain sufferers to sort out, diagnose, and treat these often complicated conditions. Most frequently, these professionals and support staff are each located in their own offices, are seen by the patient in sequence, and may not be aware of all the others involved in the care of the patient. The process prevents these professionals with varied perspectives from collaborating in the care of the patient. Each diagnoses and treats the patient from his or her own perspective. Patients often receive different diagnoses and treatment plans. The frustrated patient, seeking relief from symptoms, may engage several therapies concurrently in hopes of finding a solution.

The Spine Center design calls for a multidisciplinary staff, representing both traditional healthcare providers—primary care, medical and surgical specialists, physical therapists, clinical psychologists, nurses and social workers—as well as alternative health care providers in chiropractic and massage therapy. In Year One, all of the traditional health care providers began to practice together in one setting. While not everyone was onsite at the same time, a surgeon, a medical specialist, a physical therapist, and a nurse staffed the clinic each day. Other specialists agreed to be available to clinic staff for telephone consultation and came to the clinic to see the patient if needed. Same-day pain interventions were arranged with the Pain Service. As members of the team and having offices within the Spine Center, the clinical psychologist and social worker/care manager were available for “curbside” consultations and to meet the patient and family during their initial clinic visit. Mental health providers found that establishing a face-to-face relationship increased acceptability of the referral and decreased the no-show rate of pa-

tients scheduled for a full psychological evaluation. Putting everyone together in one place has simplified the process for the patient and made consultation with other disciplines easier and quicker. The variation in clinical assessments and treatment plans has narrowed. Patients now receive reinforcing information from each of the different disciplines.

In Year One, The Spine Center progressed from a multidisciplinary practice to an interdisciplinary practice. The difference is subtle but significant. Jean Sorrells-Jones of the University of Texas describes the distinction.¹⁰ In *multidisciplinary care*, the patient has the benefit of diagnosis and treatment from each discipline. Diagnosis and treatment is done in sequence, with one provider referring the patient on to the next when they cannot diagnose or can no longer help the patient. In *interdisciplinary care*, the disciplines concurrently contribute to the diagnosis and the treatment plan. The Spine Center aimed to establish interdisciplinary care from the beginning. Each new patient scheduled for the clinic was given an appointment with both a physician and physical therapist. Each assessed the patient from his or her own discipline’s perspective, discussed their findings and recommendations, and then arrived at a mutually agreed upon diagnosis and plan of care.

Of course, this did not happen all at once. We initially encountered significant barriers to the communication essential to interdisciplinary work. Physical therapists and physicians often use different language and perform different tests in their assessments. They may arrive at the same diagnosis, but use different labels from different paradigms. Likewise, they often make different recommendations. By practicing together, however, a plan of care could usually begin on the day of the initial evaluation. An immediate benefit from this model was patient convenience. For example, if the surgeon evaluating the patient determined that surgery was not indicated, and instead recommended therapy, but the therapist’s findings suggested a poor prognosis with physical therapy treatment, a third alternative could be developed on site, with a same-day consultation sought. This interdisciplinary plan of care was initiated on the day of the first evaluation in many cases. Starting

treatment right away saves the patient time and the payer money.

Interdisciplinary care requires organizational support for development and improvement. In Year One, several initiatives were undertaken.

- **Common space.** The organization allocated a large space for a conference room dedicated to Spine Center meetings and teamwork. This space became the center for planning, sharing, and learning, not only for staff, but for patients as well. In addition, a small shared workroom in the clinic brought the staff together to process the work on a day-to-day basis.
- **Meeting time.** Each week the entire team, including support staff, clinicians, and administrative leaders, met to discuss operations, to share clinical successes, and to work through difficulties.
- **Time for learning together.** During the first six months of operations, the team realized that they needed to get to know each other personally as well as professionally, and to trust one another's assessments and decisions. This was critical because the model called for multiple points of access to the team. Recognition of this need was discussed openly in team meetings early in the design process. As the team members grew in their understanding of and respect for each others' clinical expertise and value, the time needed for clinical assessment and decisionmaking decreased and the number of patients seen per session increased. In addition, weekly time was set aside to meet as a team for the specific purpose of interdisciplinary case presentation and clinical decision-making. This time enabled the team to seek input from all disciplines and arrive at a treatment plan for difficult cases.
- **Time for improving together.** The members of the team met frequently in small improvement groups to solve day-to-day problems and to tackle bigger issues.

Interdisciplinary practice evolves over time, it does not just happen. Defining interdisciplinary care as mission driven provides the support so essential for interdisciplinary practice to thrive.

Creating the Infrastructure for Clinically Integrated, Point-of-Service Outcomes Measurement

National Spine Network (NSN) survey instruments provided The Spine Center with acceptable measurement tools. The tools had been developed by NSN and refined based on feedback from the end users—physicians and patients. The strategic plan called for efficient and timely integration of this survey data into the clinical care process. Heretofore, clinical outcomes were only available to NSN Spine Centers on a quarterly and aggregate basis, allowing only for after-the-fact outcomes assessment. However, still precluded was integration into real time clinical care. Two key breakthroughs enabled this to happen: touch pad technology and socializing “Willie Byte.”

Touch pad technology

Working collaboratively with the NSN systems staff, The Spine Center developed the databases and the data collection system to support the desired goal—a system of data collection that would provide for use of the outcomes measures as part of clinical care. Making data collection and data entry user friendly was vital to providing concurrent, point-of-service information. NSN Centers had tried several data collection methods, including optical scanning of “bubble” forms at the University of Iowa, but no method worked for our purposes. We were fortunate that just as we were in need of a data collection solution, one appeared on the horizon. Staff at NSN and Weinstein were working to automate the survey system by combining touch-pad computers with electronic survey software to accommodate both the patient and provider questionnaires. During the two months before the scheduled clinic opening, Brett Hanscom, the data analyst at The Spine Center, and Jim Schneider, a consultant for the NSN, collaboratively developed, pilot tested and installed into the clinic the new technology and data collection system. Finally, point-of-service reports for The Spine Center, utilizing the Clinical Value Compass model, were completed by the Dartmouth Group. A unique but

heretofore unmentioned feature is a digital photograph captured of each patient during clinic registration, obtained at the same time as the patient completes his or her initial intake on the touch pad. After registration is completed, information is downloaded to the computer, and the Patient Summary Report[®] is created.¹¹ The patient's picture is placed at the top of the report, making it much easier for providers to recall the patient in subsequent encounters, either over the phone or in the clinic. Figure 2 shows a completed Patient Summary Report[®].

The Spine Center Patient Summary Report[®] has become an integral part of clinical practice in the Center. The report presents data using the Value Compass, and includes a graphical representation of patient health status. On return visits, a slightly different set of questions is used, and both baseline and followup data are presented on one Summary Report[®]. In addition to the Patient Summary Report[®], The Spine Center Data System includes five major components: an electronic survey program, a scheduling system, a tracking system, a "real-time" reporting system, and a quarterly reporting system that are described in the box entitled "The Spine Center Data System."

Socializing "Willie Byte"

We have come to think of our computers as key members of our microsystem. Batalden gives personhood and personality to technology when he refers to the use of technology in the microsystem as "Willie Byte." Without the use of computer technology, the point of service, "real time," clinical data collection and analysis needed for effective and efficient clinical care would not be possible. But the technology must be supported, and the hardware and software tailored to the individual site needs, while maintaining its intrinsic core, if it is to become all it can be for any given microsystem. To accomplish this, The Spine Center designers employed a systems analyst. The systems analyst was charged with developing the databases and reports, and providing analytic support, transforming the NSN plus Health Status Survey[®] into a point-of-service application.

The Spine Center Data System

The *Spine Center Data System* (SCDS) is a collection of *Microsoft Access* applications designed to collect, manage, and retrieve outcomes data on spine patients. The SCDS has five essential parts:

An *electronic survey program*—running on small, touch-pad PC computers – allows patients to complete questionnaires in the waiting room. The same software, distributed over a Windows NT network, allows clinicians to record data from both local and remote PC workstations. A central database collects survey data from all sources, and provides quick access to summary reports.

The SCDS *scheduling system* allows the Spine Center reception staff to register all patients into the system prior to their scheduled visit date. The system automatically checks each patient's electronic record for consistency and produces a list of patients who need to complete a questionnaire and what type of questionnaire they need to do (e.g. baseline or follow-up). This list provides a convenient reference for a busy reception staff who are both checking in patients and administering the survey.

An inadvertent keystroke or a forgotten survey can make data management very difficult. The SCDS *tracking system* allows a data manager to monitor patient and clinician survey status at any time of the day. Mistakes can be quickly remedied and reminders readily delivered for forgotten surveys.

Of all the system's features, a *"real-time" reporting system* provides the most utility to clinicians. As soon as a patient completes a questionnaire, a report summarizing health status, history and location of symptoms, comorbid conditions, work status, compensation status, and expectations is immediately generated. For all follow-up questionnaires, data from baseline are retrieved and displayed graphically to show how the patient has improved/deteriorated since the baseline assessment.

A *quarterly reporting system* allows clinicians and managerial staff to examine an aggregate summary of overall patient health status and clinician treatment patterns. An additional piece of software is provided by the NSN. "DataView," also a *Microsoft Access* application, displays DHMC Spine Center data against data collected at all other NSN centers. Benchmarking any variable is possible with this system.

—Brett Hanscom

Patient:
A-Number:
Date of Birth:
Visit Type:
Clinician:

DHMC Spine Center

Age: 56
Gender: male
Race: White
Weight: 270
Height:

Follow-Up Summary

HISTORY

Current Problem Areas: lower back, buttocks, hip and leg below the knee
 Compared to Last Visit, Condition Is: somewhat better now
 Other Providers Seen in Last 6 Months: a general practitioner, a neurosurgeon, an orthopaedic surgeon, a pain clinic and a physical therapist
 Treatments in Last 6 Months: medication, physical/occupational therapy, splint or brace and home exercise

Initial Visit Date:

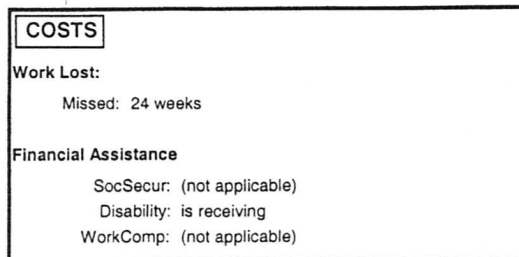
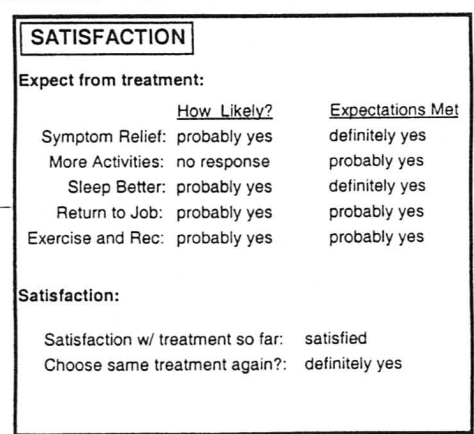
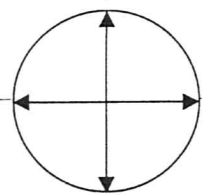
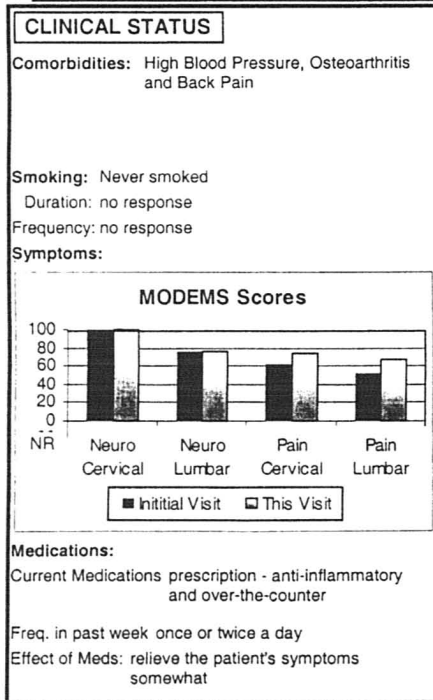
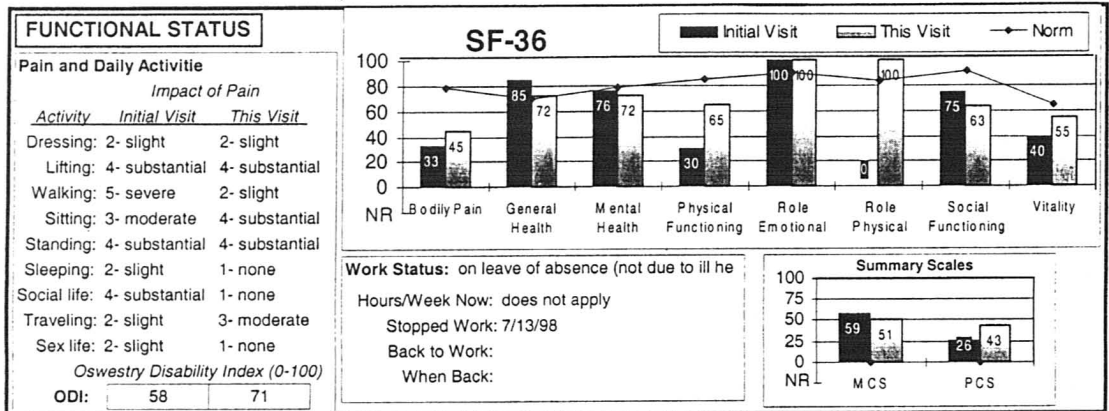


Figure 2. The Spine Center at Dartmouth-Hitchcock Patient Summary Report[®]. Source: Reprinted with permission from the Dartmouth-Hitchcock Medical Center, Lebanon, New Hampshire.

User-friendly applications and reports were finalized based on constant feedback and interaction with all team members.

Prior to opening the clinic, the systems analyst provided each staff member with a personalized tutorial in the use of the touch pad to complete patient and provider surveys. As questions arose, the systems analyst was readily available to help a physician with the provider survey, or the receptionists with a download of patient data. This onsite support was critical to the system's success in the first few weeks as the entire staff, novices to the new system, learned the ins and outs of concurrent data collection for clinical care and outcomes measurement. The systems analyst tamed "Willie Byte" for the Spine Center microsystem.

Integrating Data Collection into Clinical Care Processes: Feed Forward and Feedback

The real-time use of outcomes data in the clinical encounter is an exciting opportunity made possible by touch pad technology. The Spine Center Patient Summary Report[®] is both a feed forward and feedback instrument, that is, it presents data commonly used for measurement of outcomes (feedback) to the clinician for use in clinical assessment (feed forward). This information, available to the provider prior to the patient encounter, is effective in enhancing communication between the provider and patient. In The Spine Center, the report is attached to the top of the patient's medical record, is available for the clinician to review prior to seeing the patient, and is used by the provider and patient to discuss the patient's condition during the visit. Useful information regarding the patient's health status is presented on the report graphically (see Spine Center Summary Report[®], Figure 2).

During the visit, the provider uses the data from the summary report to focus the interview and to initiate conversation about particularly troublesome topics, such as ongoing litigation, worker's compensation, or the patient's emotional status in coping with his or her physical difficulties. In and of themselves, the

clinical health scales presented on the report are not diagnostic tools; rather, they paint a picture of the whole person, providing clues or directions to pursue. When integrated into a big picture complete with the patient history, the physical examination findings, and the clinician's knowledge of the evidence, the individualized report provides information on the current status and progress over time on many dimensions of health. In addition to the use in the care of individual patients, this longitudinal data can be analyzed by the clinician for a group of patients, or a population of patients within a center and to compare groups across centers, providing the clinician feedback on a specific population of patients. This feedback can be used on another level to compare providers, facilities, and patients against national norms and assess outcomes in all four compass directions, forming the basis for data driven clinical quality improvement efforts. The box entitled "Feed Forward and Feedback in Clinical Care" describes the use of the data in feed forward: clinical assessment and management of a patient.

Putting the "Clinical Value Compass" into Practice—A Balanced Set of Measures

Nelson and Batalden described the "clinical value compass" as a tool to present a balanced approach to measure and display value in health care.⁴ The Clinical Value Compass is a measurement design for identifying and monitoring those key indicators of care that enable one to assess the quality of health care. The compass provides a framework for measuring changes in four major categories of health care value: (1) functional status; (2) biological status; (3) patient expectations and satisfaction; and (4) costs (see Figure 3).

The need to improve value in health care is a driving force that providers must grapple with. A valid measurement tool that is comprehensive in scope that augments practice and yields useful and specific information is required to measure and improve outcomes. The Value Compass system calls for measurement *prior* to onset of care, *during* care at regular intervals, and at the *conclusion* of care,

Feed Forward and Feedback in Clinical Care

Over the past year we have used the functional health status scores in our clinical assessment of our patients, and we have found them to enhance and facilitate communication during the provider-patient encounter.

The provider has an opportunity to review the Spine Center Initial Visit Summary prior to seeing the patient. (See Figure 3. The Initial Visit form is the same but has only one data set). Though we are still learning a great deal about how to understand and use this information at the point-of-service, we have found the Oswestry Disability Index and the SF-36 subscales and summary scores to be most informative in clinical care thus far. In addition, they raise many questions for which we currently do not have answers. For example: What does a low general health score tell us if all other scales are at or above age and gender adjusted norms? What does a 6-point change in the vitality scale tell us about a particular patient from one visit to the next over a 13-day period? When the scales are seen as one of many means of gathering pertinent data about our patient, similar to a portion of the physical exam, lab studies, or radiographic studies, they contribute very useful information.

The information on the Visit Summary Report is a highly effective and efficient starting point for clinical assessment. By reviewing and verifying the information with the patient, the clinician can quickly focus on areas that will have a high information yield or that may often go unchecked in a standard interview and physical exam. For example, a patient presented to our Spine Clinic with chronic low back pain that made his normal activities bothersome. However, he was continuing to function at a fairly high level. In reviewing his scores on the Visit Summary Report we noted that his emotional and mental health scales were the largest

affected and his sleep (on the Oswestry scale) was the daily activity that was most severely affected. By sharing these results with the patient and further assessing the issues with the patient, we were able to hone in on a potentially difficult issue (somatization) in a manner that is consistent with our philosophy of comprehensive, interdisciplinary care.

The data collection methods also allow longitudinal assessment of individual patient progress. Again, we use the information as a starting point to inquire and investigate patient self-reports. In the Follow-up Report (Figure 3) we can see that this patient's physical functioning (PF) and role physical (RP) scores are very much improved while his general health and social functioning have actually decreased, slightly. In this post treatment visit, the patient's positive response to treatment is obvious on the graphs. The report also prompts the clinician to inquire further about the decreases in general health and social functioning to determine if further interventions are necessary.

We have noted that patients are very willing to discuss the graphs placed in front of them, even when the topic is highly sensitive. By focusing the discussion on what the "the interesting piece of paper" tells us, some inhibitions and defenses appear to lessen and we are able to move to discussions that patients report to be very important but often not discussed in previous medical encounters.

Chronic back pain affects individuals differently and it affects each patient's perception of his or her total well being in a unique way. We believe that feeding forward functional health data can aid in the exploration of an individual's physical, mental, and social well being in a way that patients find non-threatening and providers find useful and efficient.

—Thomas Walsh

enabling providers, patients, and administrators to evaluate the outcomes of care on a broad range of measures. While defining the broad categories of measures, the clinical value compass leaves the decision up to clinicians, within various practice environments, as to what specific measures are to be used for each indicator and each population.

The NSN Health Status Survey®—A Time Tested Instrument

The Spine Center at Dartmouth-Hitchcock is a member of the National Spine Network, a nonprofit

organization whose 26 members are dedicated to improving spine care throughout the world. These Centers are multidisciplinary, are recognized as leaders in the delivery of high quality patient care, and have demonstrated a commitment to evidence-based treatments.

Key to the NSN Outcomes Program has been the development of an outcomes measurement tool specific to the population of spine patients. As a member of the NSN, American Academy of Orthopaedic Surgeons (AAOS), and North American Spine Society (NASS) outcomes committees, Weinstein helped assimilate previously used outcomes surveys into a

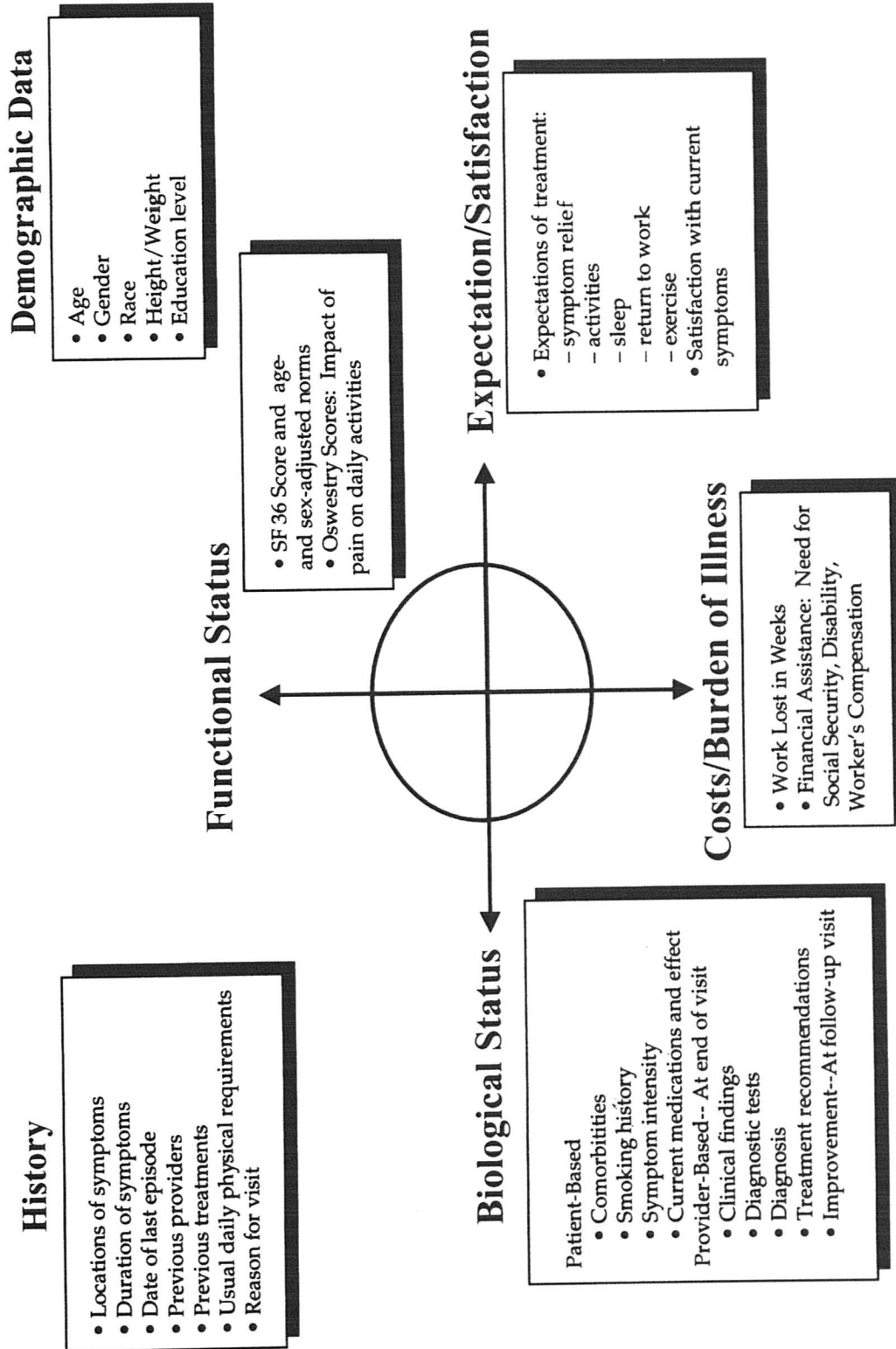


Figure 3. Dartmouth Clinical Value Compass with Spine Center Measures. Source: Reprinted with permission from the Dartmouth-Hitchcock Medical Center, Lebanon, New Hampshire, © 1998.

single user-friendly tool. The Spine Center intends to use this data to evaluate the overall vision and improve practice and outcomes as part of the process, not as an after thought.

The NSN Health Status Survey[®] includes a broad set of measures configured into three components. The first is a patient-based instrument which captures the patient's point of view of his or her health status and which is completed at the beginning of a provider visit. This includes demographic data; clinical history; a general health status measurement and the SF-36 (generic), and the Oswestry (spine specific) measurement tools. It is also designed to be compatible with MODEMS (an AAOS assessment instrument). The second component is a provider-based set of measures that captures the physician's and/or physical therapist's perspective (e.g., diagnostic tests, treatments and response, etc), which is completed by the provider at the conclusion of the visit. A third component is another provider-based set of measures completed by the physician if the patient has surgery. The NSN Health Status Survey[®] corresponds well to the requirements of the clinical value compass. The instrument has been used extensively by the NSN, with over 50,000 patient entries.

Research as Part of Practice: The NIH/NIAMS Spine Patient Outcomes Research Trial (SPORT)

Using the Spine Center at DHMC and in the NSN as a working model for care, improvement and research on spinal outcomes, Weinstein proposed to National Institutes of Health and National Institute of Arthritis, Musculoskeletal, and Skin Diseases (NIAMS) a multisite clinical trial to determine the long-term effects of surgical and nonsurgical interventions on the treatment of spinal problems. Funding for the grant was awarded in the summer of 1999. Enrollment of patients is due to begin on March 1, 2000. Central to the proposal is the idea that clinical research and data collection can be integrated into a busy clinical practice setting. The proposal calls for the use of a modified NSN Health Status Survey[®], use of NSN touch pad technology, and implementation of

the clinical processes developed at The Dartmouth Spine Center (see Figure 4).

Each study site will tailor The Spine Center microsystem model to its own environment and processes. Through this clinical research project, the work of one team has the capacity to influence care in many practice centers across the healthcare delivery system (see Figure 5).

Reaping the Rewards: Better Understanding Our Patient Population with a Balanced Set of Measures

The development of a clinically integrated outcomes measurement system takes time and goal direction. Clearly the roots of our success are deeply embedded in 16 years of work, both at the NSN and at the University of Iowa, where Weinstein tested several strategies for bringing data into the care process. The Spine Center at Dartmouth-Hitchcock was uniquely positioned to pull it all together. Many factors converged to make this possible:

- A tested outcomes measurement instrument;
- Microsystem thinking;
- Computer and analytic expertise to harness "Willie Byte";
- The emergence of NSN touch pad technology and a survey program at just the right moment;
- A team willing to take a chance on a new venture; and
- Leaders with the vision of a new paradigm for health care.

What does the data tell us about our population of patients?

Analysis of the data is an ongoing part of the clinical practice within the Spine Center. The Value Compass provides guidance in looking at the data from multiple perspectives. More than 2,500 patients have been seen in The Spine Center in its first year of operations, and we are beginning to learn a great deal about our patients (see Figure 6 through 10).

- *Functional Status:* Using the SF-36 as a measurement tool, we see that back pain patients are significantly different from the age and sex ad-

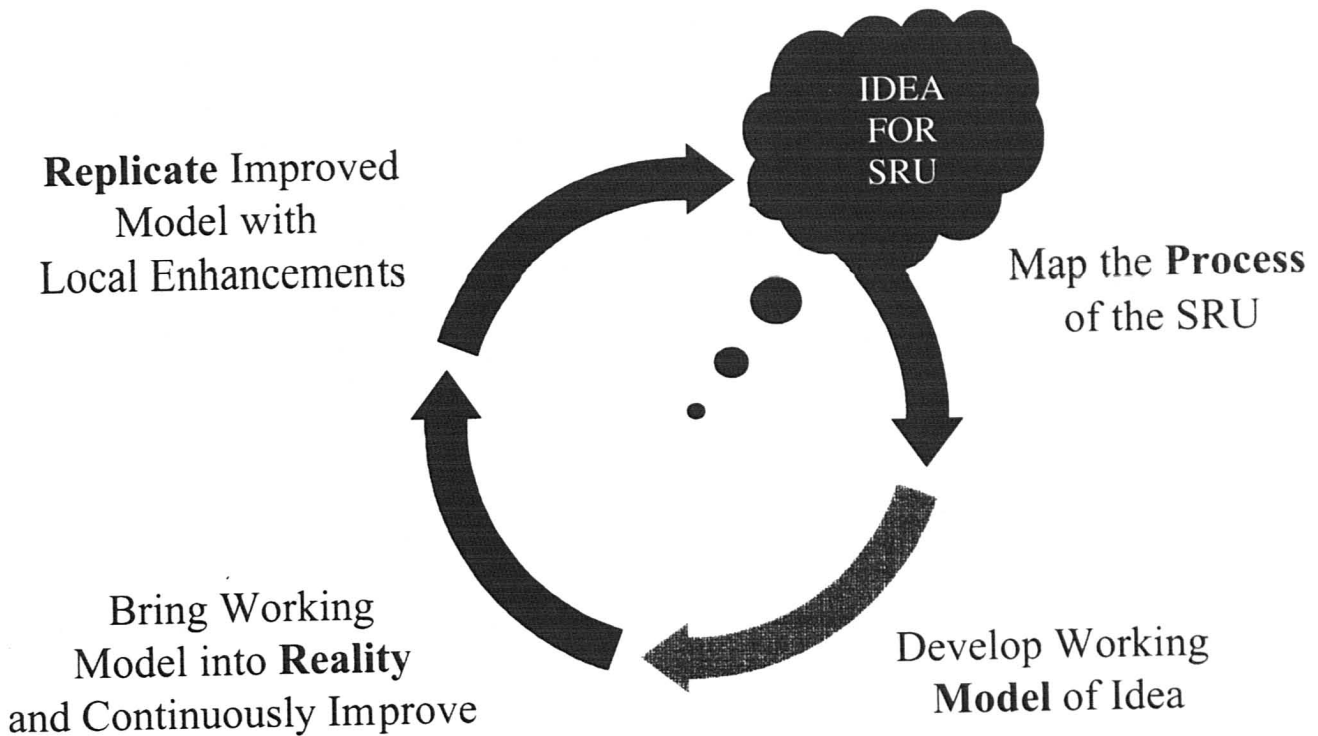


Figure 4. Replication Cycle for SRU.

justed norms, demonstrating low scores in the areas of role physical, physical functioning, and bodily pain. Figure 6 makes evident that our patients are not significantly different from the population of NSN center patients as a whole.

- *Biological/Clinical Status:* Figures 7 and 8 depict the diagnosis and treatment at initial assessment. Herniated disc is the most frequently diagnosed condition.
- *Cost:* The social and financial burden of this illness is significant, as shown in Figures 9 and 10. Back conditions result in a notable amount of lost days of work, with about 10% of our patients missing six months or more of work. Prior treatments are another measure of the cost of this illness.
- *Satisfaction with Process of Care:* At return visits patients complete a slightly different survey that measures satisfaction with their process of care

to date. While 86% of patients rated satisfaction with 14 processes of care at “very good” or “excellent,” there continues to be an opportunity to improve satisfaction with processes of care in this population.

Using the National Database

In addition to Value Compass data analysis of our own patients, we can use the NSN Outcomes Database to compare our patients to spine patients around the country. Data can provide answers to many of the following questions:

- *Are my patients different from your patients?* Each provider’s patients can be compared to the entire data set. For example, one provider commented that his case load seemed to have more patients receiving worker’s compensation than he had anticipated. Analysis revealed that indeed, 14%

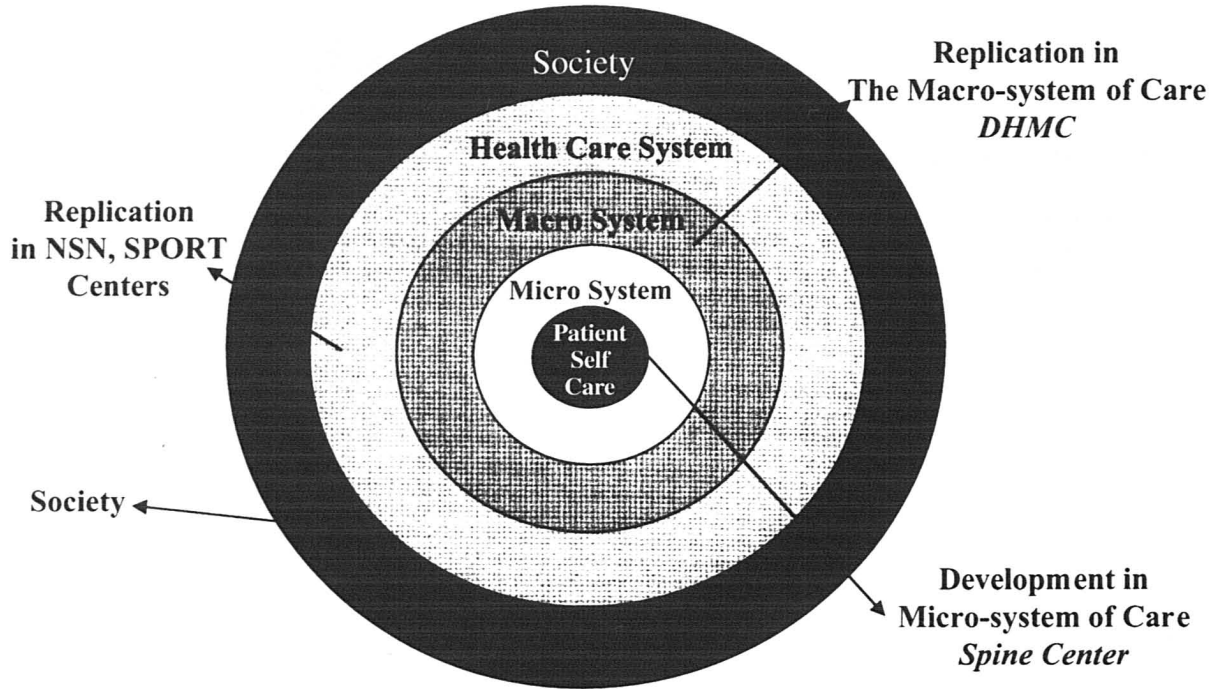


Figure 5. Improving Health Care from the Inside Out. Source: Reprinted with permission from James Weinstein and Pamela Brown, 1999.

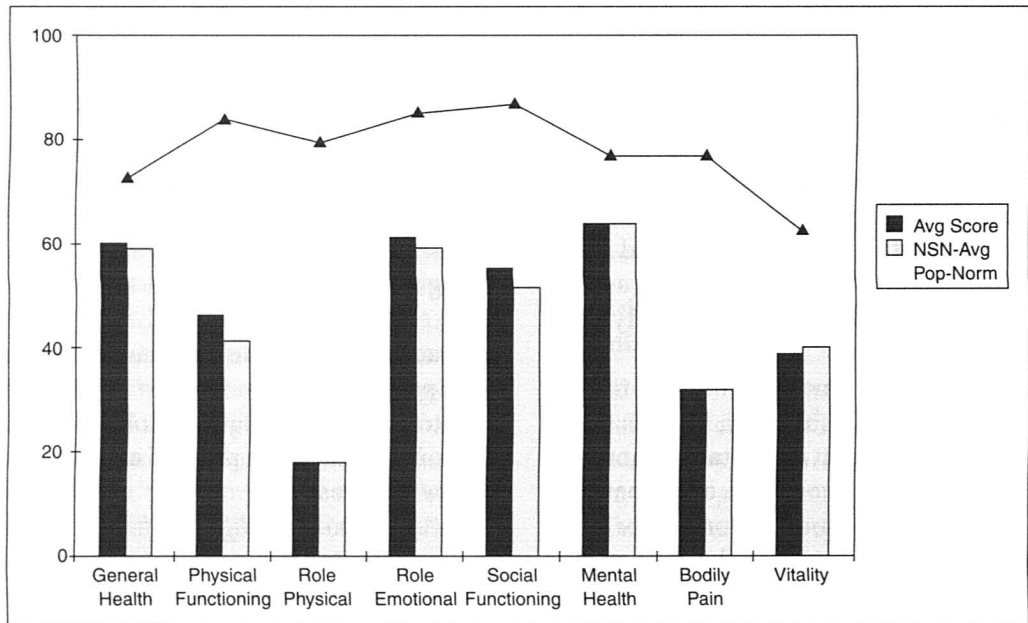


Figure 6. What Do We Know About Our Patients? Functional Status. Source: Dartmouth-Hitchcock Medical Center, Spine Center Baseline Data, August 1998–July 1999, Health Status Survey.

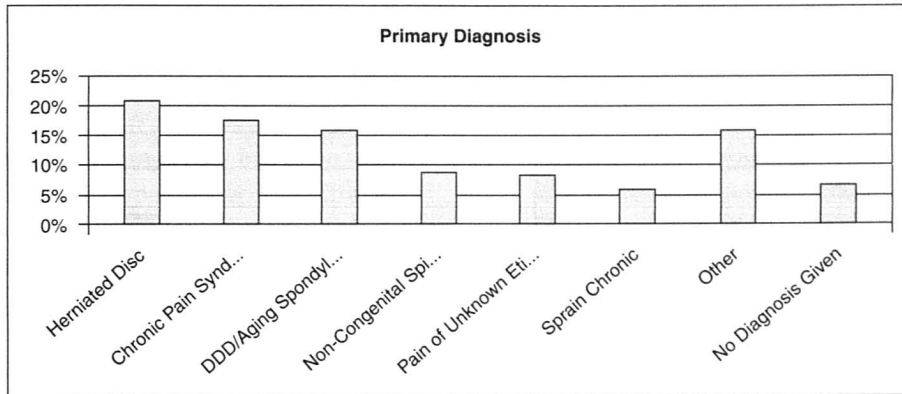


Figure 7. What Do We Know About Our Patients? Clinical Status—Primary Diagnosis. Source: Dartmouth-Hitchcock Medical Center, Spine Center Baseline Data, August 1998–July 1999, Health Status Survey.

of his case load were receiving worker’s compensation, compared to 11% at other centers.

- *Are our patients sicker than patients in other centers?* The most frequently self-reported health problems in our population are frequent headaches (9%), high blood pressure (8%), osteoarthritis (8%), depression (8%), and heart disease (6%). Patients at other NSN centers most frequently report genital/urinary system disorders (8%), high blood pressure (7%), depression (6%), frequent headaches (6%), and osteoporosis (6%).

In general, the burden of co-morbid illness appears to be quite similar across NSN centers.

- *What is the education level of the patients in our population?* In this rural academic medical center, which serves most of Northern New England, 34% of patients have completed high school but have not attended college, versus 29% of patients at other NSN centers. On the other hand, only 21% of our patients have attended some college, compared to 28% of patients Network wide. Approximately 35% of patients have

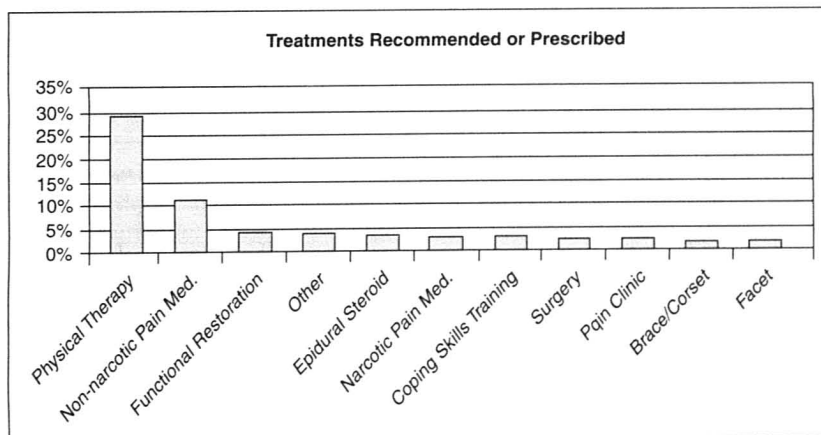


Figure 8. What Do We Know About Our Patients? Clinical Status—Treatments Recommended or Described. Source: Dartmouth-Hitchcock Medical Center, Spine Center Baseline Data, August 1998–July 1999, Health Status Survey.

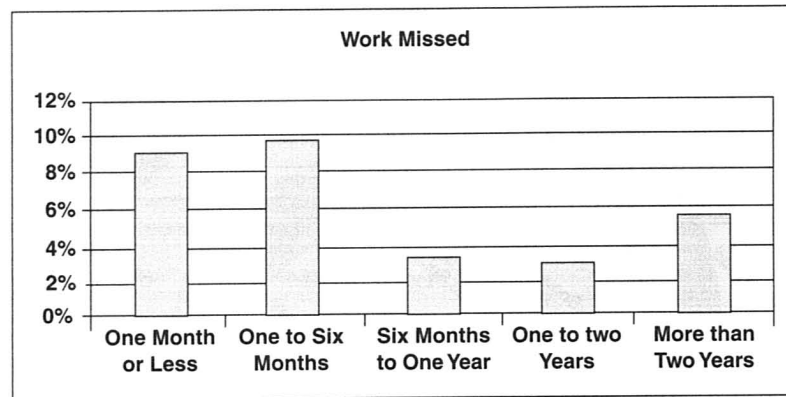


Figure 9. What Do We Know About Our Patients? Measures of Cost—Work Missed. Source: Dartmouth-Hitchcock Medical Center, Spine Center Baseline Data, August 1998–July 1999, Health Status Survey.

a college or post-graduate degree, which is identical to the rate for other NSN centers.

Next Steps

With a growing population of patients who have completed follow-up surveys, the capacity to measure outcomes in specific populations is emerging. Planning is now underway to investigate treatment outcomes, cost, and satisfaction by diagnosis. With that knowledge, improvement in our outcomes based on our data can begin in earnest.

Lessons Learned: Looking Back at Year One

As we worked to use the model during implementation, we were reminded by Batalden that Deming was fond of saying:

All models are wrong; some are useful!

During the implementation and throughout the first year of operation, staff members and leaders refined and tailored The Spine Center microsystem

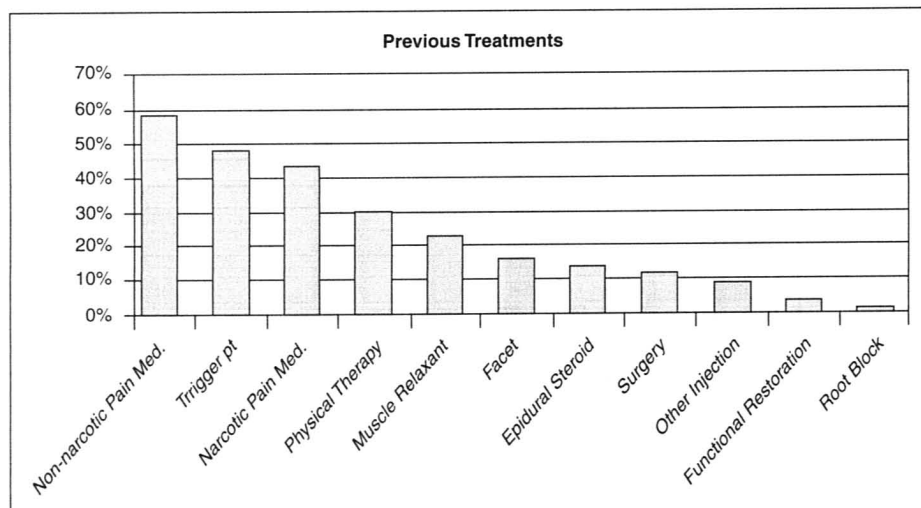


Figure 10. What Do We Know About Our Patients? Measures of Cost—Previous Treatments. Source: Dartmouth-Hitchcock Medical Center, Spine Center Baseline Data, August 1998–July 1999, Health Status Survey.

model, finding within it a most useful approach for thinking about, designing, and refining a clinical practice.

Reflecting on our first year gives us the opportunity to see the magnitude of change that has been accomplished. These changes impact how we think about care, and how we practice; the systems for outcomes measurement; the technological and data expertise required for such a model; the data collection and entry methods; and, most importantly, the use of data in clinical care and in improvement work. Table 1 is a synopsis of the shifts in thinking and practice that occurred during year one, as the new model was implemented.

The first year of a new venture is always an adventure. The microsystem and the host organization have learned a great deal about what it takes to build a new service with the capacity for improving outcomes. A few lessons stand out:

- Feed forward of patient-based data can improve the assessment, the patient-clinician relationship, and the plan of care.

- Graphical display of patient-based data using the value compass framework is a powerful way to summarize patient current status and changes in outcomes over time.
- Microsystem thinking can be used to launch an innovative clinical program.
- The microsystem and the macrosystem can have different priorities. Every effort needs to be made to support the new and fragile structure of the microsystem during the first year of development. The staff and talent needed to start a new program are often not the staff and talent needed to continue and refine the effort. Expect staff changes.
- Interdisciplinary care can increase patient convenience, reduce cost, and increase efficiency. It must be supported and given time to develop.
- A new model for care represents a significant change in an organization’s culture. Resistance to change is to be expected. For the new culture to survive it needs to be successful. Success will take longer to demonstrate than is expected—give it time!

Table 1
SUMMARY OF KEY CHANGES IN THE NEW MODEL OF CARE

| Concept | Traditional Model | New Model |
|--------------------------------------|---|--|
| Thinking Model | Linear, each practice unique | Microsystems/Smallest Reproducible Unit (SRU) |
| Practice Model | Serial, multidisciplinary, multiple places, multiple visits | Integrated, interdisciplinary “one-stop shopping” |
| Outcomes Measurement | After the episode of care | Concurrent with and integrated into episode of care; feed forward and feedback |
| Computer and Data Expertise Database | Centralized resource, “one size fits all” data systems, systems improvement | Team based resource, tailored data systems, iterative local improvements |
| | Designed for research and financial purposes | Designed for outcomes improvement purposes |
| Data Collection Method | Retrospective record review, or concurrent paper survey | Concurrent using touchpad technology |
| Data Entry | By hands into database | Data downloaded from touchpad directly to database |
| Data Analysis and Reports | As needed | Standing reports for outcomes measurement and improvement |
| Improvement | Outside or added to the practice model | Integrated into the architecture and culture of the practice |

- “Willie Byte” is an essential member of the new microsystem for health care—he needs to be tamed by a person who understands systems and data.
- You can’t do everything in one year—but you can do a lot.
- Keep the mission in mind—persistence is key.
- The tortoise wins!!!

Looking Forward—What Can We Expect from Year Two?

Year Two will see a maturing of the systems and infrastructure that support the Spine Center. New staff will bring new ideas and energy to developing systems and clinical care. The interdisciplinary team has matured as well, becoming increasingly more comfortable with practicing together and gaining the benefits of interdisciplinary dialogue. Year Two will see the integration of the alternative care disciplines of massage therapy and chiropractic care into the team. Two members of the staff are currently enrolled in the Master’s Program at the CECS, which will deepen the team’s expertise in microsystem thinking, outcomes measurement, and improvement work. With data systems in place, “Willie Byte” harnessed for the team, and over 2,500 Spine Center patients entered into the database, the opportunity to use the data to better understand patients, the outcomes of treatments, and to improve care based on that data is really upon us. With the enriching presence of the staff and resources of the Spine Patients Outcomes Research Trial at NIH, we hope to further integrate research and

evidence-based thinking into everyday practice, making The Spine Center at Dartmouth-Hitchcock into a viable model of health care for the new millennium. New solutions can be successful. Individual microsystems can make a difference in our health care outcomes.

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