HARVARD | BUSINESS | SCHOOL

N9-609-016

FEBRUARY 18, 2009

ROBERT S. HUCKMAN

MICHAEL E. PORTER

RACHEL GORDON

NATALIE KINDRED

Dartmouth-Hitchcock Medical Center: Spine Care

For patients, good enough isn't enough.

—Dr. James Weinstein

In April 2008 Dr. James Weinstein, founder of the Spine Center at Dartmouth-Hitchcock Medical Center (Dartmouth-Hitchcock), and Dr. William Abdu, the Spine Center's current medical director, were reflecting on a daylong retreat for the Spine Center's staff. The Spine Center had been widely studied by outside parties, and leaders at Dartmouth-Hitchcock, one of the premier medical centers in the Vermont-New Hampshire region, had repeatedly pointed to the Spine Center as a preeminent program for the institution.

There had been lively discussion during the retreat about progress against the center's mission of offering multidisciplinary care for patients suffering from spinal problems and how to engage physicians who worked at the center. On the heels of this debate, there were major questions to be answered. Where had the model generated the most value? Where had it fallen short of expectations? What was its future direction, and how could it serve as a model for care delivery in other areas in the hospital?

Dartmouth-Hitchcock Medical Center

Dartmouth-Hitchcock's mission was "to advance health through research, education, clinical practice and community partnerships, providing each person the best care, in the right place, at the right time, every time."[1] Dartmouth-Hitchcock was located on 225 acres in rural Lebanon, New Hampshire, near the border of Vermont. New Hampshire and Vermont were the tenth and second-least populated states in the nation with roughly 1.3 million and 620,000 residents, respectively. Dartmouth-Hitchcock was New Hampshire's only academic medical center and Level 1 Trauma Center.[a] Dartmouth-Hitchcock comprised four different entities. These included the Mary Hitchcock Memorial Hospital, a not-for-profit hospital with approximately 400 beds; the Dartmouth Medical School; and the Veteran Affairs Regional Medical and Office Center, a 43-bed hospital that provided a broad range of care to veterans.

[a] Academic medical centers were hospitals with a three-part mission: to provide medical care, train future medical professionals and perform research. Academic medical centers typically offered care by specialists unavailable at local community health centers or hospitals. Level 1 Trauma Centers were hospitals that had received the highest designation of care to treat injured patients.

Professors Robert S. Huckman and Michael E. Porter and Research Associates Rachel Gordon and Natalie Kindred, both of the Global Research Group, prepared this case. HBS cases are developed solely as the basis for class discussion. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management.

The final element was the Dartmouth-Hitchcock Clinic, a group practice of full-time, salaried physicians. The Clinic employed more than 900 primary care and specialty physicians in New Hampshire and Vermont. Approximately 500 of these physicians practiced primarily on the main Dartmouth-Hitchcock campus. Most of the remaining physicians were based at one of four multi-specialty practices in the surrounding New Hampshire communities of Concord, Manchester, Nashua, and Keane.

Dartmouth-Hitchcock had been recognized for its high quality of care and had been named one of the nation's best hospitals, with its gastroenterology, gynecology and cancer programs named among the top 50 in their respective categories in the country.[2] Dartmouth Medical School ranked among the top 50 medical schools in the country.[3]

In 2007, Dartmouth-Hitchcock had about 8,400 full-time equivalent employees, 22,500 inpatient admissions, and 1.7 million outpatient visits (**Exhibit 1** provides selected operating and financial data for Dartmouth-Hitchcock). The hospital's clinical services were organized into 10 *departments*: anesthesiology, community and family medicine, medicine, obstetrics and gynecology, orthopedics, pathology, pediatrics, psychiatry, radiology, and surgery. Most departments were divided into focused *sections*. For example, the department of surgery included 11 different sections, each of which corresponded to a unique physician specialty (e.g., cardiac surgery, general surgery). Outpatients were seen in one of the section-based clinics.

The clinic and hospital were separate corporations but tightly integrated in terms of their financial and organizational structure. The clinic, hospital, and medical school had parallel organizational structures based on the 10 clinical departments. The physician chairs of each of the 10 clinical departments reported separately to the president of the hospital, the president of the clinic, and the dean of the medical school. Dartmouth-Hitchcock negotiated with health plans on behalf of both the hospital and the clinic physicians for both inpatient and outpatient reimbursement rates.

Doctors received reimbursement through professional fees and the hospital through technical fees. Technical fees covered facilities and non-physician services such as the cost of operating rooms, nursing and technical staff, and clinical supplies. Some services (e.g., housekeeping) were designated as cost centers, which meant that the hospital budgeted the cost of those services each year and allocated them across the revenue centers (e.g., clinical sections) that used those services.

Medicare, the federal insurance program for patients older than 65, accounted for 40% of the hospital's inpatient admissions; Medicaid, which insured low-income individuals, accounted for 13% of admissions; and most of the remainder was covered by private insurers. Four payers accounted for 80% of Dartmouth-Hitchcock's privately insured patients.

As late as the mid-1970s, all clinic physicians, regardless of specialty, received the same salary. Over time, however, market compensation began to differ significantly across specialties, and the clinic had to adjust its formula. In 2005, the clinic adopted a supplemental, productivity-based structure for distributing a portion of professional compensation among sections that continued to be in use in 2008. The goal was to set the base salary for each physician at 80% of the median market rate for their particular specialty. Physicians then were eligible to receive a variable component that would, in theory, bring the average physician's compensation close to the median market rate for his or her specialty.

Each physician's variable compensation came from a pool of funds that was first allocated across departments—or, if applicable, sections—based on the relative value units (RVUs) generated by all physicians in that department or section. An RVU was a unit of standard work that was assigned to

specific clinical tasks such as various types of office visits and surgical procedures.[b] RVUs were assigned on the basis of three factors: the amount of physician work required to provide a service, the service's level of associated expenses to the physician practice, and the professional liability insurance cost associated with the service.

For a given month, RVUs would be summed across all physicians in a section or department. The variable compensation pool would then be distributed in lump sums to each department or section according to its share of total RVUs. Section chiefs and department chairs were then given significant latitude in distributing these funds across individuals. In determining individual compensation, most chiefs and chairs considered contributions to teaching and research as well as the volume and quality of direct clinical care. The weights assigned to each of these aspects of performance varied by section and department. For example, Weinstein's formula for compensating physicians in orthopedics combined several criteria including, but not limited to, contributions to teaching and research, patient satisfaction, on-call availability, service to the department, RVUs, and fiscal responsibility.

Many at Dartmouth-Hitchcock viewed the introduction of RVUs as a positive step for the organization. Abdu stated, "To me the benefit of a RVU system is in people knowing what they need to do in order to meet their benchmarks." The RVU system, however, could lead physicians to maintain full schedules, making it more challenging to secure last-minute appointments and consultations.

Dartmouth-Hitchcock had an internally developed information system providing an integrated electronic medical record across outpatient and inpatient care delivered in both clinic offices and the hospital. Medical records were accessible to both patients and clinicians online. The hospital offered access to Patient Online, a web-based tool that allowed patients to manage their health care information and needs. Once registered, patients could use Patient Online to request and send information to their healthcare providers, manage many of their appointment needs, request prescription renewals, view their medical record, and view and pay balances.

Patients at Dartmouth-Hitchcock were also able to access detailed information about the effectiveness of various clinical interventions. For 30 years, the hospital had been home to the renowned Dartmouth Institute for Health Policy and Clinical Practice (Dartmouth Institute),[c] which collected and analyzed data on costs and clinical outcomes. The Dartmouth Institute had done seminal work revealing wide variations in patient care, even among the nation's top hospitals.[4] The Institute published the recurrent *Dartmouth Atlas of Healthcare*, which analyzed variation in utilization rates, costs, and clinical outcomes across a wide range of procedures and services using Medicare data.

In 2005, Dartmouth-Hitchcock began publicly posting data on its procedure volumes, process quality, costs, and some clinical outcomes—both positive and negative—on its website as part of a "shared decision making" philosophy involving both patients and clinicians. (See **Exhibits 2a, 2b** and **2c** for sample reports.) The hospital's approach had been highlighted in the local and national media.[5] As part of this effort, the hospital created a "Charges for Healthcare Services" page on its website to help patients better understand the cost of care. The page included a link to the "Out of Pocket Estimator" that helped patients estimate what they would need to pay after insurance.

---

[b] RVUs for particular activities were established as part of the Resource-Based Relative Value Scale (RBRVS), a compensation structure adopted by the United States government in 1992 for physician reimbursements by Medicare. RVU weights were updated regularly by the Centers for Medicare and Medicaid Services (with some input from the American Medical Association and other groups representing physician interests) and had become the basis for physician reimbursement by most private health insurers.

[c] The Dartmouth Institute was previously known as The Center for the Evaluative Clinical Sciences.

Dartmouth-Hitchcock had also been a pioneer in emphasizing "shared decision making" between patients and their doctors, especially when there was uncertainty concerning the best course of treatment for a particular condition. Weinstein referred to such decisions as "preference based" in that the preferences and values of the patient typically were the deciding factor given the lack of clear clinical support for any one approach. To help patients make such decisions, Weinstein founded the Center for Shared Decision Making, which provided patients with access to materials about their specific conditions. After viewing materials appropriate for their conditions, patients could actively discuss treatment options with their doctors. (See **Exhibit 3** for the Center for Shared Decision Making web page for back pain.)

Principles similar to those in the Spine Center were followed in Dartmouth-Hitchcock's Comprehensive Breast Center. The center offered an interdisciplinary set of providers including pathologists, radiologists, oncologists, reconstructive surgeons, geneticists, physical therapists, and care coordinators. The co-location of many of these providers enabled patients to consult with multiple professionals during any single visit to the center. This center also provided patients access to a wide variety of educational resources concerning their conditions.

Spine Care

The spine played a critical role in supporting the human trunk, enabling movement, and protecting the spinal cord, which linked the brain to the body and enabled mobility and sensation. The spine consisted of a series of flanged cylindrical bones called vertebrae, each separated by a cushioning, doughnut shaped disc. The stacked vertebrae and discs formed the spinal canal, a vertical tunnel consisting of four parts: the cervical spine, supporting the head; the curved thoracic spine, supporting the rib cage which protected the heart and lungs; the mobile lumbar spine, which allowed the chest and abdomen to move separately from the pelvis; and the sacrum at the spine's base, connecting the spine to the pelvis. (See **Exhibit 4** for a diagram of the spine.) Composed of millions of nerve fibers originating in the brain, the spinal cord ran through the spinal canal and sent off branches to form nerve roots at each level of the spine. For example, cervical nerve roots connected to nerves throughout the upper body, arms, and hands; lumbar nerve roots connected to the legs and bladder.

In 2008, an estimated 31 million Americans suffered from back pain.[6] According to one study, back pain caused 18% of Americans to lose an estimated 149 million work days annually.[7] While most low back pain subsided in a short time with minimal or no treatment, pain lasting longer than three to six months was considered chronic. Patients with low back pain were typically described as having a specific (e.g., arthritis, fracture, tumor) or non-specific (e.g., back pain) diagnosis.

Spinal pathology was divided into five broad categories: adult degenerative, pediatric, trauma (typically fractures), infections, and tumors. Adult degenerative conditions accounted for the majority of spine disorders.

A 2008 study in the *Journal of the American Medical Association* placed the medical costs for spine treatments at almost $86 billion in 2005, a 65% increase from 1997.[8] Factors that affected the rising costs were: increased drug spending; greater use of medical imaging, diagnostic tests, spinal injections, and surgical procedures; and lowered willingness to tolerate pain coupled with higher patient expectations. Although expenditures had increased for spine conditions, the study did not find an associated improvement in health outcomes.

Some common spinal conditions included: a herniated disc, in which the soft center of an intervertebral disc protruded through a tear in the disc's thick outer layers; osteoporosis, or bone deterioration due to low bone mass; scoliosis, or severe spinal curvature and rotational deformity; spondylolysthesis, a spinal defect causing vertebra to slip forwards or backwards; and stenosis, or narrowing of the spinal canal. Sciatica was a term describing symptoms of pain, tingling and numbness in the lower back and leg occurring when a disc abnormally protruding from the vertebral column pressed against the sciatic nerve, which extended down the back of the leg.[9]

Three major categories of treatment existed for back pain. These were medication (e.g., non-steroidal drugs or steroid injections to treat pain symptoms); physical medicine (e.g., restoring function through physical therapy and exercise),[d] and surgery.

Patients with back pain typically presented at either the office of their primary care physician or a hospital emergency room. If a physician at either location determined that a patient's condition could be treated with non-steroidal medications and rest, the patient would be sent home to see if symptoms subsided. If, however, a physician felt that a patient needed more complex treatment, she could refer the patient to a wide variety of medical or surgical specialists. These included: pain specialists (who could provide steroid injections); radiologists (who could perform additional diagnostics imaging and therapeutic injections); physical medicine specialists (who could perform functional restoration techniques based on physical therapy and exercise); orthopedic spine surgeons (who focused on neuro-musculoskeletal conditions); or neurosurgeons (who focused on neurological conditions). Both orthopedic surgeons and neurosurgeons were trained in most forms of spine surgery, but one specialty might be more likely to treat specific conditions. For example, an orthopedic surgeon would normally perform surgery to treat spinal deformity, such as scoliosis, while a neurosurgeon would normally remove intradural spinal tumors (e.g., tumors located in the fluid-filled, cord-like thecal sac that encased the spinal cord).[10]

Ideally, a patient's course of treatment would move from the least- to most-invasive forms of therapy. For example, a patient with persistent back pain would begin with diagnostic testing, typically starting with an x-ray, if indicated. If this did not reveal a clear diagnosis, a doctor might recommend magnetic resonance imaging (MRI), which was especially useful in identifying disc and other soft tissues, as well as fractures, infections and tumors. Because diagnostic imaging tests, including x-rays, MRIs, and computed tomography (CT) scans, often revealed abnormalities unrelated to a patient's pain, identifying the true source of pain through these tests alone could be challenging. Other diagnostic tests included bone scans, used to search for fractures, infections, or tumors; discography, used to examine intervertebral discs; electromyography (EMG) and nerve conduction velocity (NCV) tests, used to examine the efficacy of arm and leg nerves in conducting electrical signals; and bone density studies, used to test for osteoporosis and related conditions.[11] If appropriate, the patient might next attempt nonsurgical treatment (e.g., physical medicine, injections, counseling, or exercise). If those approaches did not work, the patient might consider surgery.[12]

The three most common spinal surgeries were discectomies, laminectomies and spinal fusions. Performed to relieve pain caused by disc herniation, discectomies could often be done on an out-patient basis and were performed as either a traditional (i.e., open) procedure or arthroscopically (i.e., through a small incision using a fiber-optic camera). During a discectomy, a surgeon moved the muscle tissue above the affected bone to reveal the site of herniation and then removed the piece of inner disc protruding from the disc's outer wall.[13] Laminectomies were more invasive, requiring removal of bone and ligament to relieve compression caused by a herniated disc or stenosis.[14] Spinal

[d] Physical medicine, aimed at functional restoration, was a broad treatment category that included physical therapy, chiropractic care, the use of a braces, traction, acupuncture, pilates, yoga, and other exercise-based approaches.

fusions were performed to relieve intervertebral pain caused by fractures, spondylolisthesis or degenerative disease, and involved inserting a bone graft into the vertebral segment causing pain. The graft grew between the two vertebral segments, fusing them together to limit the range of motion of that segment.[15]

Spinal surgeries were typically performed on an inpatient basis and could be conducted by orthopedic surgeons or neurosurgeons. It was estimated that almost one million spine surgeries were performed in the U.S. every year.[16]

The charges for spine surgeries varied widely, depending on factors such as type of surgery, complexity of the patient's condition, prevalence of complication or comorbidity, type of artificial device or prosthesis used, and length of hospital stay. For example, a relatively simple spinal fusion would involve charges of about $60,000. For a more complex fusion (such as one with spinal curvature), charges might exceed $140,000. Charges for a highly complicated fusion of numerous vertebra could exceed $170,000.[17]

Like other spine treatments, surgery often reduced but did not necessarily eliminate pain. Recovery could take weeks or months, sometimes requiring substantial follow-up care, including additional surgery. It was estimated that 20% of patients who underwent spine surgery for degenerative disorders would require additional surgery within 11 years.[18]

The actual treatment path for patients varied widely. In some cases, a patient reporting low back pain might be immediately referred to a surgeon, while in others, that same patient might initially be referred to a non-surgical specialist for physical medicine or pain injections. (**Exhibit 5** presents data from *The Dartmouth Atlas of Healthcare* on regional variation in the rates of back surgery and other common procedures among Medicare patients in the United States.) Care was often not well coordinated across providers, many of whom were competing for the same pool of patients. For many spinal conditions, doctors simply disagreed about the relative merits of surgical relative to non-surgical approaches to treatment. Numerous trials comparing the outcomes of fusion surgery versus non-surgical therapies, for example, had reported contradictory results.[19]

Spine patients often suffered from a host of psychosocial factors, such as anxiety, depression and job dissatisfaction, which were thought to be significant determinants of pain and treatment outcomes.[20] Undergoing a series of time-consuming, painful and highly expensive treatments without experiencing the desired pain alleviation could be stressful and frustrating for patients. For many patients, back pain was never completely eliminated, especially for those with chronic spine conditions and exacerbating factors such as muscle weakness, obesity, and persistent life stressors.[21]

Origins of the Spine Center

In 1985, Weinstein, an orthopedic surgeon, founded the University of Iowa's Spine Diagnostic and Treatment Center, one of the nation's first multidisciplinary spine centers. While serving as director of the Iowa center, Weinstein spent a year under the tutelage of Dr. Jack Wennberg at the Dartmouth Institute. Wennberg ultimately recruited Weinstein to return to Dartmouth-Hitchcock where, in 1997, Weinstein founded the Spine Center. The first individuals hired into the center were a data systems analyst, two physical therapists, an administrative assistant, and a program manager.[22]

Weinstein advocated non-invasive approaches to treatment and saw the Spine Center as an opportunity to create a living laboratory for spine care. "I wanted to create a place where we asked questions like, 'Does what we are doing really work for the patient? If it doesn't, how can we shift our resources towards things that really work and are effective?'"

The Spine Center would have a multidisciplinary focus. A wide range of providers, such as surgeons, medical specialists in functional restoration and pain management, mental health providers, occupational therapists, and physical therapists, would practice at the Spine Center. Physicians from neurology, rheumatology, and radiology would also be available to act as consultants. The expectation was that this group would discuss and coordinate the care of their patients. Weinstein noted:

> Patients may not know the difference between a neurosurgeon and an orthopedic surgeon or that a chiropractor is different than an MD. So the vision was to make it easy for the patient. When the patient's back hurts, he or she should go to this place we call the Spine Center, which should be able to provide care, no matter what the problem is, by bringing together the best possible people. We not only wanted to bring the disciplines together, we wanted them to incorporate shared decision making by using the data systems we would develop to make decisions.

Another staff member at the Spine Center explained:

> The whole premise behind the Spine Center was to have all the spine patients come through us so we could make resources available to both patients and staff that would not necessarily be available in individual clinics. Instead of the patient navigating the system, the system would come to the patient.

For example, rather than having to wait for a patient to receive a consult or appointment with a physical therapist, a provider could send the patient directly to one of the Spine Center's physical therapists who would be able to initiate an appropriate therapeutic plan. "The goal," this staff member continued, "is to take care of all our patients' needs, even beyond the spine, in one fell swoop." Typically, these "other" needs for a spine patient included mental health services, for conditions such as depression or anxiety, as well assistance with pressing life issues such as the inability to pay bills or negotiate a return to the workforce.

In 2002 Weinstein was named Chair of the Department of Orthopedics and, in 2007, was named the Director of the Dartmouth Institute for Health Policy and Clinical Practice, succeeding his mentor and friend Jack Wennberg. Upon assuming the Chair of Orthopedics, he appointed Abdu Medical Director of the Spine Center.

The Spine Center in 2008

The Spine Center was located on the third floor of the hospital (**Exhibit 6**) and offered care for a full range of back problems from chronic low back pain to scoliosis (spinal curvature) to herniated discs. Between 2000 and 2006, the center treated nearly 3,000 herniated disc patients and more than 1,500 spinal stenosis patients.[23] Medicare and Medicaid accounted for approximately 17% and 9% of the gross revenues of the Spine Center, respectively, with private payers accounting for the bulk of the remainder. The largest single private payer accounted for 16% of the center's gross revenue. **Exhibit 7** provides the Spine Center's income statement for FY2007.

The Spine Center emphasized using non-surgical approaches to treatment as either a complement to, or substitute for, surgical procedures. Non-surgical treatments offered at the Spine Center included: physical therapy and exercise, nonsteroidal anti-inflammatory drugs, and behavioral modification to help patients avoid activities that caused pain. These treatments could be tried sequentially or simultaneously. The Spine Center offered services in five major categories:

- Comprehensive assessment for new patients: A patient referred to the Spine Center typically saw a multidisciplinary team including a physician, nurse practitioner, physical therapist, nurse and social worker. While any one of these professionals could serve as a patient's initial point of contact with the Spine Center, this team worked together on an as-needed basis—often at the time of the patient's initial visit—to develop a coordinated treatment plan for the patient. This approach allowed any member of the care team to serve as what Weinstein called the "captain of the ship" based on the needs of individual patients.

- Shared decision making: Patients considering surgery were given the opportunity to review brochures and videotapes specific to their condition with a registered nurse. Where applicable, patients were encouraged to consider non-surgical treatment options.

- Second opinion consultations: At the request of a referring physician or insurance company, surgeons affiliated with the Spine Center would provide second opinions regarding potential surgical cases.

- Functional assessment: A patient could be evaluated to determine suitability for the Spine Center's Functional Restoration Program—an intensive three-week rehabilitation program offered as an alternative to surgery. The center's experience suggested that functional restoration was the most effective treatment choice for those with chronic pain and no associated medical diagnosis.

- Physical Therapy: Patients whose back pain might be alleviated through physical therapy either arranged to have therapy with a McKenzie certified physical therapist[e] at the Spine Center or with a physical therapist closer to their home.

In many cases, matching patients to the appropriate treatment represented a complex problem. One staff member noted, "This is a tough population with a lot of chronic pain and sometimes we just don't have answers for our patients. As a provider that can be hard to face after a while." Another staff member added, "It's especially hard when we are working with surgeons. They want to see surgical cases. They don't want to see the chronic low back pain patient who probably is not the ideal surgical patient."

Structure

The Spine Center included 25 full-time equivalent (FTE) staff: 2.5 surgeons, two non-surgical physicians, five nurses, six allied health professionals (e.g., physician assistants and physical and occupational therapists), one social worker, three administrators, and 5.5 clerical workers. The 2.5 surgeon FTEs were spread across six surgeons, and the two non-surgical physician FTEs were also spread across six physicians. Physicians who saw patients at the Spine Center typically did so for a designated period at least once a week. With the exception of Abdu and Dr. Rowland Hazard—physical medicine specialist and head of the Functional Restoration Program—none of those physicians was based primarily in the Spine Center and none was paid out of the Spine Center's budget.

[e] Developed in the 1960s, the McKenzie approach sought to move a patient's pain from his or her extremities and centralize the pain in the patient's lower back under the theory that lower back pain was better tolerated than leg and arm pain. The McKenzie Method emphasized teaching patients how to self treat and manage their own pain using exercise and other strategies. The McKenzie method was considered ineffective for patients without "centralized" pain or for those suffering from ailments such as lumbar spinal stenosis or facet joint osteoarthritis. Vert Mooney, "What is the McKenzie Method for Back Pain and Neck Pain?" November 14, 2005 on the *Spine Health website*, http://www.spine-health.com/wellness/exercise/what-mckenzie-method-back-pain-and-neck-pain accessed November 20, 2008.

Though affiliated physicians were asked to make a weekly time commitment to the Spine Center, they remained primarily affiliated with the sections that employed them (e.g., neurosurgery or orthopedic surgery). One staff member commented, "We have had providers that have been very successful at coming here and maximizing available resources and others that will come here and practice as they always have in their home clinics." Another staff member offered, "Our practitioners are responsible to their section chiefs and directors—and not necessarily to the center's medical director—as to how they practice at the center. If someone comes here and they don't want to practice how we think they should practice, it's difficult to enforce a change."

Administrators at the Spine Center felt that emphasizing the Spine Center's team-based approach might offset the lack of line authority that the center had over its affiliated physicians. "We need to spend more time talking to our providers to make the Spine Center more appealing to them so that we get their buy-in to the Spine Center," one administrator explained. "We have to create that loyalty amongst our doctors. It's really an added piece of work that nobody else has to do here with their own departments or sections."

The Spine Center was established as a cost center rather than as a revenue center. This structure ensured that the Spine Center and a doctor's home section or department would not compete for revenue. Weinstein explained: "If a neurosurgeon sees a patient in the Spine Center and decides to do surgery, the credit[f] for that surgical case goes to the neurosurgery section." Similarly, a surgeon's professional fees for pre- or post-operative office visits also reverted to that surgeon's home section or department.

Structuring the Spine Center as a revenue center would have required attributing a portion of each affiliated providers activity to the center and the remainder to their home departments, and this proportion would vary across providers and over time. Stephen LeBlanc, chief operating officer of Dartmouth-Hitchcock, added:

> We have always tried to make decisions and allocate resources based on institutional needs, rather than operate under a model in which every department generates its revenues, has its expenses, and at the end of the day, retains all the profit that it generates. We are an academic multispecialty group practice and, as such, departments and sections have their budgets and are expected to meet them. Yet we pool our income in order to cross-subsidize departments and services to support our mission and institutional goals.

While the Spine Center did not receive revenue for surgical cases or office visits with surgeons, it did receive service revenue from non-surgical treatments, such as functional restoration and physical therapy. These revenues supported the Spine Center's dedicated infrastructure. Nurses, therapists, and administrative staff were paid out of the service revenues generated at the center. In this model, Weinstein remarked, "Any other ancillary service or section that sees the patient initially in the Spine Center but does follow-up work outside of the center gets all the billing credit for any care the patient receives outside of the center." For example, any radiology procedures performed on a Spine Center patient generated revenue solely for the department of radiology.

Because no surgery revenues went to the Spine Center, it generated relatively low technical fees, often leaving it with a deficit. One administrator explained, "Without financial control you are really up the creek. It's hard to enforce the vision and manage the team when we don't control the purse strings." According to another staff member, the Spine Center's status as a cost center made the annual budgeting process "one based on justification. Every time we need to go forward and expand,

[f] Credit in this context refers to payment.

we need to get it approved based on patient volumes because we don't have our own profit-and-loss statement."

Research

Central to Weinstein's initial vision for the Spine Center was connecting clinical practice to academic research on the cost-effectiveness of various approaches to treatment. He noted, "Clinical practice should not just generate revenue, it should generate evidence that can be used to improve clinical practice. When this evidence tells us something doesn't work, we should stop doing it."

The research agenda of the Spine Center had its roots in Weinstein's work with collaborators as a resident at Rush Medical Center in Chicago during the 1970s and at the University of Iowa in the 1980s and 1990s. At Dartmouth, Weinstein worked with the National Spine Network (NSN)—a not-for profit data registry that had collected clinical data on more than 60,000 spine patients as of 2004—to make his work available to colleagues across the United States.

Weinstein and his colleagues had won in excess of $30 million in funding from the National Institutes of Health (NIH) since the founding of the center. Roughly $21 million of this total was dedicated to the Spine Patient Outcomes Research Trial (SPORT), a 10-year, multicenter trial on the effectiveness of various treatments for patients with the common spinal diagnoses of herniated discs or spinal stenosis. Weinstein was the principal investigator for this trial, and self-reported patient data collected at the Spine Center was used to secure the needed NIH funding.

A 2008 study from the trial, published in the *New England Journal of Medicine*, found that spinal stenosis patients receiving surgery improved more rapidly and reported better function and less pain than non-surgical patients.[24] However, patients who did not receive surgery saw improvements in function and pain over time. Weinstein commented, "What we now know and can share with our patients is that they have a choice. If they choose surgery, they will improve more and faster than those who choose watchful waiting. But, interesting and noteworthy, if their preference is not to have surgery, their condition is not likely to worsen and they will see some improvement over time." Roughly 40% of symptomatic SPORT patients remained in watchful waiting eight years into the trial.

Care Delivery Process

Referral and scheduling Patients either learned of the Spine Center on their own or were referred to it from other parts of Dartmouth-Hitchcock or from physicians practicing in the community. The majority of the Spine Center's referrals came from physicians outside of the DHMC system. Referring physicians completed a standard form indicating the reason for the referral (e.g., initial evaluation, physical therapy, surgical assessment) as well as supplementary information about the patient (see **Appendix A**). If patients with back pain came directly to Dartmouth-Hitchcock without a referral (e.g., through the emergency room) they were referred to the Spine Center.

A patient's first encounter with the Spine Center would typically occur over the phone with one of the Spine Center's patient liaisons, who would complete a patient intake and triage form. If a patient was referred, the liaison used information provided by the referring physician to facilitate triage. If the liaison and clinicians at the Spine Center felt the patient should receive a different type of care than that requested by the referring physician, a clinician from the center would contact the referring provider. One doctor explained, "It's a delicate balance. You don't want to offend your referring provider community."

The triage form provided the liaison with guidelines to determine which type of provider the patient should see based on his or her complaint. If the liaison was unsure how to schedule the patient, the liaison would consult with either the Spine Center's medical director or a nurse. The liaison also tried to capture what previous care, if any, the patient had received to better understand the patient's complaint. If the patient had received care elsewhere, the liaison would contact the institution to collect the appropriate clinical information. Depending on the outcome of the call, the liaison would make an appointment with the appropriate provider.

As part of this initial scheduling process, patients were asked to complete an electronic survey either online prior to their visit or—for those uncomfortable with computers or without computer access—during their first visit using an electronic touchpad provided by the hospital (**Exhibit 8**). Patients received assistance from the liaison if needed.

The survey contained two parts: a health survey and a quality of life survey. The first part asked the patient about his or her general symptoms, previous health history and family history while the second part focused on the patient's functional, mental and physical state. On subsequent visits to the clinic, the patient completed a new quality of life survey but only updated the health survey as needed. **Appendix B** includes examples of the questions found in both parts of the survey. Some questions were specific to the Spine Center while others were taken from a well-known, validated functional health survey called SF-36.[g] Many centers around the world used SF-36 to collect data; the Spine Center was notable in that it used this information in a "real-time" manner to inform clinical practice. Using the SF-36 also enabled the Spine Center to benchmark its own data against other providers and contribute to multi-center research efforts.

Initial visit The next step after completing the survey was the patient's initial visit to the Spine Center. The patient began this visit by registering and confirming her medical information, including existing medications and known allergies. This updated information was then downloaded, and a printed summary was sent to the patient's doctor for discussion during the patient's initial visit and all subsequent visits. When the Spine Center first opened, many patients were seen by a physician, physical therapist and, in some cases, a pain specialist during the initial visit. This policy, however soon changed: "We found this was not a resource efficient use of everyone's time," commented Dr. Abdu. "Many of our patients didn't need the entire works."

Under the revised approach, a patient would visit one provider, either a physician or another type of clinician, such as a physical or occupational therapist or a nurse practitioner. Quite often this initial visit would provide the patient with a complete diagnostic and therapeutic plan, allowing them to return home with an exercise regimen or medication to manage their pain symptoms. Weinstein estimated that 30-40% of Spine Center patients fell into this category.

If the patient presented with a more complicated case or one that required treatment that was not the specialty of the initial provider, the patient would be referred for additional consultation either within or outside of the center. For example, additional diagnostic studies, such as a CT or MRI, would be ordered from radiology or a surgical assessment might be requested from a physician within the center. In most cases, all consultations needed to assess a patient's condition could occur on the same day as the initial visit. If not, the patient might be asked to return to Dartmouth-

[g] The SF-36 was a multi-purpose, short-form health survey with 36 questions that measured functional health. In addition, the survey measured well-being scores based on psychometrically-based physical and mental health summary measures and a preference-based health utility index. It was a generic measure that did not target a specific group or disease. Findings from the SF-36 had been used to survey general and specific populations, compare the relative burden of diseases, and differentiate the health benefits produced by a wide range of different treatments. For more information and source see, John E. Ware, "SF-36® Health Survey Update," on the *SF-36.org website*, http://www.sf-36.org/tools/SF36.shtml, accessed November 20, 2008.

Hitchcock within a few days for additional tests or consultations. In all cases, the center's goal was to accommodate patients' needs while avoiding unnecessary trips to the medical center. Once these steps were completed, the initial provider—perhaps with another consulting provider—would discuss treatment options with the patient. In addition, the patient would be referred to the Center for Shared Decision Making to obtain additional information about their treatment options.

Each time a patient returned to the Spine Center, she would repeat the health status survey, which included the generic SF-36 and the spine-specific Oswestry Disability Index (ODI). The survey also asked patients about their expectations for treatment and medical information related to comorbidities, medications, and allergies. It provided clinicians with a picture of a patient's progress over time and any important changes that would account for a change in health status unrelated to spinal conditions. Patients would also fill out a "pain diagram" (**Appendix C**). The pain diagram was an outline of the human body, on which patients could use a stylus to indicate the type and location of the pain they felt. It provided doctors and patients with a graphical representation of the patient's pain symptoms. If a patient indicated that she had multiple symptoms in anatomically inconsistent locations, then clinicians were able to conclude that the patient might not be a good candidate for surgery and should consider alternative forms of treatment. Abdu explained:

> The data point out things about the patient that you can't get in the usual patient-clinician encounter, such as the patient's objective perspective on his or her physical and mental functioning. It tells you about expectations and satisfaction with regard to treatment and overall outcomes. Patients can also see how they are doing relative to other patients' progress. They might tell you, "I'm doing great; everything is great, my pain is better." But their answers to the survey questions might reflect that that they are actually in a lot of pain. So I can ask deeper questions about things that I might otherwise miss. The data not only ties in directly with the clinical work that we do in the evaluation of our patients, but it also ties in with the idea of shared decision making. We can give patients the appropriate information with which to make decisions.[h] Then we can follow their outcomes and feed that back into the information loop.

Treatment of recurring symptoms Given the chronic nature of back pain, patients who had received treatment might experience a recurrence of their symptoms. If so, they would contact one of the spine center triage nurses to initiate another round of diagnosis and treatment. One doctor described this process:

> The process loop happens all over again. Based on a patient's condition and diagnosis, they might get an injection in the pain service and that might resolve the issue. Or they might not get better, so they come back to see the surgeon who might recommend surgery and then the Spine Center provides their follow-up care. Or the patient might request physical therapy and see the therapist for a few sessions and then be discharged. We might also help them with other issues that a social worker might specialize in such as workman's compensation or disability.

If a patient's recurrent condition appeared to be related to psychosocial as well as physical issues, his care would be coordinated by a two-person team including his initial provider and a social worker. Dr. Abdu said, "Our social worker works with our patients who often have complex problems. They could be any combination of social (e.g., marital strain, child abuse), employee-employer relations, pain, medication (e.g., narcotics abuse) or disability issues. With the social worker on hand, I can see my other patients but know that this patient is being taken care of."

[h] See **Appendix D** for an example of a patient summary report.

Outcomes measurement The Spine Center aggregated and analyzed the data collected from all patients as illustrated in **Exhibit 9**. Summary data on the center's processes and clinical outcomes were also available to patients on the Dartmouth-Hitchcock website (**Exhibit 10**). Abdu explained the link between these data and the design of clinical processes at the Spine Center:

> A key use of the data is benchmarking. Every physician thinks they are doing the right thing and yet many of us do things very differently than our colleagues in other locations. In order to figure out who's doing best practices, you need data. This allows the potential for benchmarking against a physician doing similar or the same procedures in different areas to look at outcomes. And it allows *you* to do the research.

Several staff members at the Spine Center noted that, at times, there could be resistance to collecting data among both providers and Dartmouth-Hitchcock administrators. "The biggest resistance for our physicians turns out to be the unknown factor," commented Abdu. "It's not that doctors think it's a bad idea, it's just that they are not sure that it is a good idea. And their first comment is, 'My patients won't fill out the survey.' However, as new providers spend more time in the Spine Center, and observe that over 90% of patients fill out the surveys, their resistance decreases."

Obtaining buy-in from non-clinical administration at the hospital proved to be a greater challenge. As a staff member explained, "Non-clinical administrators often want to see a return on investment. It can be frustrating because they may be willing to bring in new computer systems, new software, and new people to analyze their financial data. Yet when it comes to bringing in statistical people and infrastructure to examine our processes of care and outcomes, we are often asked, 'What's the return on investment?'"

Weinstein noted that collecting and analyzing data could offer answers about the effectiveness of medical care. He observed: "Insurance companies make us bill for things that don't work and when we try to do things that do work, we don't get paid for them." Frustrated that Dartmouth-Hitchcock received no direct compensation for the unique data the Spine Center provided, Weinstein added:

> The medical system has built all kinds of data systems based on an arcane billing and coding structure with perverse incentives and lots of information about what we charge patients. There is little data on the safety and efficacy of what we do for them, and there is no data, at all, on whether most things actually work in the environment of a healthcare system or a hospital or a practice or a spine center. If we fly a plane without instruments, we are more likely to crash. Medicine is no different, and doctors need to see what may not be obvious, even in good weather.

What Next?

Weinstein believed that the Spine Center's unique approach to multidisciplinary care and data collection held significant potential to improve patient outcomes. Whether the Spine Center had achieved its full potential was an ongoing question. In Weinstein's words, "Is the Spine Center a facility where people from different departments happen to see their spine patients, or is it truly a multidisciplinary, team-based model?" How to improve the model, and extend it to other areas within DHMC, was at the top of Weinstein and Abdu's agenda.

Exhibit 1 Selected Financial and Operational Information for Dartmouth-Hitchcock, 2006-2007

	2007	2006
Revenue ($ '000)		
Payment for Patient Services from Third Parties and Patients	$939,417	$878,999
Federal Budgets for Veterans Affairs Services	119,928	106,946
Funded Research	130,723	137,673
Tuition Income and Fees	18,448	16,848
Gifts, Bequests and Endowments	61,374	35,464
Other Income	85,106	66,400
Total Revenue	$1,354,996	$1,242,330
Operating Expenditures ($ '000)		
Dartmouth Medical School	$209,135	$203,198
Dartmouth-Hitchcock	969,765	912,600
Veterans Affairs Medical Center	123,847	110,535
Total Operating Expenditures	$1,302,747	$1,226,333
Patient Statistics		
Total Patients Discharged[a]	22,591	21,539
Patient Days of Service[a]	107,534	105,055
Average Daily Census	295	288
Operations Performed	17,100	16,420
Births	1,131	1,120
Emergency Department Visits	30,891	28,728
Total Outpatient Visits	1,672,023	1,699,596
Total Employees[b]	8,392	8,168

Source: Adapted from Dartmouth-Hitchcock, 2007 Annual Report (Lebanon: Dartmouth-Hitchcock, 2007), pp. 43–44.

[a] Includes patients admitted for observation and intensive care nursery bassinet patients.

[b] Full-time equivalents.

Exhibit 2a Overall Hospital Performance Results Posted on Dartmouth-Hitchcock Website[a]

Overall DHMC Performance Results

On this page:
VOLUMES | SAFE AND EFFECTIVE CARE | COST OF CARE | WHAT OUR PATIENTS SAY ABOUT US

VOLUMES
We count the number of procedures or type of care occurring in the hospital during a specific time period. Research shows us that for some procedures and types of care, hospitals that do a certain number or more are likely to have better outcomes. The minimum number is based on research from the Leapfrog Group, whose goal is to increase the safety, quality and affordability of healthcare. (For more detail, click on each underlined measure below. A dash " - " means that there is no available comparison.)

DHMC 2007	Top 10%	Average Standard
		Back to Top
224	-	450
1085	-	400
150	-	120
98	-	50
23	-	11
27	-	13
45	-	100

LEAPFROG SURVEY

Coronary artery bypass graft (CABG) surgery: Number of coronary bypass graft (CABG) surgeries done at DHMC in 2007.

Percutaneous coronary intervention (PCI): Number of percutaneous coronary interventions (PCI) done at DHMC in 2007.

Aortic valve replacement surgery: Number of aortic valve replacements done at DHMC in 2007.

Abdominal aortic aneurysm (AAA) repair surgery: Number of abdominal aortic aneurysm repair surgeries done at DHMC in 2007.

Pancreatic resection surgery: Number of pancreatic resection surgeries done at DHMC in 2007.

Esophagectomy surgery: Number of esophagectomy surgeries done at DHMC in 2007.

Bariatric surgery: Number of bariatric surgeries done at DHMC in 2007.

SAFE AND EFFECTIVE CARE
Monitoring our care helps us evaluate and improve the way we deliver care. We emphasize areas where experts agree on the best treatment for a certain condition. (For more detail, click on each underlined measure below. A dash " - " means that there is no available comparison.)

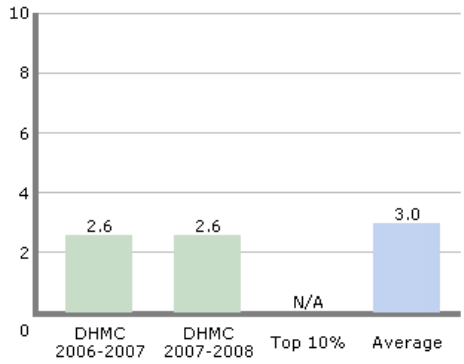
	DHMC 2008	Top 10%	Average
OVERALL PERFORMANCE			Back to Top
Overall performance for heart attack care (composite): Percent of eligible patients getting all the recommended elements of care for heart attack.	97%	-	96%
Overall performance for heart failure care (composite): Percent of eligible patients getting all the recommended elements of care for heart failure.	91%	-	86%
Overall performance for pneumonia care (composite): Percent of eligible patients getting all the recommended elements of care for pneumonia.	71%	-	82%
Overall performance for surgical infection and complication prevention (composite): Percent of eligible patients getting all the recommended elements of care for preventing surgical infection and other complications.	88%	-	-

Source: Dartmouth-Hitchcock website, http:/ / www.dhmc.org/ qualityreports/ list.cfm?metrics=Overall, accessed December 12, 2008.

[a]Launched in 2000, the Leapfrog Group collected and published data from over 1,300 U.S. hospitals with the aim of informing healthcare consumers and improving the quality of care.

Exhibit 2b Overall Mortality Data Posted on Dartmouth-Hitchcock Website

MORTALITY RATE (%)



See DHMC's statistical change in mortality

A **low score is better** than a high score.

The DHMC 2006-2007 score is for the period July 2006 to June 2007. The DHMC 2007-2008 score is for the period July 2007 to June 2008.

N/A means that there is no available comparison.

The average score is an estimated or "expected" value for DHMC after taking into account the severity of illness of the DHMC patients, and is based in part on the Clinical Data Products Data Base maintained by the University HealthSystem Consortium (UHC) for the period July 2007 to June 2008.

Source: Dartmouth-Hitchcock website, "Mortality Rate," http:/ / www.dhmc.org/ qualityreports/ metric.cfm?metrics=Overall&dimension=SAFE%20AND%20EFFECTIVE%20CARE&subdimension=OVERALL%20MORTALITY%20RATE&metric=Mortality%20rate, accessed January 29, 2009.

Exhibit 2c Examples of Healthcare Charges Posted on Dartmouth-Hitchcock Website

Doctor's Office Visit for a New Patient
(first visit or patients not seen within past 3 years)

Back to top

Type of Visit Charges do not include diagnostic testing such as lab services or X-rays. Call (800) 368-4783 for more information.	Hospital Charge (HBAS)	Professional Charge	Total Charge (Click on the calculator to find out more about how much you will owe)
Low-Level Visit *	$ 76	$ 28	$ 104
Low-to-Moderate-Level Visit *	$ 92	$ 57	$ 149
Moderate-Level Visit *	$ 131	$ 88	$ 219
Moderate-to-High-Level Visit *	$ 191	$ 128	$ 319
High-Level Visit *	$ 229	$ 173	$ 402

CT Scans

Back to top

Type of Visit Call (800) 368-4783 for more information.	Hospital Charge (HBAS)	Professional Charge	Total Charge (Click on the calculator to find out more about how much you will owe)
Abdominal CT scan	$ 4750	$ 475	$ 5225
Chest CT scan	$ 1900	$ 400	$ 2300
Head CT scan	$ 1700	$ 400	$ 2100
Pelvis CT scan	$ 3950	$ 475	$ 4425
Brain MRI	$ 3575	$ 700	$ 4275
Knee MRI	$ 2950	$ 600	$ 3550
Pelvis MRI	$ 3325	$ 700	$ 4025
Spine MRI	$ 2600	$ 575	$ 3175

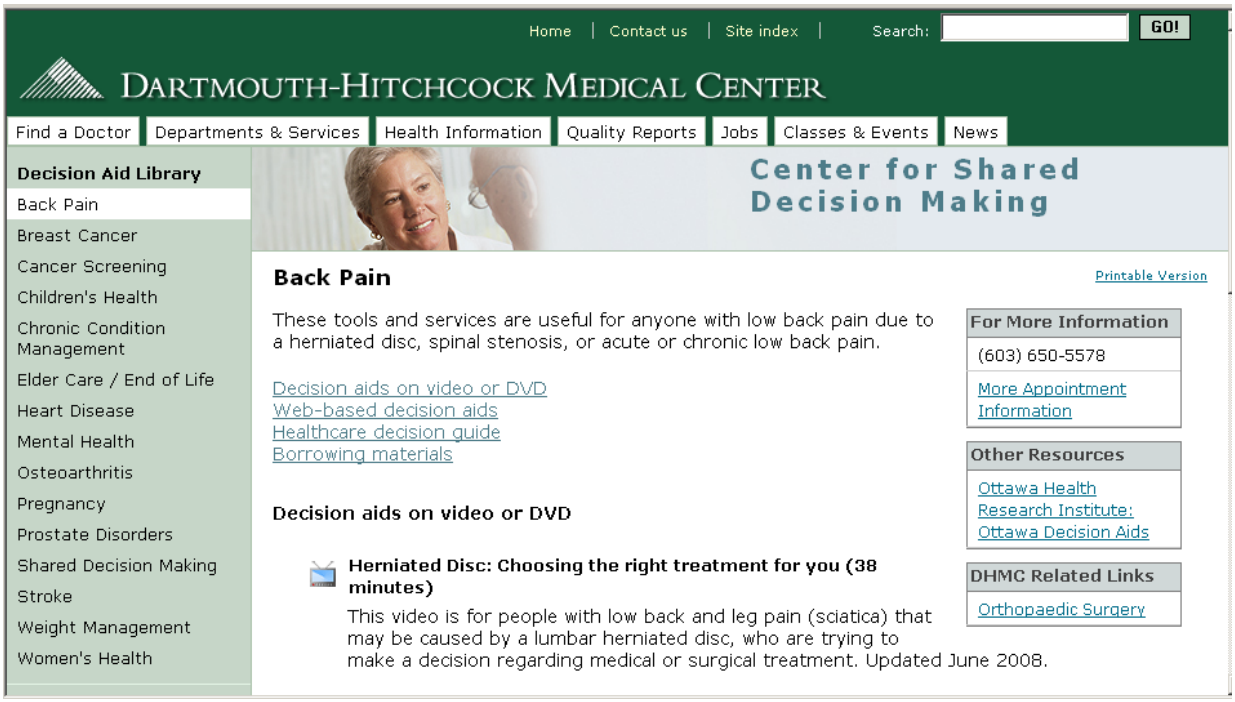
Bones, Muscles, Orthopaedics

Back to top

Type of Visit Call (800) 368-4783 for more information.	Hospital Charge (HBAS)	Professional Charge	Total Charge (Click on the calculator to find out more about how much you will owe)
Carpal tunnel release (one hand)	$ 5000	$ 5225	$ 10225
Hip replacement *	$ 29450	$ 15250	$ 44700
Knee arthroscopy	$ 4950	$ 6800	$ 11750
Knee replacement (one knee) *	$ 27550	$ 16350	$ 43900
Knee replacement (both knees) *	$ 43275	$ 29875	$ 73150

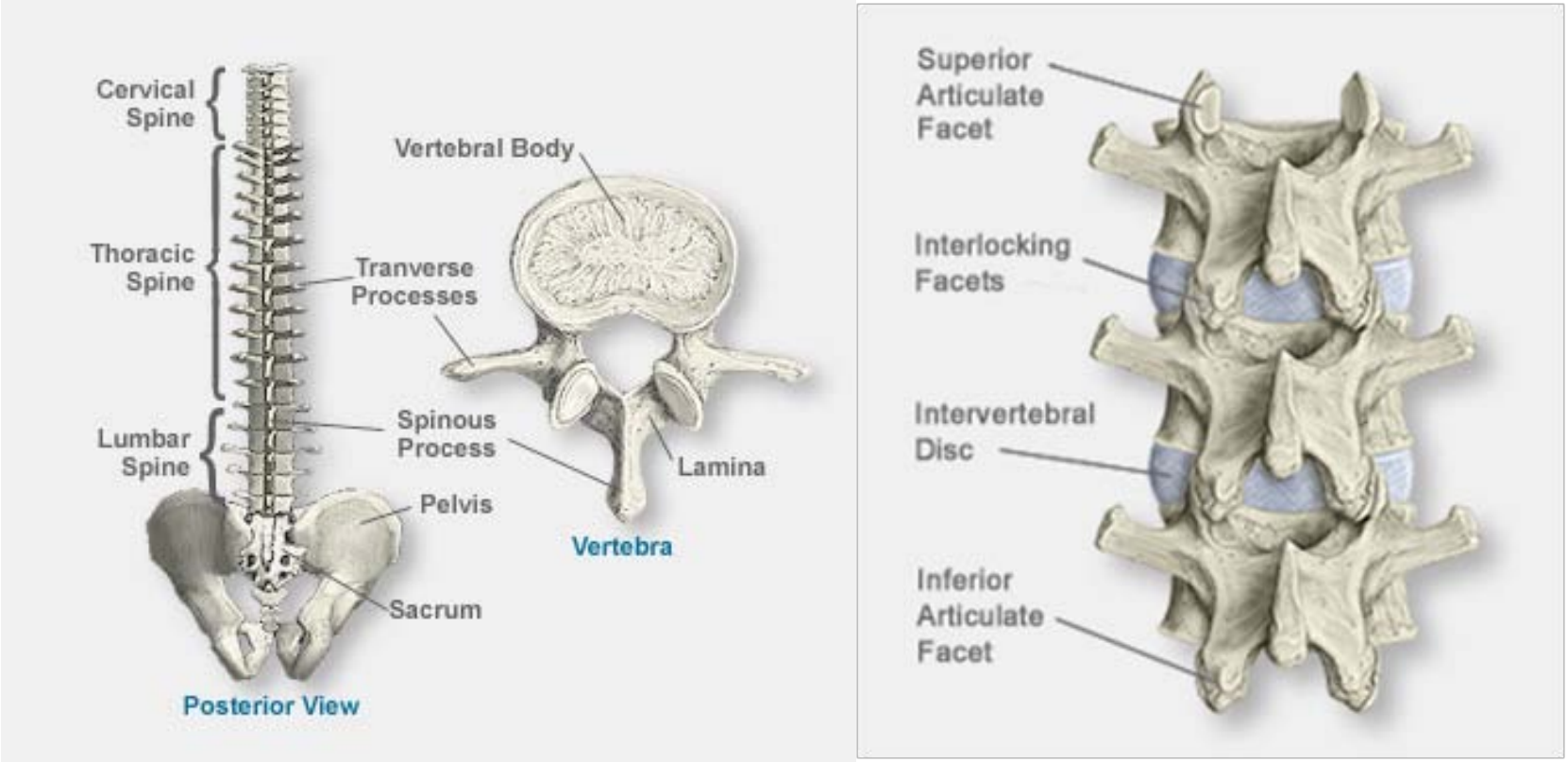
Source: Dartmouth-Hitchcock website, "How Much Does DHMC Charge for Healthcare?" http:/ / www.dhmc.org/ webpage.cfm?site_id=2&org_id=564&gsec_id=0&sec_id=0&item_id=29649, accessed December 12, 2008.

Exhibit 3 Dartmouth-Hitchcock Center for Shared Decision Making, Back Pain Web Page



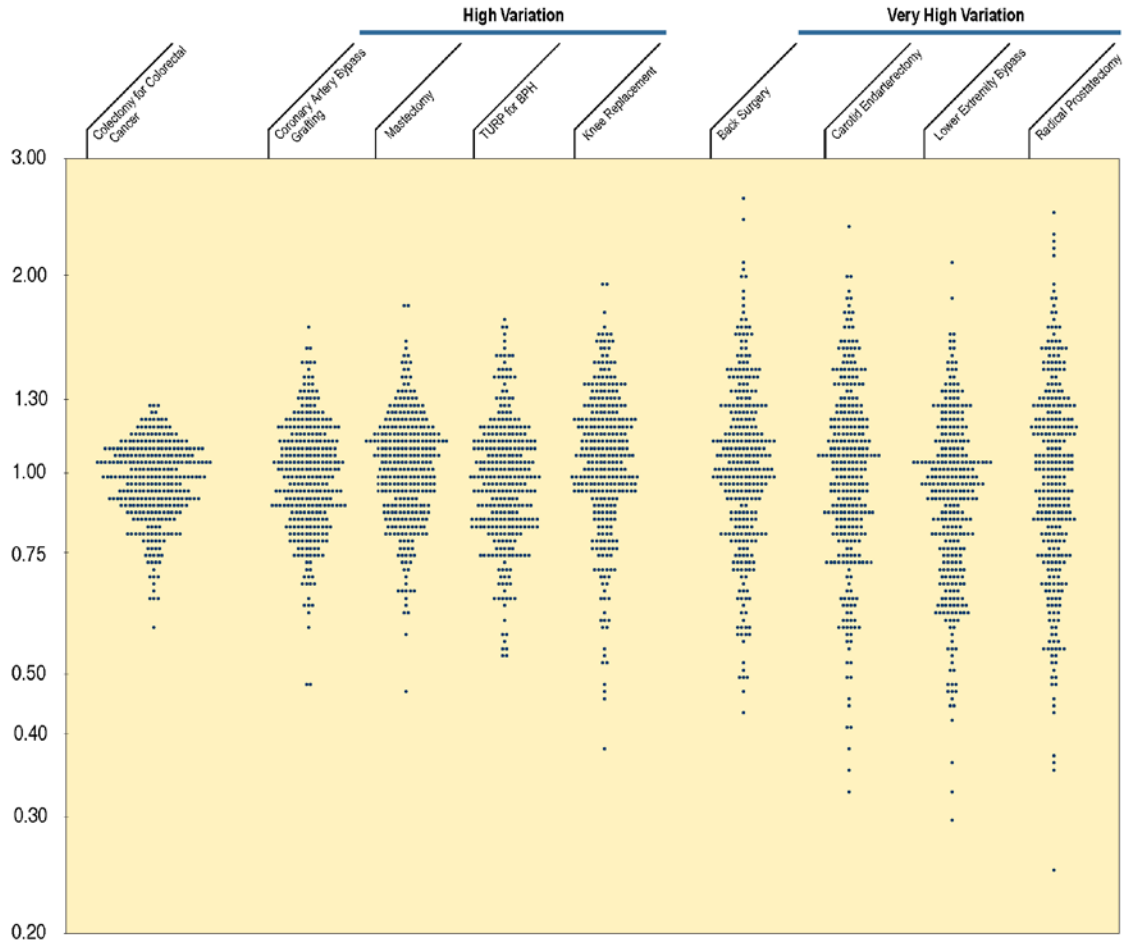
Source: Dartmouth-Hitchcock website, http:/ / www.dhmc.org/ webpage.cfm?site_id=2&org_id=108&morg_id=0&sec_id=0&gsec_id=39685&item_id=39686, accessed January 27, 2009.

Exhibit 4 Anatomy of the Spinal Column (left) and Vertebrae (right)



Source: Southern California Orthopedic Institute website, "Anatomy of the Spine," http:/ / www.scoi.com/ spinanat.htm, accessed December 8, 2008.

Exhibit 5 Regional Variation in Selected Surgical Procedures among Medicare Patients in the Unites States, 1994-1995

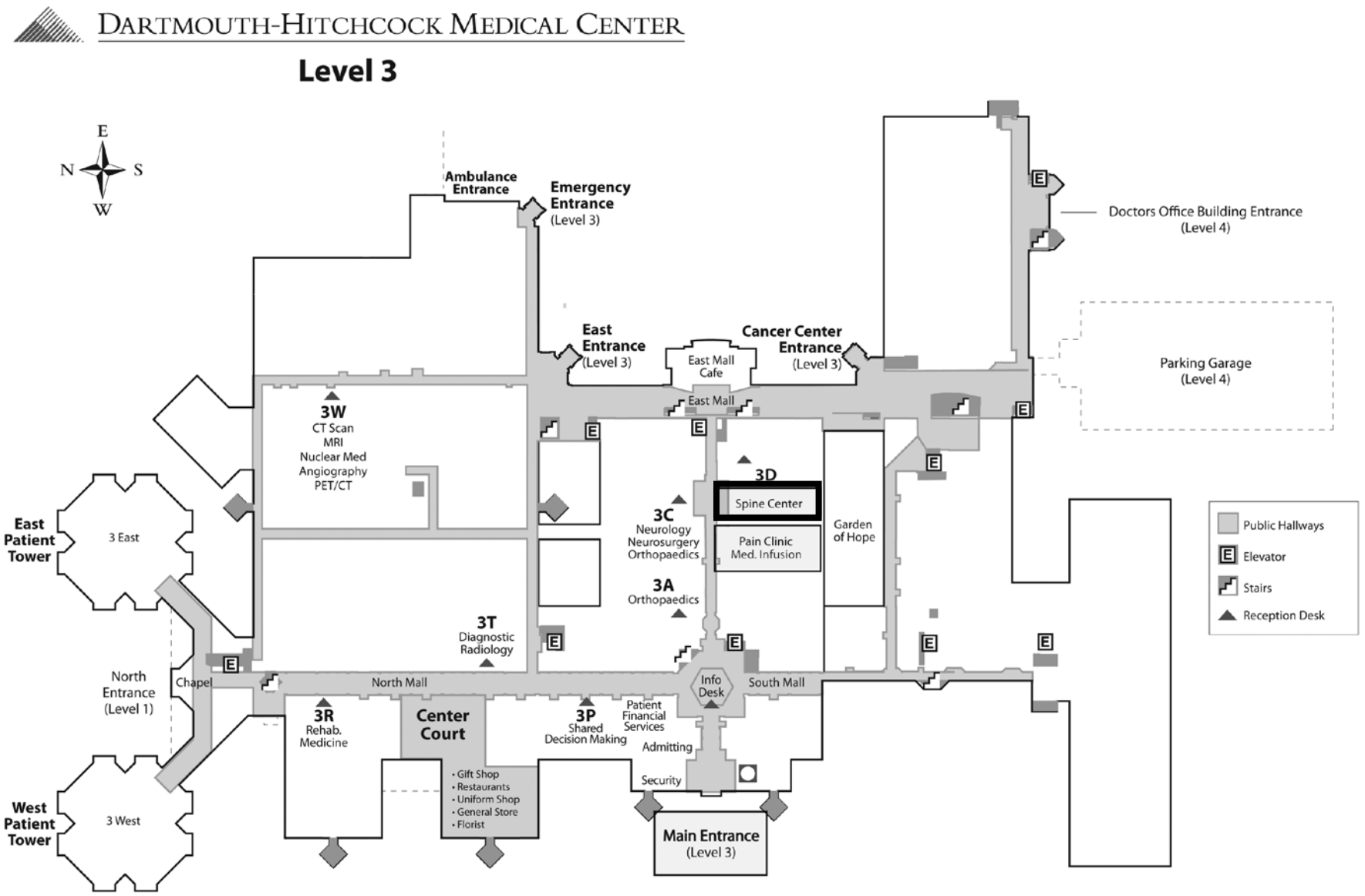


		High Variation I				Very High Variation II			
	Colectomy for Colorectal Cancer	Coronary Artery Bypass Grafting	Mastectomy	TURP for BPH	Knee Replacement	Back Surgery	Carotid Endarterectomy	Lower Extremity Bypass	Radical Prostatectomy
Index of Variation									
Systematic Component of Variation or SCV (X 100)	18.9	40.5	43.9	52.2	64.3	91.2	100.5	109.8	127.6
Ratio to SCV of colectomy for colorectal cancer	1.0	2.1	2.3	2.8	3.4	4.8	5.3	5.8	6.8
Range of Variation									
Extremal ratio: (highest to lowest region)	2.2	3.5	3.6	3.3	5.2	6.0	7.2	7.0	10.0
Interquartile range: (75th to 25th percentile region)	1.21	1.30	1.30	1.34	1.33	1.47	1.50	1.53	1.62
Number of Regions with High and Low Rates									
Rates more than 25% below the national average	15	21	19	30	30	42	56	83	71
Rates 30% or more above the national average	0	23	26	27	55	62	60	30	60

Note: The top graph shows rates per thousand Medicare enrollees using a log scale centered on the national average. Each point represents one of 306 hospital referral regions in the United States.

Source: *Dartmouth Atlas of Healthcare*, 1998

Exhibit 6 Mary Hitchcock Memorial Hospital, Layout of 3rd Floor



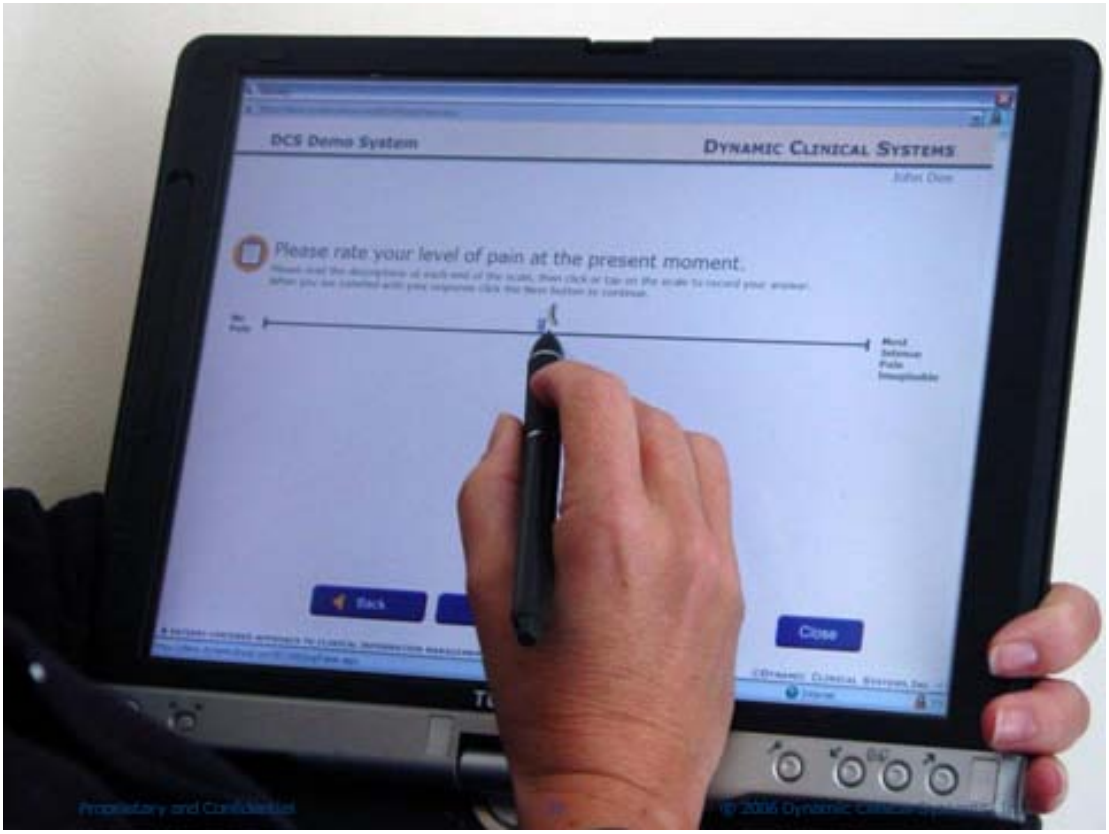
Source: Adapted from Dartmouth-Hitchcock website, http:/ / www.dhmc.org/ spine/ More_Appointment_Information/ find_us.html, accessed December 6, 2008.

Exhibit 7 Spine Center Income Statement, FY 2007

	Technical Services	Professional Services	Total
Gross Patient Service Revenue			
Technical	$1,618,023	-	$1,618,023
Professional	-	13,602	13,602
Total Gross Revenue	$1,618,023	$13,602	$1,631,625
Deductions from Revenue			
Contractuals	$577,693	$7,657	$585,350
Bad Debt	20,951	213	21,163
Charity	28,724	399	29,123
Total Deductions	$627,368	$8,268	$635,636
Net Patient Service Revenue	$990,656	$5,334	$995,989
Direct Operating Expenses			
Spine Center	$1,940,339	$1,049	$1,941,338
Medications	61	-	61
Nursing	1,169	-	1,169
Pathology	348	-	348
Radiology	720	386	1,106
Rehabilitation	2,046	-	2,046
Surgery	-	1,144	1,144
Other	534	3,314	3,848
Direct Operating Expenses	$1,945,216	$5,893	$1,951,109
Allocated Expenses	187,101	661	187,762
Margin Before Overhead	($1,141,661)	($1,221)	($1,142,882)
Overhead	221,267	685	221,952
Total Operating Expenses	2,353, 583	7,239	2,360,822
Operating Margin	($1,362,928)	($1,905)	($1,364,833)

Source: Company documents.

Exhibit 8 Touchpad for Patient Survey



Source: Company documents.

Exhibit 9 Sample of Aggregate Data for Spine Center Patients

View User Report

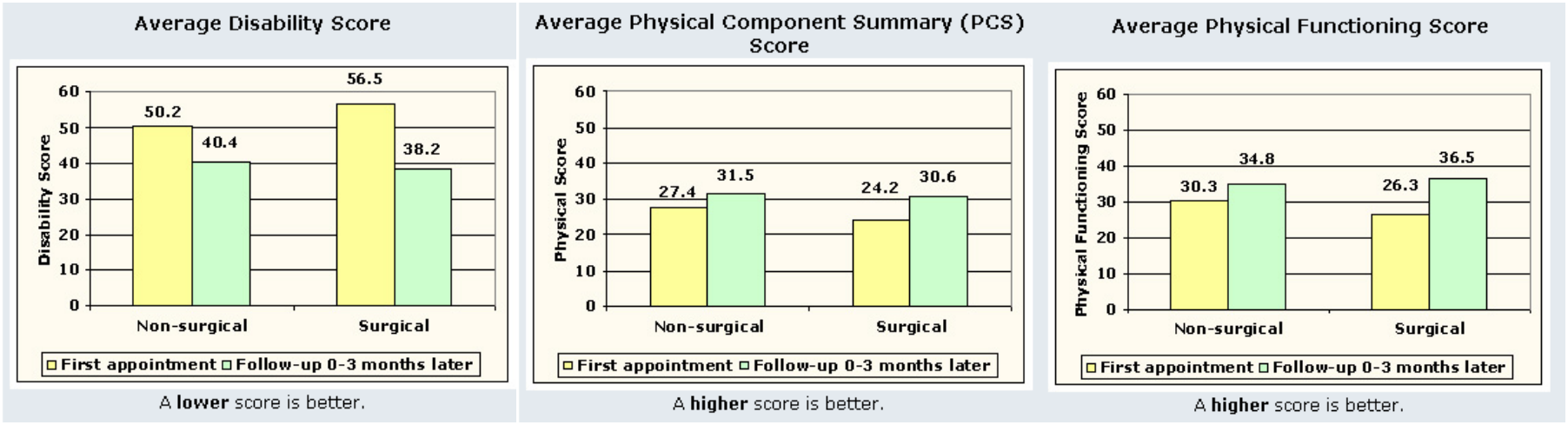
print close

Run Name:	Aggregate Survey Responses	**From Due Date:**	04/13/2003
Template Name:	Aggregate Survey Responses	**To Due Date:**	01/06/2006
Report Type:	Aggregate Survey Responses	**Clinical Area:**	Spine Clinic
Start Time:	01/06/2006 09:07AM	**Clinician:**	*<Not Set>*
Completion Time:	01/06/2006 09:10AM	**Survey Group:**	Spine Initial

Description	All	Women	Men	Unknown	Women 0-18	Women 19-49	Women 50-69	Women 70+	Men 0-18	Men 19-49	Men 50-69	Men 70+
Length of Spine Problems												
Asked	7131	3855	3276		24	1870	1346	615	19	1676	1182	399
Answered	6911	3727	3184		22	1831	1301	573	19	1641	1147	377
%More than 3 years	50.8	50.7	51.0	0.0	27.3	47.1	56.0	51.0	15.8	47.4	55.6	54.1
%1 to 2 years	11.4	12.6	9.9	0.0	22.7	13.8	10.8	12.2	15.8	10.6	9.0	9.5
%3 to 6 months	10.2	10.3	10.1	0.0	0.0	11.2	9.5	9.9	10.5	11.2	9.2	8.0
%2 to 3 years	8.6	8.5	8.6	0.0	4.5	8.9	8.1	8.6	21.1	8.5	7.1	12.7
%7 to 12 months	8.2	8.8	7.6	0.0	13.6	9.6	7.8	8.6	10.5	8.7	6.8	5.0
%Other	2.7	2.3	3.2	0.0	8.0	2.4	2.0	2.4	6.6	3.4	3.1	2.7
Average Worked Hours Per Work												
Asked	7131	3855	3276		24	1870	1346	615	19	1676	1182	399
Answered	6747	3619	3128		22	1781	1255	561	18	1619	1124	367
%40 or more hours	49.2	37.4	62.9	0.0	0.0	47.7	38.5	3.6	16.7	76.8	60.7	10.9
%Does not apply	30.9	37.4	23.4	0.0	45.5	22.1	37.4	85.4	33.3	12.0	24.0	71.4
%30 - 39 hours	10.1	13.2	6.6	0.0	18.2	16.7	12.7	2.7	16.7	6.7	6.9	4.6
%20 - 29 hours	5.7	7.1	4.0	0.0	18.2	8.3	6.4	4.3	5.6	2.9	5.0	6.0
%Less than 20 hours	4.1	5.0	3.0	0.0	18.2	5.2	5.0	4.1	27.8	1.6	3.4	7.1
Physical Requirements of Activity												
Asked	7131	3855	3276		24	1870	1346	615	19	1676	1182	399
Answered	6649	3555	3094		21	1763	1236	535	15	1605	1125	349
%Moderately strenuous	36.9	36.3	37.5	0.0	38.1	41.2	35.1	23.0	40.0	40.7	35.6	28.4
%A little strenuous	26.2	29.0	23.0	0.0	28.6	25.1	30.9	37.6	0.0	18.1	27.4	32.4

Source: Company documents.

Exhibit 10 Example of Summary Data for Surgical and Non-surgical Clinical Outcomes: Herniated Disc Patients[a]



Source: Dartmouth-Hitchcock Spine Center website, "Herniated Disc: Treatment Satisfaction and Outcomes," http:/ / www.dhmc.org/ qualityreports/ spine/ disc.cfm#outcomes, accessed December 15, 2008.

[a] These charts represent the survey results for patients with follow-up visits within 0-3 months of their first appointment, and therefore do not include the outcomes of patients who did not require a follow-up appointment.

Appendix A Referral Form

DARTMOUTH-HITCHCOCK MEDICAL CENTER

PH#:(603) 650-2225 SPINE CENTER REFERRAL FORM FAX# (603) 650-6322

Spine Center Home Page – http://www.dhmc.org/ortho/spine_center Quality Reports – http://www.dhmc.org/qualityreports/spine

LIST OF PROVIDERS

ORTHOPAEDIC SURGEONS:
William Abdu, MD, MS
Sohail Mirza, MD
Dilip Sengupta, MD
James Weinstein, DO,MS

NEUROSURGEONS:
Perry Ball, MD
Nathan Simmons, MD

PAIN SPECIALISTS:
Ralph Beasley, MD
Margaret Caudill-Slosberg, MD
Robert Rose, MD
Julie Sorenson, M.D.
Tabitha Washington, MD

NON-SURGICAL SPINE SPECIALISTS:
Rowland Hazard, MD
Jon Lurie, MD, MS
Linda Brown, ARNP
Colleen Olson, ARNP

OCCUPATIONAL MEDICINE:
Robert McLellan, MD

PHYSICAL THERAPISTS:
Eric Hartmann, DPT
Birgit Ruppert, PT,Cert MDT

OCCUPATIONAL THERAPY
Stacia Martin, OT

PHYSICAL THERAPY ASST:
Raynee Carlson, PTA

CARE MANAGEMENT:
Elizabeth Ossen,MSW
Patricia Proulx, MSW

FUNCTIONAL RESTORATION PROGRAM:
650-8285

For office use only:
Appt time and date:_____
_____
Provider:_____
_____

Patient Name:_____

DOB:_____ Soc. Sec#:_____

Address:_____

Hm#: (____)_____Wk#: (____)_____

Diagnosis/Comments (NO Codes please):_____

Is this for Workers Compensation: **YES NO** Date of Injury_____

Consultation Requested: (Completion of this document indicates a request for consultation/treatment)

☐ *Evaluation and Treatment – Comprehensive evaluation and treatment with a non-surgical spine specialist, including review of imaging, ,non-surgical treatment options, and/or subsequent consultation with a surgeon, pain specialist, spine trained physical therapist, and rehabilitation programs as indicated. This is a non-surgical evaluation. When in doubt, this is where to start.*

☐ *Anesthesia-Pain Service Provider – Comprehensive evaluation with an anesthesiologist specializing in pain management, providing recommendations for medication management to referring provider, assess indication for injections/procedures, or surgical or other referrals as appropriate.*

☐ *Functional Assessment – Comprehensive evaluation for patients with chronic pain lasting more than 3 months, who have failed medical and surgical management, to assess current physical capacities, personal recovery goals and make recommendations for rehabilitation.*

☐ *Physical/Occupational Therapy – Comprehensive evaluation/treatment by a therapist specializing in the treatment of back/neck pain patients, to include outpatient/home therapy programs. Includes work readiness assessments, conditioning, and mini-functional capacity evaluations.*

☐ *Surgical Opinion* – **Please verify with patient that they are seeking surgical intervention as a treatment option.** *Comprehensive evaluation by one of our Spine Center Surgeons to assess indications and options for surgical intervention for patients having failed medical management. If surgical indication is unclear or surgery is not indicated, after review of the documentation and imaging, we may refer to one of the services listed above for initial evaluation.* **If surgical opinion is requested, patient should have imaging concordant with clinical findings.)**

Pertinent imaging studies available of spine: _____ Date performed: _____

Are you requesting a specific provider? If so please list here: _____

At the Spine Center we will do our best to honor your requests for specific providers, but in some cases this causes delay in access. After review of access and clinical documentation, we may schedule alternate triage for your patient to provide the most appropriate and timely evaluation. We will do our best to call your office to discuss any changes.

Pertinent documentation should be sent for this appointment, including, when possible: imaging reports, operative reports pertinent to the evaluation, injection studies, past medical history, medications, allergies.

Patients should be instructed to HAND CARRY their imaging studies and if possible the imaging reports if not at DHMC-Lebanon.

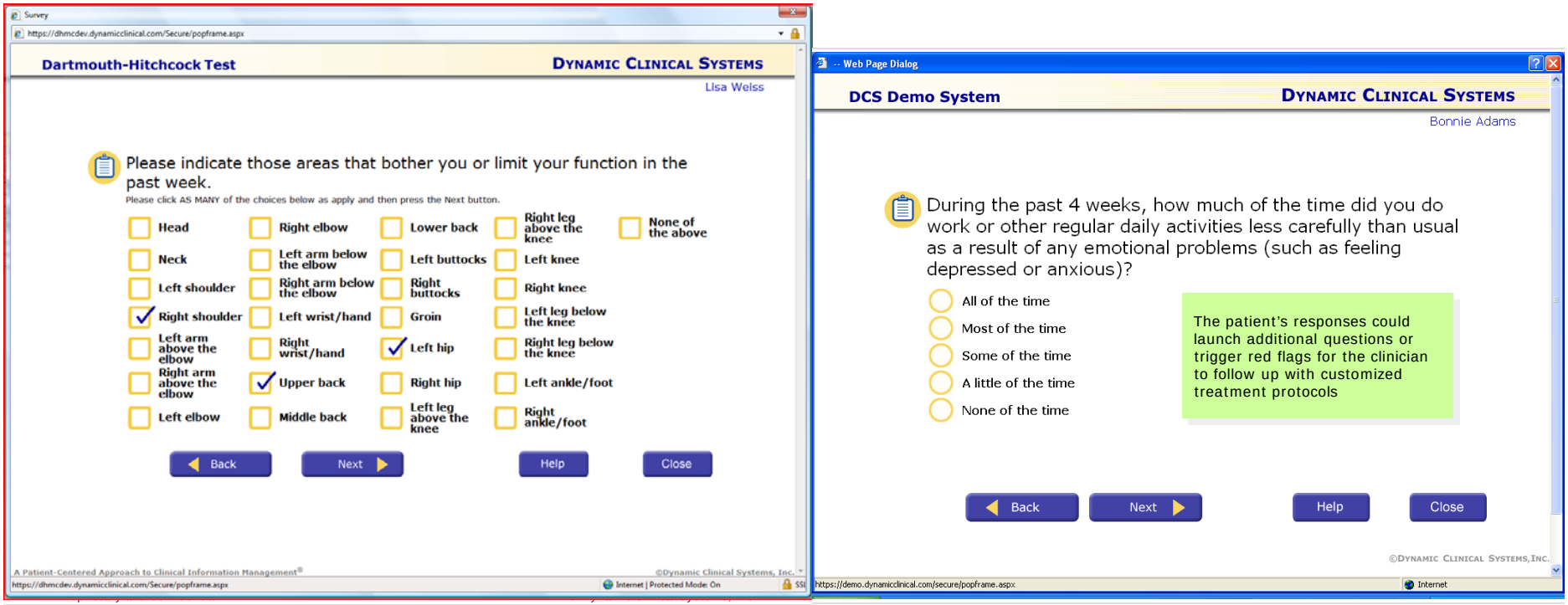
REFERRING PROVIDER (please print):

Name:	
Address:	
PH#	FAX#:

Notice regarding confidentiality: This facsimile transmission and the accompanying material contain confidential information from the Dartmouth-Hitchcock Medical Center that may be privileged. The information is for the exclusive use of the addressee named on this transmission sheet. Disclosure, copying, distribution, or use of the contents of the material transmitted by person(s) other than the intended recipient is prohibited. If you have received this facsimile in error, please notify us immediately by telephone so that we may arrange to retrieve these documents.

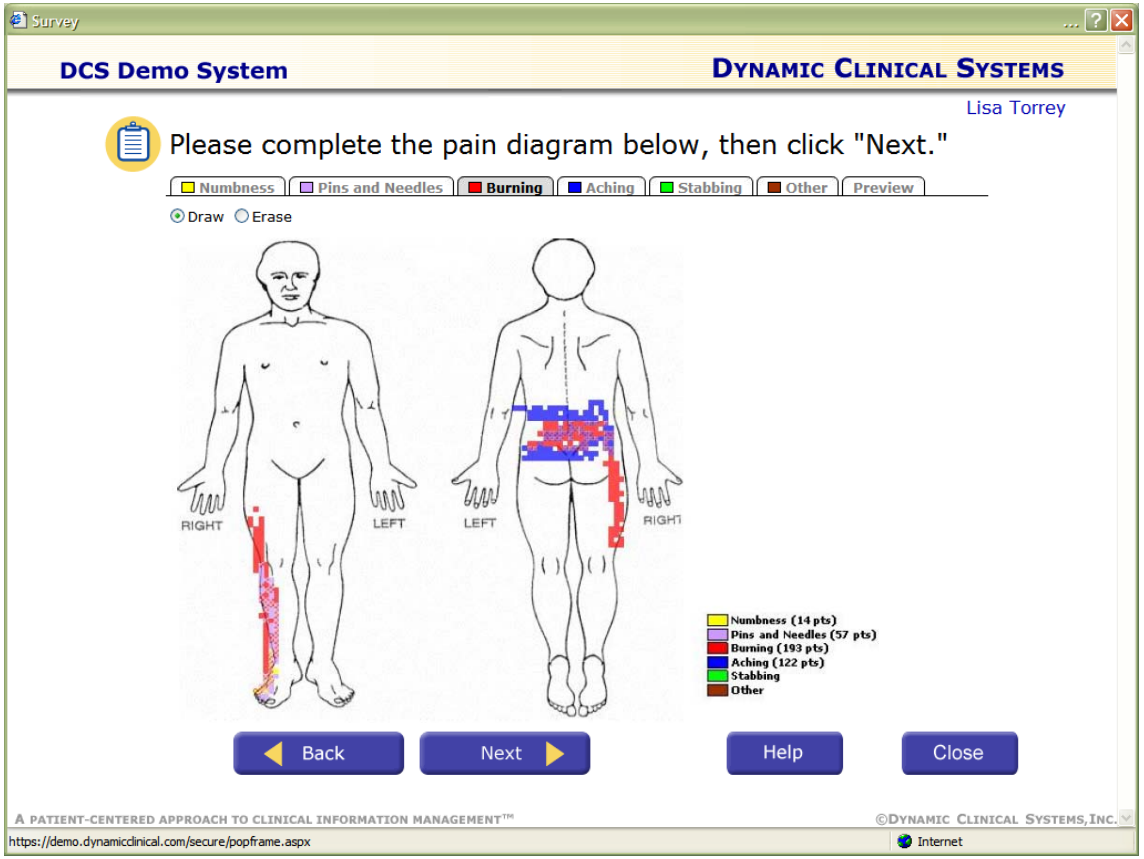
Source: Company documents.

Appendix B Sample Electronic Survey Questions



Source: Company documents and Dynamic Clinical Systems.

Appendix C Sample Pain Diagram



Source: Company documents and Dynamic Clinical Systems.

Appendix D Sample Patient Summary Report

Real Spine Patient A –
H-Quest Patient Summary Report

Patient: [redacted] Clinician: Abdu MD,William A Report Date: [redacted]

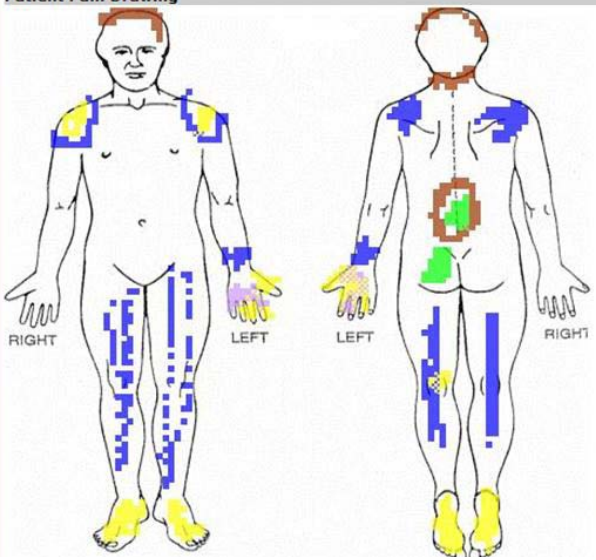
NO Photo On File

Appointment: Spine Clinic; RN6; 08/30/2007
Survey Group: Spine Initial; completed on 08/30/2007; 35 mins
Reason for visit: Initial evaluation

Review of Systems *(as of 08/30/2007)*

Const: Weight loss; Weakness; Fatigue, lack of energy; Fever or chills; Pain
ENT, Eyes: Dry mouth
Resp: Wheezing; Shortness of breath
Cardio: Heart palpitations (fluttering heart beat); Swelling of arms or legs
GI: Nausea, vomiting
Uro-gyn: Sexual problems
M/S: Joint stiffness; Joint pain; Back pain; Muscle stiffness; Reduced range of motion
Neuro: Balance difficulty, dizziness; Numbness, tingling; Muscular weakness; Other neurological symptoms
Hemo/lymph: Patient denies any blood/lymph node symptoms
Psych: Memory loss, forgetfulness, confusion; Difficulty concentrating; Feeling irritable; Anxiety, worry; Difficulty sleeping
Skin/Hair:

Patient Pain Drawing



Personal Summary *(as of 08/30/2007)*

Demographics: White; Male; 55 yrs old; Married; Graduated from high school or GED
Primary Language: English
Working Status: Disabled and/or retired because of ill health
Physical requirements of job/activity: Moderately strenuous
Social: Does not live alone

Work Disability *(as of 08/30/2007)*

Job requirements: Moderately strenuous
Legal action: None
Social Security disability: Not planning to apply
Disability Insurance: Receiving
Worker comp disability: Not planning to apply

Health History *(as of 08/30/2007)*

Current conditions: COPD, emphysema, Sleep apnea; Anxiety
Condition history: Fracture; COPD, emphysema, Sleep apnea; High cholesterol; None; Erection problems; Anxiety, Depression
Previous Surgeries: Spine surgery, Bone fracture repair surgery, Other bone/joint/musculoskeletal surgery
Hospitalizations, Bone, joint, musculoskeletal: 4
Family history: Cancer, Diabetes, Arthritis, Spine problems, High cholesterol, Osteoporosis; Lung Cancer
Family Members w/ Lung Cancer: Father(Older than 70 years old)
Family Members w/ Diabetes: Brother(50 - 70 years old)
Medications: Anti-inflammatory, Muscle relaxant, Narcotics
Pain med frequency: 3 or more times a day
Pain med effect on symptoms: Relieves symptoms somewhat
Medication allergies: None known

Health Habits *(as of 08/30/2007)*

BMI: 21.7 (Normal weight); 160 lbs; 6 feet, 0 in
Tobacco use: Currently smoke / chew tobacco; Cigarettes;

History of Present Illness *(as of 08/30/2007)*

Chief complaint: Left shoulder, Right shoulder, Left elbow, Right elbow, Left wrist/hand, Right wrist/hand, Middle back, Lower back, Left buttocks, Left leg above the knee, Left leg below the knee
Initial Visit: 08/30/2007
Length of symptoms: More than 3 years
Date of episode: 07/07/2007
Prior providers: Emergency Room, General Practitioner, Orthopedic Surgeon, Pain Clinic
Prior treatments: Medication, Physical/Occupational Therapy, Splint or brace, Surgery, Pain Clinic

Red Flags / Considerations

Clinical protocols / measures

Low Mental Component Score
Counsel patient on smoking cessation

Patient-reported scores (see graphs on next page)

ODI: 68 (lower = better)
AUDIT: 2: low risk
Physical Function: 19 (Norm: 49)
Role Physical: 18 (Norm: 49)
Bodily Pain: 20 (Norm: 50)
General Health: 35 (Norm: 50)
Vitality: 21 (Norm: 52)
Social Function: 13 (Norm: 51)
Role Emotional: 25 (Norm: 51)
Mental Health: 13 (Norm: 52)
MCS: 19 (Norm: 52)
PCS: 25 (Norm: 49)

	Expectations	Expectation met
Symptoms Relief:	Extremely likely	
More Activities:	Extremely likely	
Sleep Better:	Extremely likely	

Numbness (212 pt
Pins and Needles (
Burning
Aching (326 pts)
Stabbing (40 pts)
Other (108 pts)

Source: Company documents and Dynamic Clinical Systems.

Endnotes

[1] The Dartmouth-Hitchcock Medical Center website, http://www.dhmc.org/webpage.cfm?site_id=2&org_id=566&gsec_id=28903&sec_id=28903&item_id=28903, accessed November 20, 2008.

[2] Christine Paquin, "DHMC Ranked Top 50 in Oncology, Gynecology," *The Dartmouth.com News*, July 24, 2007, http://thedartmouth.com/2007/07/24/news/dhmc/ accessed on October 7, 2008.

[3] *U.S. World News and Report* ranked DHMC one of the nation's top hospitals in its *2007 Report of America's Best Hospitals*. "Awards and Rankings," *The Dartmouth Hitchcock Medical Center website*, www.dhmc.org accessed on October 7, 2008.

[4] The Dartmouth Atlas of Healthcare Recent News and Press Releases web page, www.dartmouthatlas.org/press/releases.htm accessed November 9, 2008. Specifically see: "Medicare pays some California Hospitals four times more than others…" (November 2005) and "Dartmouth studies show wide variations in hospital care and outcomes for chronically ill Medicare patients," (October 2004).

[5] To see CBS Evening News clip visit http://www.cbsnews.com/stories/2007/06/20/eveningnews/main2956631.shtml accessed October 7, 2008.

[6] Patrick Thatcher, "Back Pain Costs Americans Billions Annually," *McLatchy-Tribune Business News*, November 10, 2008, via ProQuest Smart Search, accessed December 1, 2008.

[7] William S. Shaw, Steven J. Linton and Glenn Pransky, "Reducing Sickness Absence from Work Due to Low Back Pain," *The Journal of Occupational Rehabilitation,"* 2006. Volume 16, Issue 4, p. 592, via ProQuest Smart Search, accessed December 1, 2008.

[8] This paragraph based on the following article, Brook I. Martin, et. al, "Expenditures and Health Status Among Adults with Back and Neck Problems," *Journal of American Medical Association*, 2008; 299 (6); 656-664 via www.jama.com accessed November 4, 2008.

[9] "Consumer Health: Spine Conditions and Treatments," North American Spine Society website, http://www.spine.org/Pages/Default.aspx, "Anatomy of the Spine," Southern California Orthopedic Institute website, http://www.scoi.com/spinanat.htm, "Spinal Stenosis," and "Sciatica," Spine-Health website, http://www.spine-health.com/, accessed December 9, 2008, and and "Spinal Stenosis," Mayoclinic.com, http://www.mayoclinic.com/health/spinal-stenosis/DS00515, accessed December 11, 2008.

[10] Philip R. Shalen, M.D., "Specialty Care Physicians and Pain Management," Spine-Health website, http://www.spine-health.com/treatment/pain-management/specialty-care-physicians-and-pain-management, accessed December 9, 2008.

[11] "Low Back Pain," American Academy of Orthopedic Surgeons, http://orthoinfo.aaos.org/topic.cfm?topic=A00311#Diagnosis, and "Neurological Diagnostic Tests," American Academy of Neurological Surgeons, June 2006, http://www.neurosurgerytoday.org/what/patient_e/glossary.asp, accessed December 10, 2008.

[12] American Academy of Orthopedic Surgeons, "Low Back Pain," September 2007, http://orthoinfo.aaos.org/topic.cfm?topic=A00311, accessed December 2, 2008.

[13] "Discectomy," North American Spine Society website, http://www.spine.org/Pages/ConsumerHealth/SpineConditionsAndTreatments/CommonProblemsCorrectiveActions/CommonSurgicalProcedures/Discectomy.aspx, accessed December 9, 2008.

[14] "Laminectomy or Laminotomy," North American Spine Society website, http://www.spine.org/Pages/ConsumerHealth/SpineConditionsAndTreatments/CommonProblemsCorrectiveActions/CommonSurgicalProcedures/LaminectomyorLaminotomy.aspx, accessed December 9, 2008.

[15] Peter F. Ullrich, Jr., M.D., "Lumbar Spinal Fusion Surgery," Spine-Health website, http://www.spine-health.com/treatment/spinal-fusion/lumbar-spinal-fusion-surgery, accessed December 9, 2008.

[16] "Back Pain; Most Back Pain Could Be Cured without Surgery or Drugs if Doctors if Doctors Treated Muscles—not the Spine—Says Leading Pain Specialist," *Pharma Business Week*, April 21, 2008, via Factiva, accessed December 2, 2008.

[17] "Medicare Reimbursements UP Overall but Down for 360° Fusions: Notes from This Year's Surprising CMS IPP Proposal," Spine-Health website, http://doctor.spine-health.com/Pro/practice/medicare/medicare01.html, accessed December 9, 2008.

[18] "Acute Care/Hospitalization: Patients who undergo lumbar spine surgery are likely to have another operation later," U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality, April 2007, http://www.ahrq.gov/research/apr07/0407RA19.htm, accessed December 2, 2008.

[19] Richard A. Deyo, M.D., M.P.H., Alf Nachemson, M.D., Ph.D., and Sohail K. Mirza, M.D., "Spinal Fusion Surgery—The Case for Restraint," *The New England Journal of Medicine*," February 12, 2004, Vol. 350, No. 7, p. 722-726, http://content.nejm.org.ezp-prod1.hul.harvard.edu/cgi/content/full/350/7/722#R19, accessed December 2, 2008. Also supporting this assertion was a study published in *The British Medical Journal* that found that spinal fusion candidates may achieve comparable results to non-surgical rehabilitation. "Spinal Fusion," Mayo Clinic.com, May 13, 2008, http://www.mayoclinic.com/health/spinal-fusion/BA00011, accessed December 2, 2008.

[20] Eugene J. Carragee, M.D., "Persistent Low Back Pain," *The New England Journal of Medicine*, May 5, 2005, Vol. 352, No. 18, p. 1891–1898, http://content.nejm.org.ezp-prod1.hul.harvard.edu/cgi/content/full/352/18/1891, accessed December 2, 2008.

[21] Marjorie Eskay-Auerbach, M.D., J.D., Heidi Prather, D.O, and Stuart W. Weinstein, M.D., "Back Pain Basics: Common Questions, Uncomplicated Answers," North American Spine Society, 2007, http://www.spine.org/Documents/back_pain_basics_web.pdf, accessed December 9, 2008.

[22] James N. Weinstein, D.O., M.S., Pamela W. Brown, M.S., R.N, Brett Hanscom, M.S., Thomas Walsh, M.S. P.T., O.C.S., Dip. M.D.T., and Eugene C. Nelson, D.Sc., "Designing an Ambulatory Clinical Practice for Outcomes Improvement: From Vision to Reality—The Spine Center at Dartmouth-Hitchcock, Year One," Quality Management in Health Care, 2000, Vol. 8, No. 2, p. 1-20.

[23] Dartmouth-Hitchcock website, "Spinal Stenosis," http://www.dhmc.org/qualityreports/spine/stenosis.cfm, and "Herniated Disc," http://www.dhmc.org/qualityreports/spine/disc.cfm, accessed December 16, 2008.

[24] James N. Weinstein, D.O., M.S., Tor D. Tosteson, Sc.D., Jon D. Lurie, M.D., M.S., Anna N.A. Tosteson, Sc.D., Emily Blood, M.S., Brett Hanscom, M.S., Harry Herkowitz, M.D., Frank Cammisa, M.D., Todd Albert, M.D., Scott D. Boden, M.D., Alan Hilibrand, M.D., Harley Goldberg, D.O., Sigurd Berven, M.D., Howard An, M.D., for the SPORT Investigators, "Surgical Versus Non-Surgical Therapy for Lumbar Spinal Stenosis," *The New England Journal of Medicine*, February 21, 2008, Vol. 358, No. 8, p. 794-810, http://content.nejm.org/cgi/content/abstract/358/8/794, accessed December 9, 2008.