THE COMMONWEALTH FUND

Case Study

Organized Health Care Delivery System • August 2009

Marshfield Clinic: Health Information Technology Paves the Way for Population Health Management

Douglas McCarthy, Kimberly Mueller, and Sarah Klein
Issues Research, Inc.

ABSTRACT: Marshfield Clinic is a not-for-profit, physician-governed multispecialty group practice serving residents of rural Wisconsin through a regional ambulatory care system, an affiliated health plan, and related foundations supporting health research and education. Marshfield has engaged its physicians and staff in a program of clinical performance improvement aimed at enhancing patient access, coordination of care, and efficiency of clinical operations. An internally developed electronic health record acts as a care planning tool for delivering preventive care and managing chronic diseases. A telemedicine network expands access to care for patients living in rural and remote areas. Marshfield Clinic's experience shows how an organized group of physicians can improve patient outcomes and reduce costs by undertaking a population-based approach to ambulatory care management supported by robust information technology. It also suggests that group-level performance incentives that are aligned with an organization's strategic goals have the potential to enhance population health management.

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For more information about this study, please contact:

Douglas McCarthy, M.B.A.
Issues Research, Inc.
dmccarthy@issuesresearch.com

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Commonwealth Fund pub. 1293
Vol. 26

OVERVIEW

In August 2008, the Commonwealth Fund Commission on a High Performance Health System released a report, *Organizing the U.S. Health Care Delivery System for High Performance*, that examined problems engendered by fragmentation in the health care system and offered policy recommendations to stimulate greater organization for high performance.[1] In formulating its recommendations, the Commission identified six attributes of an ideal health care delivery system (Exhibit 1).

Marshfield Clinic is one of 15 case study sites that the Commission examined to illustrate these six attributes in diverse organizational settings. Exhibit 2 summarizes findings for Marshfield. Information was gathered from Marshfield Clinic health system leaders and from a review of supporting documents.[2] The case study sites exhibited the six attributes in different ways and to

Exhibit 1. Six Attributes of an Ideal Health Care Delivery System

- ***Information Continuity*** Patients' clinically relevant information is available to all providers at the point of care and to patients through electronic health record (EHR) systems.
- ***Care Coordination and Transitions*** Patient care is coordinated among multiple providers, and transitions across care settings are actively managed.
- ***System Accountability*** There is clear accountability for the total care of patients. (We have grouped this attribute with care coordination since one supports the other.)
- ***Peer Review and Teamwork for High-Value Care*** Providers (including nurses and other members of care teams) both within and across settings have accountability to each other, review each other's work, and collaborate to reliably deliver high-quality, high-value care.
- ***Continuous Innovation*** The system is continuously innovating and learning in order to improve the quality, value, and patients' experiences of health care delivery.
- ***Easy Access to Appropriate Care*** Patients have easy access to appropriate care and information at all hours, there are multiple points of entry to the system, and providers are culturally competent and responsive to patients' needs.

varying degrees. All offered ideas and lessons that may be helpful to other organizations seeking to improve their capabilities for achieving higher levels of performance.[3]

ORGANIZATIONAL BACKGROUND

Marshfield Clinic, headquartered in Marshfield, Wisconsin (population 19,500), is a not-for-profit multispecialty group practice founded in 1916 with a mission to serve patients by providing accessible, high-quality health care, research, and education. Marshfield employs almost 800 physicians and 6,400 staff and serves 377,000 individual patients at 41 ambulatory care sites located in 33 communities in predominantly rural areas of northern, central, and western Wisconsin (Exhibit 3). Patients made 3.6 million visits during 2008. Roughly 28 percent of the clinic's physicians, including those in family practice, general internal medicine, and pediatrics, provide primary care—33 percent when including those who specialize in obstetrics and gynecology.

Marshfield operates as a regional ambulatory care system. Its market share is 34 percent of the primary care delivered in its service area, which covers 60 percent of the state and includes about 1 million people. About one-half of its physicians practice in Marshfield and the other half in outlying communities. The Clinic expanded from its original Marshfield location in response to invitations from underserved communities, through mergers with and purchases of other local physician practices, and from the ongoing development of new clinic sites (several under way) that have been chosen to help maintain a balanced patient demographic base encompassing all segments of the population.

The Clinic's main campus in Marshfield is adjacent to St. Joseph's Hospital, a 500-bed Catholic teaching institution and regional referral center owned by Milwaukee-based Ministry Health Care. Marshfield Clinic and Ministry Health Care jointly own and operate a 25-bed critical-access hospital in Park Falls and a diagnostic and treatment center on a shared medical campus in Weston. Marshfield also recently assumed control of a 75-bed acute-care hospital in Rice Lake, known as Lakeview Medical Center.

Marshfield Clinic sponsors Security Health Plan (SHP) of Wisconsin, the successor to the Greater Marshfield Community Health Plan—one of the first health maintenance organizations to serve a rural area of the United States.[4] SHP arranges employer group,

Exhibit 2. Case-Study Highlights

Overview: The not-for-profit Marshfield Clinic serves residents of northern, central, and western Wisconsin through a multispecialty group practice of almost 800 physicians who provide care to 377,000 patients visiting 41 ambulatory clinics in 33 rural communities, a health plan covering 150,000 people living in 32 counties, and related foundations supporting the institution's research and education mission.

Attribute	Examples from Marshfield Clinic
Information Continuity	An electronic health record (EHR) with decision support and electronic prescribing is available across all Clinic sites and on portable tablet PCs. The system enables physicians to access patient medical records and laboratory and radiology results from hospital and ambulatory settings or from home. When indicated, the EHR requires physicians to acknowledge the risk of a severe drug interaction before proceeding with a prescription. A patient Web portal provides patients with online access to health information, immunization records, and prescription refill requests. A Web-based immunization registry links health care providers, health departments, schools, day-care centers, and a retirement community in a 23-county area.
Care Coordination and Transitions; System Accountability*	The EHR shows when preventive and chronic care services are due and generates an intervention list of patients with high-risk chronic conditions who are not meeting treatment goals to support physicians and their assistants in care planning and follow-up. A messaging tool enables providers to request assistance or lab tests from the exam room, streamlining communication with support staff while also creating an electronic record of those interactions. Nurses manage telephonic care following physician-approved protocols for anticoagulation, heart failure, and cholesterol control.
Peer Review and Teamwork for High-Value Care	Physicians engage in improvement through guideline-based performance feedback, coaching, and education. Regional medical directors attend local departmental meetings to share performance results and improvement strategies and solicit feedback.
Continuous Innovation	Clinic leaders have made the achievement of high performance an integral part of the organization's core strategy and vision. Participation in the Medicare Physician Group Practice (PGP) Demonstration enables the medical group to assess the effects of performance incentives on outcomes. Local sites are engaged in redesign efforts to optimize workflows, e.g., assigning medical assistants specific clinical tasks such as conducting diabetic foot exams. The Biomedical Informatics Research Center invents and tests new approaches to information synthesis that enhance and facilitate the clinical use of information technology by physicians and staff. A personalized medicine research project aims to develop an individually tailored approach to prevention, diagnosis, and treatment based upon a person's unique genetic profile. The Center for Community Outreach supports evidence-based population and environmental health improvement strategies in priority areas identified by the State of Wisconsin.
Easy Access to Appropriate Care	Marshfield serves all patients who seek care, regardless of ability to pay. Its contractual partnership with a federally qualified community health center provides medical and dental care to low-income uninsured and underinsured individuals and families. A mobile health screening van provides testing and referral for women regardless of insurance. Advanced-access scheduling increases timeliness of appointments and continuity with the same physician. Nurses staffing a 24-hour call line use the EHR to tailor advice to care plans, perform triage using online guidelines, and schedule clinic appointments (at select clinics) as needed. Telehealth services expand access to care in rural and remote areas to overcome transportation barriers and health provider shortages. "Telepharmacy" services enable drug dispensing in remote locations that lack a pharmacy.

* System accountability is grouped with care coordination and transitions, since these attributes are closely related.

Exhibit 3. Marshfield Clinic Locations

Source: The Marshfield Clinic.

individual, Medicaid, Medicare, and Children's Health Insurance Program coverage, as well as third-party administration, for 150,000 residents of 32 Wisconsin counties through a network of 42 affiliated hospitals and 3,800 providers (including Marshfield Clinic physicians). The health plan offers open access to its specialists, without the need for a referral from a primary care physician. While 22 percent of Marshfield's patients are enrolled in the health plan, SHP is both administratively and financially separate from the Clinic and does not subsidize its operations.[5]

Other business ventures include Marshfield Laboratories, which provides clinical testing services for clients nationwide, occupational health services, and an applied sciences division that seeks commercial applications for biotechnology innovations.

Two related foundations help fulfill the Clinic's research and educational mission. The Marshfield Clinic Research Foundation employs scientists and supports the Clinic's physician investigators in the conduct of approximately 450 clinical research trials and other health research projects that are designed to advance and communicate scientific knowledge that improves health. The goal is "integrating research into practice and clinical practice into research," said Humberto Vidaillet, M.D., medical director of the research foundation. The foundation has five centers, which focus on clinical research, rural health, human genetics, epidemiology, and biomedical informatics (see Continuous Innovation section for more on the latter). The Marshfield Clinic Education Foundation sponsors graduate medical residency and fellowship programs, continuing professional medical education, patient education, and other learning opportunities. Marshfield Clinic is also a designated academic campus of the University of Wisconsin School of Medicine, where many Marshfield physicians hold clinical teaching appointments.

The organization is governed by a board of directors on which Clinic physicians are eligible to serve after two years of employment. The board elects a nine-member executive committee and meets monthly to review the committee's actions, make major decisions, and set policy. Roughly 75 percent of Marshfield's net revenue ($906 million in 2008) comes from commercial sources, including Security Health Plan, which pays the Clinic on a capitated basis that promotes proactive care management. The remainder comes from Medicare, Medicaid, and federally qualified health center (FQHC) programs.

INFORMATION CONTINUITY

Marshfield Clinic has developed an electronic health record (EHR) of increasing sophistication since 1985, with electronically coded clinical information on all patients dating back to 1960. Clinic physicians were provided wireless, tablet-style personal computers in 2003 for quick access to the EHR and for electronic prescribing and dictation. The EHR, named CattailsMD, allows providers to access patient information including diagnoses, procedures, medications, test results, radiology images, and physicians' notes at all Clinic locations. Digital ink-over forms enable physicians and staff to complete forms quickly and add drawings or other free-form notes to the medical record as necessary. A data warehouse supports the EHR's analytic and reporting functions.

Marshfield's ongoing information technology investments, including the cost of the EHR, represent about 3.5 percent of its annual revenue. The Clinic eliminated paper charts in 2007, saving an estimated $7 million per year (about 25 percent of its health information management and medical transcription budget) by reducing space and centralizing job functions. Overall patient satisfaction increased during implementation of the EHR, and anecdotal feedback suggests that patients are responding positively to the Clinic's use of information technology. The EHR has enabled a number of improvements, as described below.

Web Portal for Patients. Patients can use a Web portal to communicate electronically with the Clinic and perform such tasks as requesting prescription refills, checking on needed preventive care, viewing their health history and laboratory results, and learning about various medical topics. The Clinic is considering expanding the services the portal provides to include e-visits and electronic scheduling. Approximately 16 percent of patients now make use of it.

Electronic Access to Lab Results. Laboratory test results and imaging studies are available electronically for physician or consulting specialist review, eliminating delays in document or film transfer and the duplicate testing that often results from missing information. The presentation of this information and other patient data can be customized to highlight results that are important to particular specialties. For instance, a cardiologist may highlight electrocardiogram results and discharge summaries for easy viewing, while a nephrologist may highlight laboratory results for dialysis patients. The integration of electronic dental and medical records is another new focus.

E-Prescribing with Decision Support. Electronic prescribing allows physicians to take account of patients' drug allergies (tracked by the EHR) and reduces problems related to illegible handwriting, thus minimizing the incidence of medication errors, pharmacy callbacks, and patient time spent waiting for prescriptions to be filled. When indicated, the software prompts physicians to acknowledge the risk of a severe (i.e., contraindicated) drug interaction before proceeding with a prescription. After making such acknowledgment mandatory, the rate at which such prescriptions were cancelled increased from 8 percent to 31 percent.

Marshfield encourages physicians to consider the use of "preferred alternatives" in prescription drug classes that have interchangeable drug products, a large difference in monthly cost, and a large volume of prescriptions with variation in prescribing practices. After the Clinic required physicians to document in the EHR the reason they chose not to use the preferred alternative, prescribing patterns changed, saving payers and patients $2.5 million in one year. The majority of those savings came from increased use of two preferred drugs: Prilosec OTC (an over-the-counter version of a popular "proton pump inhibitor"), whose use rose from 49 percent of its drug class to 63 percent, and a preferred statin (cholesterol-lowering drug) that jumped in use from 35 percent of its drug class to 65 percent. The benefits accrue to many stakeholders. "If you have electronic prescribing with appropriate decision support, you should be able to decrease the cost of drug therapy to society, to payers, and to patients, ultimately," said Gary S. Plank, Pharm.D., corporate director of pharmacy services.

Electronic Registries and Databases for Tracking Immunizations and Community Health. During the 1990s, Marshfield Clinic collaborated with local immunization providers to develop an electronic registry for tracking childhood immunizations. Today, the Web-based Registry for Effectively Communicating Immunization Needs (RECIN) links physicians, hospitals, nursing homes, public health departments, schools, day-care centers, and a retirement community in a 23-county area and interfaces with the Wisconsin Immunization Registry to document up-to-date immunization history across a patient's life span. RECIN incorporates a decision-support system to avoid over- or under-immunization, warns about vaccine contraindications and allergies, improves the efficiency of vaccine administration and billing, and facilitates outreach to patients who are due or overdue for immunizations. Within 14 months of the registry's deployment, the immunization rate for two-year-olds in Wood County (where Marshfield Clinic is located) rose from 67 percent to the national goal of 91 percent.[6]

In 1991, the Marshfield Clinic Research Foundation created the Marshfield Epidemiologic Study Area (MESA) to facilitate population-based health research. MESA is a region of 24 zip codes in northern and central Wisconsin where the majority of the 85,000 residents receive their medical care from Marshfield. Researchers combine data on the population in this region with primary and specialty care records from the Clinic and tertiary care records from the local hospital. The relative stability of the local population enables continuity in data collection for tracking and studying changes in the health of the community over longer periods.

The database also can be tapped to monitor emerging public health concerns, such as the effectiveness of the flu vaccine and available treatments each flu season, with immediate benefits to Marshfield Clinic patients. For example, prior to the 2008–2009 influenza season, Marshfield Clinic's research team was working in collaboration with the Centers for Disease Control and Prevention to conduct real-time effectiveness studies of influenza vaccines, using MESA as a study population. When the researchers discovered in early 2009 that the flu strain circulating in the community was one the CDC had identified as being resistant to the commonly prescribed antiviral drug oseltamivir, the Clinic was able to alert its physicians of these findings immediately via e-mail. "That has huge implications for correct treatment and better patient care," said Theodore Praxel, M.D., M.M.M., Marshfield Clinic's medical director for quality improvement and care management. "Avoiding an ineffective treatment means not wasting the patient's resources on a medication that wouldn't help," he said.

Ministry Health Care, which operates hospitals and medical groups in Marshfield Clinic's service area, recently agreed to purchase Marshfield Clinic's EHR system for implementation in its facilities over the next three to five years (the EHR is already being used at one Ministry Medical Group location and in two Ministry hospitals). The two organizations plan to link their systems as part of a regional health information organization allowing shared access to 2.5 million patient records.[7] The EHR met 2006 standards for functionality, interoperability, and security issued by the nonprofit Certification Commission for Healthcare Information Technology.

CARE COORDINATION AND TRANSITIONS: TOWARD GREATER ACCOUNTABILITY FOR TOTAL CARE OF THE PATIENT

Primary Care Teams. Marshfield Clinic views care management as a critical component of its population health management philosophy, which emphasizes the role that primary care teams can play in coordinating care for patients within the larger environment of a multispecialty practice.[8] Because many patients have multiple chronic diseases, the Clinic seeks an integrated approach to disease management as an extension of primary care. Physician assistants and nurse practitioners, who provide care to defined panels of patients or handle urgent care visits, also extend the role of primary care within the Clinic.

Primary care teams use the EHR-generated "iList" (short for intervention list) to identify patients

with chronic conditions (e.g., diabetes, heart failure, high blood pressure) who are not meeting treatment goals. The primary care physician's medical assistant reviews the list and follows evidence-based protocols to perform delegated tasks and outreach. For example, the medical assistant might call a diabetic patient to schedule an overdue blood lipid test so that lab results are available at the patient's next planned care visit. This proactive approach enhances the physician's ability to engage in care planning and reduces the need for follow-up later. "Our physicians have found that using [the iList] has been an eye-opener as far as putting a face on those patients who could be slipping through the cracks," Douglas J. Reding, M.D., M.P.H., the Clinic's vice president, said in recent Congressional testimony.[9]

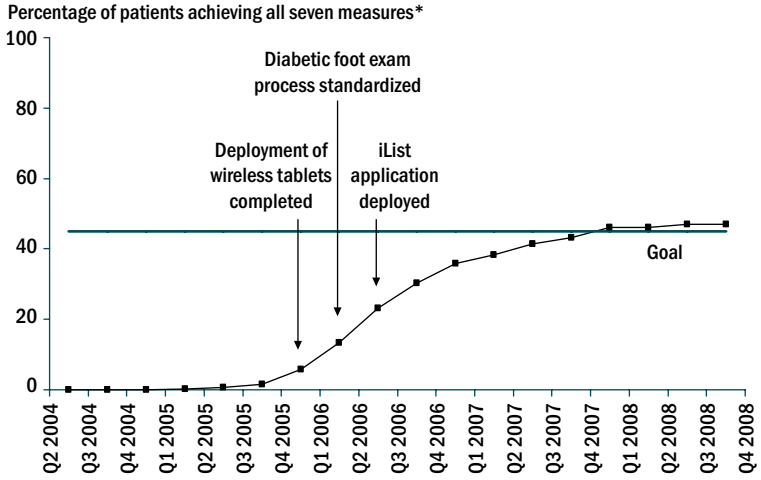
To facilitate comprehensive care during patient visits, the "PreServ" (preventive services) application organizes clinical information within the EHR into an electronic "dashboard" that highlights needed preventive and chronic care services (e.g., immunizations, cancer screenings, laboratory tests for diabetes). Physicians can communicate with support staff to order these services or request other assistance without leaving the exam room by using a messaging tool in the EHR that links the message to the medical record. The system streamlines communication and helps ensure that tasks are completed. Physicians also use the system to print graphs and other reports to aid in educating patients and tracking their progress over time.

Customization features within the EHR allow physicians to accelerate patient monitoring schedules, when, for example, patients need closer follow-up after abnormal test results or when they have a family history of cancer. Physicians can refer patients who face challenges controlling diabetes to an intensive self-management education program taught by a multidisciplinary team including diabetes educators, dieticians, pharmacists, behavioral specialists, and therapists.

These and other quality improvement interventions—such as the use of evidence-based guidelines and standing orders, the provision of continuing medical education and performance feedback, and standardization of care processes—are associated with substantial improvements in "bundles" of quality measures that the Clinic tracks for its population of approximately 17,500 patients with diabetes.[10]

- The proportion of diabetics who received all of seven chronic care services—blood pressure measurement, two hemoglobin A1c tests, a fasting lipid profile, a microalbumin test

Exhibit 4. Marshfield Clinic: Effects of Diabetes Quality Improvement Initiative on Process of Care



Note: Electronic reminder system deployed in first quarter 2005.
* Measures include: blood pressure, hemoglobin A1c, two hemoglobin A1cs, fasting lipid profile (LDL), microalbumin/evidence of nephropathy, pneumococcal vaccination, and foot exams.
Source: Marshfield Clinic.

(or evidence of nephropathy), pneumococcal vaccination, and a foot exam—rose from zero in 2004 to 47 percent in 2008 (Exhibit 4).

- Diabetics achieving three treatment goals—control of blood glucose, blood pressure, and low-density lipoprotein (LDL) cholesterol—rose from 8 percent to 21 percent from 2004 to 2008 (Exhibit 5).
- The rate of all-cause hospitalizations among diabetic patients fell from 360 per 1,000 in 2005 to 317 per 1,000 in 2007. The Clinic estimates that this reduction saved $5 million to $14 million from avoided hospital admissions (Exhibit 6).

Telephonic Care Management Programs. Marshfield has developed telephonic care management programs for patients who require ongoing support or monitoring between physician visits. These programs, which are staffed and administered by the Clinic, use guideline-driven protocols that are individualized for each patient. An anticoagulation service is the most mature example of this approach; similar programs have been developed for patients with heart failure and those who need help controlling cholesterol levels. The Clinic chose to focus on these three conditions first because of the costs associated with them, the number of patients involved, and the potential impact of improving care for these conditions on performance under the Medicare Physician Group Practice Demonstration (described in the Continuous Innovation section below).

Patients on anticoagulant medication (Coumadin), who require regular monitoring to ensure optimal dosing to prevent the formation of blood clots while minimizing the risk of bleeding, are introduced to the anticoagulation service by their physician or referred upon discharge from the hospital. Registered nurses educate and coach patients to promote treatment adherence, monitor patients' lifestyles and monthly blood testing, and adjust medication dosages as needed according to physician-developed protocols. Nurses consult with a medical director or the patient's physician when the protocol does not address the patient's situation (5 percent to 10 percent of cases). Patient encounters are documented in a tracking database and in the EHR for physician review and sign-off.

In a controlled study comparing outcomes for patients on Coumadin who were enrolled in the anticoagulation service to outcomes for those receiving usual care (Exhibits 7 and 8), the anticoagulation service patients:

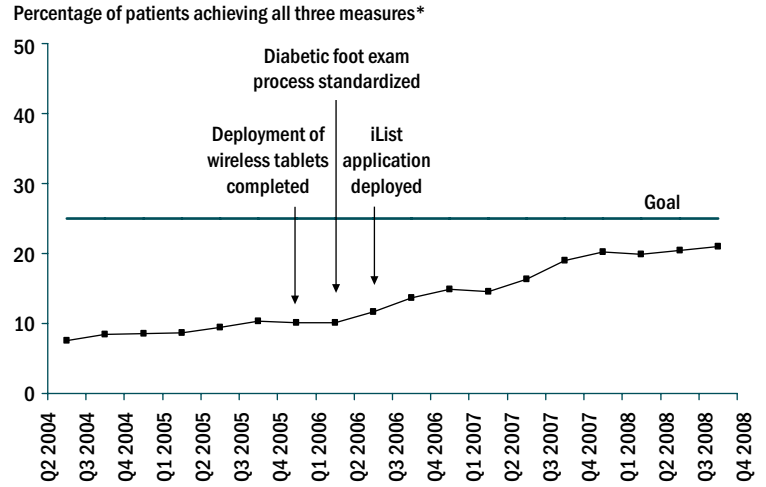
- achieved anticoagulation control more often (77.4% vs. 59.1% of the time in the target range)
- experienced 55 percent fewer anticoagulant-related adverse events (2.98 vs. 6.67 per 100 person-years)
- had 41 percent fewer hospital admissions (41.5% vs. 70.2% per 100 person-years)[11]

Cost-savings for Medicare beneficiaries were estimated at $9,443 per avoided hospitalization (including $1,222 in patient charges) or $271,014 per 100 person-years in year-2000 dollars.[12] Most of these savings accrue to Medicare under fee-for-service reimbursement, making it difficult for the Clinic to recover the costs of running the program. The Medicare Physician Group Practice Demonstration (described below) provided an opportunity for the Clinic to expand the anticoagulation service to all of its approximately 6,500 patients using anticoagulation medication.

Patients in the heart failure care management program statistically had more office visits and laboratory tests done than did patients who were not enrolled in a care management program. They were also statistically more likely to have decreased mortality, blood pressure control at goal levels, and LDL cholesterol at goal levels, and to receive influenza vaccines, pneumococcal vaccinations, and recorded weight measurement at an office visit.

Patients with diabetes or coronary artery disease who had high levels of LDL cholesterol at the time of enrollment in the care management program receive education regarding medication and therapeutic lifestyle changes to help them reach an LDL goal set by their primary care providers. Registered nurses monitor

Exhibit 5. Marshfield Clinic: Effects of Diabetes Quality Improvement Initiative on Outcomes



Note: Electronic reminder system deployed in first quarter 2005. *Measures include: blood pressure<130/80mmHg, hemoglobin A1c<7.0%, and fasting lipid profile (LDL)<100mg/dL.
Source: Marshfield Clinic.

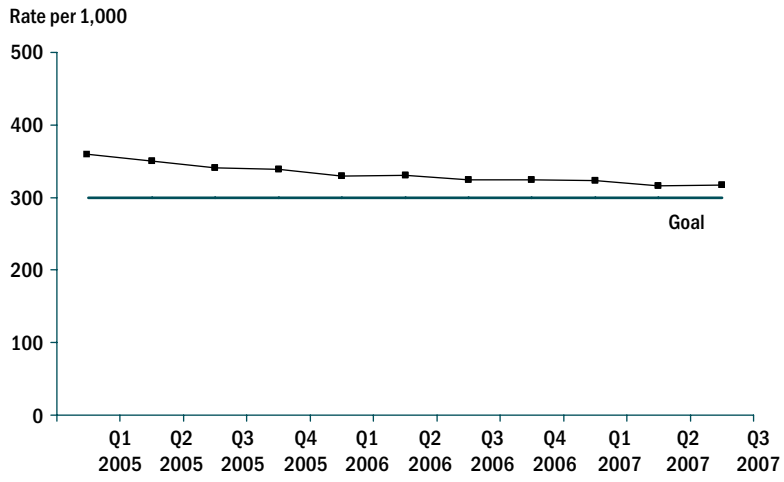
laboratory results and adjust medication according to physician protocol. Among 875 patients enrolled in the program, the median time it takes to achieve a goal of LDL less than 70mg/dL is 101 days (67 days if the goal is 100mg/dL).

PEER REVIEW AND TEAMWORK FOR HIGH-VALUE CARE

Marshfield Clinic uses its investment in informatics to produce individualized reports, or "storyboards," that use charts and graphs to display quality metrics for confidential feedback to physicians. Confidential performance feedback is provided by a peer review committee, along with development of individualized improvement plans as appropriate. Physicians are further engaged in improvement through the use of online clinical practice guidelines, continuing medical education, and peer coaching.

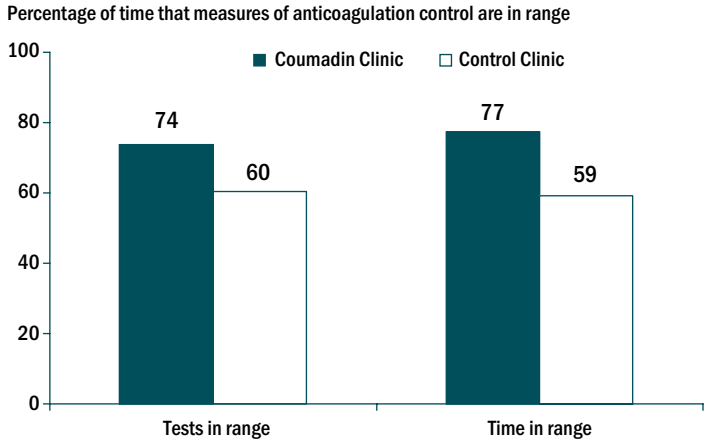
Marshfield also provides mentorship to new physicians by assigning them to experienced physicians who have prepared themselves for this role by volunteering to undergo an eight-hour training program

Exhibit 6. Marshfield Clinic: All-Cause Hospitalizations Among Diabetes Patients



Source: Adapted from T. A. Praxel, D. Erickson, T. Gabert et al., "Moving the Big N: Improving Diabetes Care for a Large Population," presentation at the Institute for Healthcare Improvement National Forum, Orlando, Fla., Dec. 9–12, 2007.

Exhibit 7. Marshfield Clinic: Effects of the Coumadin Clinic Initiative on Anticoagulation Control



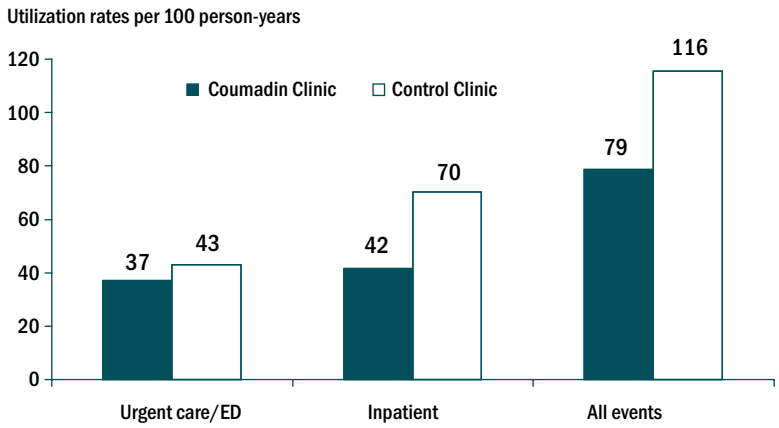
Source: J. Schmelzer, "Can Disease State Management Deliver on Its Potential in Rural Areas: Evidence From a Coumadin Clinic Initiative," presentation at the International Society for Quality in Health Care 20th International Conference, Nov. 2–5, 2003.

covering leadership and operational issues specific to the Clinic. The program helps in retaining physicians and acculturating them to the Clinic's unique approach to group practice, said Karl Ulrich, M.D., M.M.M., Marshfield Clinic's president and CEO. The Clinic also runs a program for physicians who are restarting their medical practices after a long break.

The Clinic's seven regional divisions are each overseen by a medical director and an administrator who work in a partnership designed to combine effectively the clinical practice and the business aspects of medicine. The regional medical directors attend departmental meetings to share group-level performance results and improvement strategies and solicit feedback on the Clinic's quality initiatives. In this way, medical directors help tailor the Clinic's performance improvement strategy to meet the needs of physicians while also inculcating Marshfield's population health management philosophy throughout the organization.

Rather than just hiring smart people for leadership posts and hoping they will do good things, the Clinic also defines metrics that give the administration

Exhibit 8. Marshfield Clinic: Effects of the Coumadin Clinic Initiative on Service Use



Note: ED = Emergency Department.
Source: J. Schmelzer, "Can Disease State Management Deliver on Its Potential in Rural Areas: Evidence From a Coumadin Clinic Initiative," presentation at the International Society for Quality in Health Care 20th International Conference, Nov. 2–5, 2003.

of practice an objective basis, Ulrich said. The goal is "to augment experience with performance data in real time," he said. Augmented by the specific improvement strategies described above, this approach has been associated with improvements in care, such as a 9 percent increase in the control of high blood pressure among hypertensive patients after the Clinic began sharing performance feedback with providers.[13]

Physician compensation is based on productivity (relative-value units of work) and comparative market considerations by medical specialty. To align salary with Marshfield's strategy and culture, physicians are also compensated for administration, research, and teaching activities. The Clinic is pilot-testing a "pay-for-performance" program that would reward individual physician performance on clinical quality metrics.

CONTINUOUS INNOVATION

Marshfield Clinic leaders have made the achievement of a high performance health system—based on the Institute of Medicine's six aims for safe, timely, effective, efficient, equitable, patient-centered care—an integral part of the organization's strategy and vision. The following Clinic initiatives illustrate this commitment.

Assessing the Impact Effect of Performance Incentives. Marshfield Clinic is one of 10 sites participating in Medicare's Physician Group Practice (PGP) Demonstration, which is assessing whether giving physicians the opportunity to share in financial savings generated through quality and efficiency improvements will lead to better outcomes for Medicare beneficiaries. An independent evaluation credited the Clinic with reducing Medicare spending for 42,000 Medicare patients by $25 million in the first two years of the ongoing five-year demonstration. As a result, Marshfield earned performance payments of $4.6 million for meeting financial and quality targets in the first year and $5.8 million in the second year. Marshfield Clinic was one of only two sites to earn this distinction in the first year and one of four sites to do so in the second year.[14] In the first year, the Clinic improved on all measures from the baseline year and exceeded nine of 10 quality targets for diabetes set by Medicare. In year two, it exceeded all 27 quality targets set by Medicare for diabetes, coronary artery disease, and congestive heart failure.

To prepare for its participation in the demonstration, the Clinic created the Workflow Efficiency Group, comprising providers, medical assistants, and process improvement staff, to pursue five goals: 1) improve the patient experience; 2) implement a model of care that focuses on chronic illness management; 3) improve patient access and the delivery and coordination of care through practice redesign; 4) minimize waste and rework; and 5) commit to using information technology tools to improve service delivery.[15] Specific activities that the Clinic undertook to carry out these goals[16] included:

- accelerating information system enhancements such as the creation of the iList (described above) to support chronic disease management,
- expanding the anticoagulation care management program and developing a care management program for heart failure
- providing performance feedback and education to providers
- defining best-practice models to standardize care processes for chronic care management

A best-practice model packages clinical practice guidelines with strategies and tools (such as patient education materials) for putting the guidelines into practice. Regional medical directors and clinical nurse specialists work as a team with providers and their staff to implement specific improvement techniques.

One example of practice redesign is the delegation of defined clinical tasks to medical assistants on primary care teams. For instance, medical assistants have been trained to conduct diabetic foot exams following a standardized process, with physicians becoming involved when there is an abnormal result requiring intervention. Following this change, the rate of comprehensive foot exams documented appropriately in the EMR (using digital ink-over forms) increased

from 13.5 percent to 72 percent of diabetic patients. Praxel stressed that workflow redesign is essential to increasing the efficiency of primary care teams, since it is not otherwise possible to deliver all recommended preventive care within the time available in a typical patient visit.[17]

Deploying Innovations in Information Technology. While developing its EHR system, Marshfield Clinic recognized the need to develop expertise in information technology innovation and deployment, which its leaders believe is critical to promoting high-performance medicine. The goal is to help physicians make "cogent decisions in real time," said Ulrich. The work is conducted by the Marshfield Clinic Research Foundation's Biomedical Informatics Research Center (BIRC), which acts as an "innovation engine" for the Clinic. When the Clinic finds that it cannot purchase or develop computer software that meets its needs, it calls upon BIRC's scientists and technicians to invent and test new approaches that enhance and facilitate the use of information technology and solve problems in information synthesis.

As an example, BIRC developed interpretive software so that nontechnical staff can use natural language to query the Clinic's data warehouse, thus avoiding the need to know specific diagnosis codes. BIRC also developed natural-language processing algorithms to parse text in medical records and extract terms related to medication usage. This methodology allowed researchers to correlate patients' use of cholesterol-lowering medications to cholesterol levels derived from laboratory blood tests.[18] Physicians can use a graphical display of this relationship to educate patients on the benefits of adhering to their treatment regimen.

BIRC's scientists are also seeking to tackle the challenges of information overload. For example, the growing use of home monitoring devices enables the collection of large volumes of physiologic data to track and interpret. Likewise, the multitude of performance indicators now being used to measure quality of care presents a challenge for the Clinic's leaders and physicians, who need to identify the subset of patients who will most benefit from greater attention and improvement in care.

> "The clinician will no longer function in an assembly-line fashion, but will become more like a dispatcher or air-traffic controller, electronically monitoring many processes simultaneously."
>
> *Marshfield Clinic's Biomedical Informatics Research Center*

To help make sense of such data, BIRC invented a visualization tool (known internally as a "starfield") that enables physicians to filter results by various criteria, zoom in on those that are out of recognized clinical bounds, and track whether their efforts are leading to improvement. The use of such tools may help bring about a transformation in the physician's role and, consequently, productivity. "The clinician will no longer function in an assembly-line fashion," BIRC's Web site predicts, "but will become more like a dispatcher or air-traffic controller, electronically monitoring many processes simultaneously."

Developing the Capacity to Deliver Personalized Medicine. Initiated in 2002, the Marshfield Clinic Personalized Medicine Research Project aims to translate genomic research into clinical care by integrating population-based genetic data with information that has been collected on Marshfield patients for almost three decades. The latter includes patient histories of environmental and occupational exposure and clinical data from the Marshfield Clinic EHR. The goal of the personalized medicine program is to improve patient outcomes by tailoring prevention, diagnosis, and treatment of health conditions to a person's unique genetic profile. The Marshfield Clinic Research Foundation, which has received federal and state grants to carry out translational research, collaborates with the University of Wisconsin Institute for Clinical and Translational Research and other academic research institutions engaged in the Wisconsin Genomics Initiative, recently convened by Wisconsin's Governor Doyle.[19,20]

Marshfield Clinic is an ideal testing ground for this project, as it has been serving a relatively stable patient population for many years. The project has enrolled almost 20,000 research subjects, who have volunteered DNA, plasma, and serum samples, and has permitted researchers access to medical records that have captured on average 29 years of clinical history. The Personalized Medicine Research Database uses a cryptographic key system to combine genotypic and clinical data for research studies while protecting the privacy of research subjects.

"We're looking at not just the genetic markers that predict the development and progression of disease, but how they interact with personal factors or environmental exposures to increase the risk of development and progression of disease," said Catherine McCarty, Ph.D., M.P.H., director of the Marshfield Clinic Research Foundation's Center for Human Genetics. The project also seeks to improve knowledge of pharmacogenetics or "how genetics predict [patients'] response—both good and bad—in terms of efficacy and adverse reactions to medications," she said. For example, one study is examining how certain gene variants affect the body's metabolism of the anticoagulant medication warfarin.[21] Results should help physicians determine more optimal medication dosages for particular patients.

Engaging with the Community. Marshfield Clinic in 1998 created the Center for Community Outreach (CCO) to address more fully the health-related needs of its patients by establishing stronger linkages between the Clinic and the communities in which it operates. The CCO supports evidence-based population and environmental health improvement strategies in priority areas identified by the State of Wisconsin, such as preventing alcohol, tobacco, and other substance abuse and addiction, combating obesity, and improving access to primary and preventive health services. As an example, the Clinic helps fund the Youth Net program, which engages eight- to 18-year-olds in after-school activities to promote educational, social, fitness, and citizenship development.

The Healthy Lifestyles initiative fosters community-based collaboration between employers to facilitate the implementation of work-site wellness policies and programs that support healthier lifestyle choices by employees. An employer tool kit provides strategies, guidelines, communications materials, and an audit/checklist to help employers identify ideas and areas for intervention. The tool kit is supplemented by community meetings that allow employers to share successes, learn from best practices and one another's experiences, and connect with health-promoting resources in their communities.[22]

EASY ACCESS TO APPROPRIATE CARE

Serving All Segments of the Population. Marshfield Clinic serves all who seek care, regardless of their ability to pay. When patients treated at Marshfield Clinic have no health insurance, staff of the Clinic's Patient Assistance Center help them find programs that might cover them. If none are found and the patients meet financial qualifications, the Clinic pays for care through its Community Care program. Approximately 3,000 patients receive care this way annually. The organization provided charity care worth $13 million in fiscal year 2007.

Marshfield also participates in Medicare, Medicaid, and BadgerCare, the State of Wisconsin's coverage program for low-income adults and children. The estimated costs of patient care provided by the Clinic in excess of reimbursements received from Medicare and Medicaid were $150 million in 2007. The Clinic's service area includes several geographically remote communities in federally designated Health Provider Shortage Areas. Providing dental care to underserved communities is a new focus.

The Clinic has a contractual partnership with the Family Health Center of Marshfield, a federally qualified community health center, through which the Clinic (and other local medical professionals) provides medical and dental care to nearly 4,000 low-income uninsured and underinsured individuals and families at several locations. Enrollees pay a sliding-scale premium (supplemented by state and federal funds) in this

insurance-like program, which emphasizes primary and preventive care, with access to specialty care as needed. Marshfield's research division helped support the Health Center's creation through contributions of expertise and resources to apply for federal grants.

Through the Community Health Access Program, patients of the Family Health Center and Marshfield Clinic's Community Care program receive assistance from care managers to find a primary care provider. These patients complete a health assessment, and those judged to be at high risk for chronic illness or to have unmet preventive care needs receive health education, advocacy, and support from registered nurses. Nurses conduct "motivational interviewing" to help patients take a more active role in their care and assist in making appointments when necessary.

Providing Comprehensive Care in the Community. Given the large size and rural character of the Clinic's service area, it seeks to disperse specialty care services throughout its regional network so that patients aren't required to travel long distances to the main campus in Marshfield. "Health care is a local phenomenon, and care should be provided in the community when possible," said Ulrich. High-cost quaternary care (such as gamma-knife surgery) is an exception to this general rule, since centralization ensures efficient and effective use of such highly specialized resources.

Serving Patients Outside Clinic Visits. The Clinic operates a 24-hour nurse-advice call center available to all of its primary care patients. Nurses use the Clinic's EHR to tailor advice to the patient's care plan, to perform triage using online guidelines, and, when appropriate, to schedule a physician appointment (at selected clinics). The call is documented in the EHR and the patient's physician receives an e-mail notification for review and follow-up as needed. The nurse-advice call center also answers calls from Security Health Plan enrollees, under a contract with the Clinic.

Clinic leaders believe that the call center, which handles a volume of more than 94,000 calls annually, pays for itself by decreasing the call burden on primary care providers, thereby improving physicians' productivity and work life and aiding in their retention and recruitment. The call center also ensures consistency of information given to the patient and triage to the care setting appropriate to the patient's needs. Patient satisfaction surveys related to the call center are consistently high: More than 80 percent of patients give the service a five-star rating, the highest possible.

Security Health Plan also recently began offering its members a nurse navigator program to supplement the routine assistance available from customer service staff. Registered nurses, supported by medical directors, are available by telephone to answer questions about treatment options and coverage, help connect members with appropriate services, facilitate communication with providers, and provide other services.

Drawing on federal and state grants, Marshfield Clinic created a mobile health screening unit offering mammography and osteoporosis (bone density) testing to women 18 years of age and older, regardless of whether they have health insurance. The unit coordinates with health departments, church groups, businesses, and other providers to take the 40-foot, self-contained van to any location in Wisconsin. Screening unit staff contact patients with results and help arrange follow-up care as needed.

Improving the Timeliness of Appointment Scheduling. Marshfield is redesigning patient scheduling for all of its locations using an "advanced access model" with the goal that patients will be able to see a primary care physician within one day and a specialty physician within five days of an appointment request. This approach aims to balance the demand for and supply of care by reducing the backlog of patients seeking appointments, simplifying the way that appointments are made, and addressing operational protocols that affect patient access, such as staff absences. Reserving some appointments for unforeseen needs makes it more likely that patients will see their usual physician when they need care. This

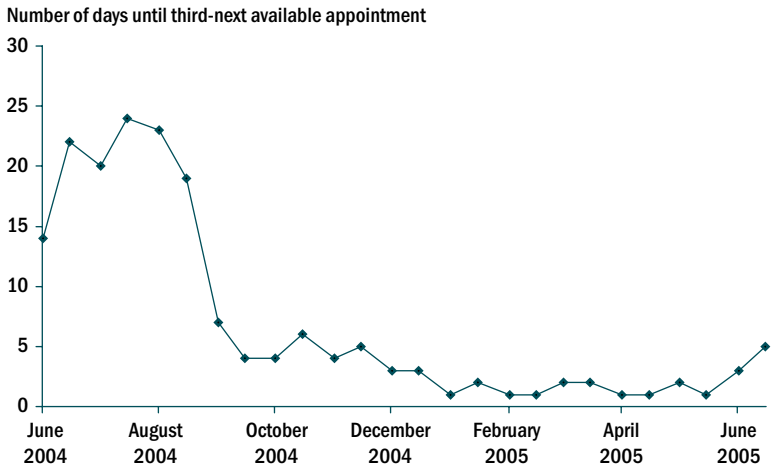
approach helps to avoid duplicate visits for those who would otherwise see another physician or visit the ER and then require follow-up with their regular doctor. Improving the accessibility and continuity of care also may help prevent costly disease complications for patients with chronic illness.

Some of Marshfield's primary care clinics have successfully reduced appointment waiting times. At the Clinic's Family Practice Clinic in Rice Lake, for example, physicians and staff participated in a 14-month Web-based learning collaboration with the Institute for Healthcare Improvement to implement advanced-access principles. The timeliness of appointment scheduling improved, as measured by a decrease in the number of days until the third-next available appointment (a commonly used accessibility metric) from 20.3 to 1.8 (Exhibit 9).[23] The Clinic has learned that successful change requires top management support, leadership from physicians at the departmental and clinic levels, educating clinic teams on process improvement principles, and ongoing review of data at the clinic level to reinforce progress.[24]

Systemwide, 11 of Marshfield's 56 primary care office locations offered a third-next available appointment for a routine office visit within one day during the third quarter of 2008 (the median wait was 4.4 days with a range from zero to 44 days), according to the Wisconsin Collaborative for Healthcare Quality.[25] Like other organizations serving rural areas, Marshfield Clinic feels the effects of the current shortage of primary care physicians, making the availability of primary care providers at specific sites a limiting factor in improving access, Praxel said.

Improving Access to Care Through Telehealth. Marshfield Clinic TeleHealth (MCT) leverages information and communications technology to provide clinical and educational services in remote and rural areas where transportation barriers and health provider shortages make in-person encounters difficult.[26] Marshfield Clinic developed telehealth over the past 11 years as a tool for access for both patients and providers with $4.5 million in grant assistance from the federal Office of Rural Health Policy and subsequently the federal Office for the Advancement of Telehealth. MCT services are now fully supported by operational funding as a means of conducting the business of health care at Marshfield Clinic; grant money is used to pursue new initiatives and expand sites and services. MCT currently links 47 sites with 43 clinical services, resulting in approximately 4,500 interactive patient

Exhibit 9. Marshfield Clinic Rice Lake Center: Effects of Advanced Access to Primary Care



Note: Average of 13 providers. Marshfield Clinic Indianhead Center is now known as Rice Lake Center.
Source: Adapted from Marshfield Clinic Indianhead Center, "Improving Access in Primary Care—Virtually," *Improvement Report* (Boston, Mass.: Institute for Healthcare Improvement, 2006).

encounters in 2008. Service volume is growing about 15 percent annually.[27]

MCT offers primary and specialty dental and health services (e.g., dermatology, psychiatry, oncology, endocrinology) through interactive clinical videoconferencing and patient peripheral technologies, such as digital stethoscopes, handheld exam cameras, and mobile retinal imaging, that facilitate remote patient exams. MCT also offers patient case management services, telepharmacy, telepathology, and education for health professionals and patients. About one-third of the regional sites are non–Marshfield Clinic locations, enabling providers to extend their services to children in Head Start classrooms and to individuals in tribal-run clinics, nursing homes, and a county jail. Integration with the Marshfield Clinic EHR promotes the same quality of care in remote encounters that patients receive in person in the larger secondary and tertiary centers.

Marshfield Clinic has been a leader in promoting the adoption of telehealth and in developing related business strategies and financial models to make the service viable. The Clinic works at the national level to develop reimbursement, legal, and regulatory standards and guidelines for delivering telehealth services. It was the first organization in Wisconsin to be approved for Medicaid reimbursement of telemedicine services. Today, nearly all of the Clinic's primary payers, including Medicare, Medicaid, and Marshfield Clinic's Security Health Plan, reimburse MCT for services delivered via telehealth.

A survey conducted as part of a quality improvement activity indicates that patients are more satisfied with telehealth encounters than with in-person health care visits, and providers also reportedly express satisfaction with telehealth visits. "The patients appreciate the ability to receive specialty health care services in rural communities. It improves their quality of life. They don't have to take time from work, they don't have to pay babysitters, and they don't have to incur the expense and the risk of traveling on Wisconsin roads" (during the winter months, when driving conditions can be difficult), said the program's director, Nina M. Antoniotti, Ph.D., M.B.A., R.N. Overall, the high degree of satisfaction, high adoption rates, and widespread use of telehealth by patients and providers alike reflect a successful focus on the human relationship in a technologically enhanced patient encounter, Antoniotti noted.

Exhibit 10. Selected Externally Reported Results and Recognition: Marshfield Clinic*

Ambulatory Care Quality (NCQA Quality Compass 2008)	*Clinical quality* (34 measures): Security Health Plan ranked in the top quartile of commercial health plans nationally or regionally on 22 measures, and in the top decile on 15 of those measures. *Patient experience* (10 measures): Security Health Plan ranked in the top quartile of commercial health plans nationally or regionally on five measures, and in the top decile on two of those measures.
National Recognition and Ratings	*Verispan Top 100 Integrated Health Networks* (2006). *National Committee for Quality Assurance:* Security Health Plan received Health Plan Excellent Accreditation, with Quality Plus Distinction in Member Connections as well as in Care Management and Health Improvement. *US News & World Report Best Health Plans:* Security Health Plan ranked among the top 50 commercial plans in 2005–2008 and among the top 25 Medicare plans in 2005, 2007, and 2008.

* See the *Series Overview, Findings, and Methods* for analytic methodology and explanation of performance recognition. NCQA = National Committee for Quality Assurance (Quality Compass 2008 represents the 2007 measurement year).

RECOGNITION OF PERFORMANCE

In addition to the results of the specific interventions described above, Marshfield Clinic has achieved notable results on selected externally reported performance indicators and has received recognition for its performance on several national benchmarking or award programs (Exhibit 10). Medicare data compiled by the Dartmouth Atlas project indicates that the cost of physician services in the Marshfield hospital referral region was 64 percent of the national average during 2001–2005, reflecting both a lower rate of visits (70 percent of the national average) and a lower payment per visit (91 percent of the national average) for Medicare beneficiaries in their last two years of life.[28]

Marshfield Clinic ranked in the top quartile on 13 of 16 performance measures among medical groups in Wisconsin participating in the Wisconsin Collaborative for Healthcare Quality. On seven of the measures, the Clinic was in the top decile (10%) of the 19 to 21 organizations ranked on the voluntary report card as of June 2009. The identification of areas of excellence does not mean that the Clinic has achieved perfection, however. Like the other organizations in this case study series, Marshfield has room for continuing improvement on performance measures (for example, on screening for tobacco use and care of patients with uncomplicated hypertension). The Clinic's track record of improvement suggests that the organization will continue to innovate so as to achieve higher performance over time.

INSIGHTS AND LESSONS LEARNED

Marshfield Clinic's experience indicates that a well-developed electronic information infrastructure provides a critical foundation for building higher levels of performance through improved patient care management. "While we don't ever want to lose the individual aspect of patient care, we're trying to close the loop from the individual back to the population to raise awareness of how the physician is doing with a given disease or constellation of diseases for their entire panel of patients," Praxel said. Physicians can then apply that broader population health perspective as a guiding framework to improve the care of individual patients.

The Clinic's EHR contains many features that can be customized by specialty and physician to increase the efficiency of physician work flow. "That customization is absolutely key" to the successful uptake of the EHR among physicians, said Edna DeVries, M.D., Marshfield Clinic's Central Division medical director. Physician involvement has been critical to the development of the EHR system. "If you look at our software, it wasn't developed by some IT folks in a vacuum. Doctors are on the development team," she noted. Marshfield's investment in technology is a long-standing one. "Clinic leaders back in the '60s and '70s saw a vision of what computers might do with medicine … and, since that time, clinic leadership—which has kept rotating over time—has stayed true to trying to invest for the future," said Ulrich.

Marshfield's leaders raised several lessons learned from the use of informatics to achieve performance improvement. First, technology and electronic records alone are not enough to drive improvement. "Doing the same old thing with more technology will not reduce costs or improve care," said Peggy Peissig, M.B.A., associate director of the Marshfield Clinic's Biomedical Informatics Research Center. To bring about transformational change, processes must be reengineered before being automated. Second, raw data in the EHR must be made clinically actionable by converting it into alerts and reminders that embed clinical guidelines into daily practice. Third, and perhaps most difficult, the roles of the care team must be redefined to use tools for more efficient workflow.

The Clinic's leaders viewed participation in the Medicare PGP demonstration as a way to prepare for a future in which providers will be rewarded rather than penalized for doing the right thing for patients.[29] The sentiment of the organization's leaders is that the Clinic was providing good-quality care prior to the Medicare PGP demonstration. Under the prevailing fee-for-service reimbursement system, however, quality improvements can be difficult to sustain because much of the savings can flow to third-party payers.[30]

The opportunity to earn a performance payment meant that the Clinic could make investments in systems and programs to further enhance performance with a reasonable expectation of recouping its costs if its efforts were successful. The Clinic's executive director, Reed Hall, J.D., credited the Clinic's success in the demonstration to "an accumulation of incremental gains" made possible by the EHR and care management initiatives.[31]

Because the Clinic applied these interventions to all of its patients, not just to Medicare patients, the benefits of its participation in the Medicare demonstration have likely extended to other payers as well. "From an ethical perspective … there was no other choice. This decision [to apply interventions to all patients regardless of coverage] is consistent with our mission and is the way we care for patients. Our providers do not usually know patients' insurance at the time of the office visit," Praxel said. "We feel that the demo has had a positive impact on the Clinic's Medicare population, as evidenced by the fact that [the health plan's] NCQA rankings in care for patients with coronary artery disease and [in] disease management [two areas stressed by the PGP demonstration] on the *US News & World Report* national rankings are quite good," he said. Security Health Plan was ranked the nation's fifth-best Medicare plan in the magazine's 2008 rankings.

The leadership of Marshfield Clinic believes that its nonprofit character and physician governance structure help promote confidence among patients that clinical decisions will be made in their best interests. Congruent with this organizational heritage, the Clinic favors in-house development of information systems and care management programs—an approach that provides flexibility to customize solutions to meet the evolving needs of its physicians and patients. The Clinic's leaders believe that this strategy has been an important factor in the willingness of Clinic physicians to adopt such solutions. It also promotes integration and coordination; for example, following a patient's call to the 24-hour advice line, a nurse can access that patient's EHR and send a follow-up e-mail to his or her physician.

> "While we don't ever want to lose the individual aspect of patient care, we're trying to close the loop from the individual back to the population to raise awareness of how the physician is doing with a given disease or constellation of diseases for their entire panel of patients."
>
> *Theodore Praxel, M.D., M.M.M., medical director for quality improvement and care management at Marshfield*

Marshfield Clinic's leaders also recognize opportunities to benefit from outside expertise and collaboration. While the Clinic has traditionally developed its own clinical guidelines, the process has become increasingly burdensome as the subjects that need to be addressed have multiplied. In response, the Clinic recently joined the Minnesota-based Institute for Clinical Systems Improvement (ICSI), a regional collaboration of medical groups and health plans that develops clinical guidelines and shares best practices for improving care. On the other hand, the Clinic also has learned that performance improvement must be tailored to the local environment. The optimal approach in a large clinical center may be different from what works best at a smaller site. "In a small center, a single person may play multiple roles in the care process for patients," Praxel said. When developing work-flow strategies, those variations must be kept in mind.

Marshfield has faced barriers in proactively coordinating inpatient care because it does not own and control the hospitals where most of its patients are admitted. (The Clinic does employ hospitalist physicians working in some of those hospitals, and its physicians make up the majority of admitting physicians in some facilities.) "Working with 14 different hospitals in multiple systems and not having a direct ability to effect change within those institutions has made coordination of transition from inpatient to outpatient a very large challenge," Praxel said. "We can make suggestions, which they may or may not find to be appropriate." The recent addition of Lakeview Medical

Center's hospital to its network is allowing Marshfield to test the integration of inpatient and outpatient care.

Although the Clinic may be at some disadvantage compared with fully integrated groups in this regard, it has nevertheless met cost-savings targets in the Medicare Physician Group Practice Demonstration. This experience suggests that, with proper incentives, a robust approach to ambulatory care management can be effective in improving patient outcomes and reducing costs.

The Clinic's relationship with Security Health Plan (SHP) presents an ongoing, though less serious, challenge. Because the two are affiliated organizations but maintain separate operations and financial statements, they must strive not to duplicate each other's services or confuse patients who may receive care from the Clinic, but may also receive disease management assistance from the Health Plan. To help coordinate efforts, Praxel serves on the quality improvement committee for SHP. Both the Clinic and SHP have joined ICSI, which provides common guidelines for care.

In summary, Marshfield Clinic's experience suggests that the sophisticated use of an EHR to support care management, together with the active leadership of physicians and the engagement of staff in clinical workflow redesign, are crucial elements for improving clinical and organizational performance. Ongoing performance monitoring and feedback to physicians—supported by group-level financial incentives that reward the group for investing in programs that improve patients' health—have also been a key to sustaining and furthering these gains.

Future challenges include current reimbursement methodologies, which do not support extensive care management strategies. The Clinic is also concerned about the increasing number of patients with chronic diseases, who need such services, as well as the poor state of the economy, which is forcing uninsured and underinsured patients to forgo care until their conditions are more advanced and more costly to treat.

Marshfield's leaders offer the following advice to organizations seeking to achieve similar results: pursue quality outcomes with an altruistic mission from the start; prepare the organization for the pace at which resulting changes need to occur; use an EHR that provides actionable data and decision-support tools; and develop physicians and senior leaders who can serve as champions. They also note the importance of developing care management programs that serve as an extension of the providers' practice rather than a barrier to its effective interaction with patients. Their advice for small practices that wish to follow these methods: invest in an EHR with clinical decision support tools and link the EHR to care management services that apply its potential.

For a complete list of case studies in this series, along with an introduction and description of methods, see *Organizing for Higher Performance: Case Studies of Organized Health Care Delivery Systems—Series Overview, Findings, and Methods,* available at www.commonwealthfund.org.

NOTES

[1] T. Shih, K. Davis, S. Schoenbaum, A. Gauthier, R. Nuzum, and D. McCarthy, *Organizing the U.S. Health Care Delivery System for High Performance* (New York: The Commonwealth Fund Commission on a High Performance Health System, Aug. 2008).

[2] Information on Marshfield Clinic was derived from presentations made during a site visit (see the Acknowledgments section for participants), and in part from a prior Commonwealth Fund case study: D. McCarthy, "Improving Quality and Efficiency in Response to Pay-for-Performance Incentives Under the Medicare Physician Group Practice Demonstration," *Quality Matters* (New York: The Commonwealth Fund, Sept. 2006). Additional information was obtained via e-mail correspondence with Dr. Praxel and from the organization's Web site and other public documents including: G. C. Pope, J. Leung, R. Constantine et al., *Marshfield Clinic Physician Group Practice Demonstration: Site Visit Final Report* (Research Triangle Park, N.C.: RTI International, for the Centers for Medicare and Medicaid Services, 2006); D. J. Reding, Testimony Before the Subcommittee on Health of the House Committee on Ways and Means, Hearing on Promoting the Adoption and Use of Health Information Technology (Washington, D.C.: U.S. House of Representatives, July 24, 2008); M. Hillman, Testimony Before the Subcommittee on Health of the House Committee on Ways and Means, Hearing on Promoting Disease Management in Medicare (Washington, D.C.: U.S. House of Representatives, April 16, 2002).

[3] A summary of findings from all case studies in the series can be found in D. McCarthy and K. Mueller, *Organizing for Higher Performance: Case Studies of Organized Delivery Systems. Series Overview, Findings, and Methods* (New York: The Commonwealth Fund, 2009).

[4] During the 1990s, Marshfield Clinic and Security Health Plan were defendants in an antitrust lawsuit brought by Blue Cross Blue Shield United of Wisconsin, one of the Clinic's partners in Greater Marshfield Community Health Plan. Although the Clinic lost at jury trial, the judgment was mainly overturned in the Clinic's favor on appeal to the U.S. Court of Appeals for the Seventh Circuit (see *Blue Cross & Blue Shield United Wisconsin and Compcare Health Services Insurance Corporation v. Marshfield Clinic and Security Health Plan of Wisconsin, Inc.*, 65 F.3d 1406 (7th Cir. 1995). For a detailed account of this litigation, see J. G. Coombs, "The Perils of Antitrust in the Health Care Marketplace," Chapter 10 in *The Rise and Fall of HMOs: An American Health Care Revolution* (Madison: University of Wisconsin Press, 2005).

[5] As they are affiliated organizations, the assets and revenues of Security Health Plan and Marshfield Clinic are combined for limited reporting purposes. They maintain separate balance sheets and do not share earnings.

[6] Information on RECIN was obtained from its Web site (http://www.recin.org) and Coombs, *The Rise and Fall of HMOs: An American Health Care Revolution.* The American Academy of Pediatrics and the Centers for Disease Control and Prevention honored RECIN with their inaugural Protect Award in 2002 in recognition of its role in preventing childhood diseases. RECIN was also identified as a Model of Practice by the *Rural Healthy People 2010* project at the Southwest Rural Health Research Center (http://www.srph.tamhsc.edu/centers/rhp2010/models.htm).

[7] P. L. Dolan, "Marshfield Clinic Puts Its EHR on the Market," *AMNews*, July 21, 2008; Ministry Health Care, "Ministry Health Care Partners with Marshfield Clinic to Create State's Largest Patient Database," http://ministryhealth.org/MinistryHealth/News/MinistryHealthCarePartners.nws.

[8] Population health management can be defined as "the technical field of endeavor which utilizes a variety of individual, organizational and cultural interventions to help improve the morbidity patterns (i.e., the illness and injury burden) and the health care use behavior of defined populations," (L. S. Chapman, *Health Management: Optimal Approaches for Managing the Health of Defined Populations* (Seattle: Summex Corp, 1997) as quoted by M. Hillman, Testimony Before the Subcommittee on Health, 2002).

[9] D. J. Reding, Testimony Before the Subcommittee on Health, 2008.

[10] T. A. Praxel, D. Erickson, T. Gabert et al., "Moving the Big N: Improving Diabetes Care for a Large Population," presented at the Institute for Healthcare Improvement National Forum, Orlando, Fla., Dec. 9–12, 2007; personal communication with Theodore Praxel, M.D., Dec. 2008.

[11] The study was funded by the federal Agency for Healthcare Research and Quality under the Integrated Delivery System Research Network program (AHRQ Contract 290-00-0016 TO #2). Intervention-group patients (N=185) were consecutively enrolled and observed during Jan. 1998 to Mar. 2001; control-group patients (N=223) were randomly selected and observed during May 2000 to Oct. 2001 (there was a minimum 12-week observation period). All patients were under the care of a Marshfield Clinic cardiologist. Source: J. Schmelzer, "Can Disease State Management Deliver on Its Potential in Rural Areas: Evidence From a Coumadin Clinic Initiative," presented at the International Society for Quality in Health Care 20th International Conference, Dallas, Tex., Nov. 2–5, 2003, http://www.isqua.org/isquaPages/Conferences/dallas/DallasAbstractsSlides/Tuesday_in_Dallas.html.

[12] M. Hillman, Testimony Before the Subcommittee on Health, 2002.

[13] Pope, Leung, Constantine et al., *Marshfield Clinic Physician Group Practice Demonstration: Site Visit Final Report.*

[14] Participants in the Physician Group Practice (PGP) demonstration were selected through a competitive process by the federal Centers for Medicare and Medicaid Services. Elderly and disabled fee-for-service Medicare beneficiaries are assigned to the demonstration site (retrospectively) if they receive the majority of their outpatient care from the participating PGP. A PGP may earn a bonus of up to 80 percent of any Medicare cost-savings that it achieves that exceed 2 percent of its expenditure target (the PGP is not penalized if it does not meet its target). The expenditure target is based on the PGP's own base-year costs inflated by the risk-adjusted annual expenditure growth rate for a comparison group of Medicare beneficiaries. If the PGP qualifies for a bonus, a portion (30 percent the first year, rising to 50 percent by the third year) is tied to the PGP's performance on quality targets. Medicare retains the remaining 20 percent of savings achieved by the PGP plus any bonus set aside for quality performance that is not earned by the PGP. See: J. Kautter, G. C. Pope, M. Trisolini et al., "Medicare Physician Group Practice Demonstration Design: Quality and Efficiency Pay-for-Performance," *Health Care Financing Review*, Fall 2007 29(1):15–29; Government Accountability Office, *Medicare Physician Payment: Care Coordination Programs Used in Demonstration Show Promise, but Wider Use of Payment Approach May Be Limited* (Washington, D.C.: GAO, Feb. 2008); Centers for Medicare & Medicaid Services, *Physician Groups Continue to Improve Quality and Generate Savings Under Medicare Physician Pay for Performance Demonstration* (Washington, D.C.: U.S. Dept. of Health and Human Services, Aug. 2008).

[15] M. Trisolini, G. Pope, J. Kautter et al., *Medicare Physicians Group Practices: Innovations in Quality and Efficiency* (New York: The Commonwealth Fund, Dec. 2006).

[16] T. A. Praxel, "Participating in the CMS Physician Group Practice Demonstration: Lessons Learned," presented at the American Medical Group Association Institute for Quality Leadership, Dallas, Tex., Sept. 24–27, 2008, http://www.amga.org/Education/IQL/p2p_iql.asp.

[17] K. S. H. Yarnall, K. I. Pollak, T. Østbye et al., "Primary Care: Is There Enough Time for Prevention?" *American Journal of Public Health,* April 2003 93(4):635–41.

[18] P. Peissig, E. Sirohi, R. L. Berg et al., "Construction of Atorvastatin Dose—Response Relationships Using Data from a Large Population-Based DNA Biobank," *Basic & Clinical Pharmacology & Toxicology*, April 2007 100(4):286–88.

[19] S. Wesbrook, P. F. Giampietro, I. Glurich et al., "Community Based Approaches to Personalized Health Care: Marshfield Clinic," Community Report, presented at the *National Summit on Personalized Health Care,* Deer Valley, Utah, Oct. 5–7, 2008, http://www.personalizedhealthcaresummit.org/community-reports; C. A. McCarty, D. Chapman-Stone, T. Derfus et al., "Community Consultation and Communication for a Population-Based DNA Biobank," *American Journal of Medical Genetics Part A*, Dec. 2008 146A(23):3026–33; C. A. McCarty, P. Peissig, M. D. Caldwell et al., "The Marshfield Clinic Personalized Medicine Research Project: 2008 Scientific Update and Lessons Learned in the First 6 Years," *Personalized Medicine*, Sept. 2008 5(5):529–41.

[20] The Wisconsin Genomics Initiative includes Marshfield Clinic, the University of Wisconsin School of Medicine and Public Health, the Medical College of Wisconsin, and the University of Wisconsin–Milwaukee.

[21] M. D. Caldwell, T. Awad, J. A. Johnson et al., "CYP4F2 Genetic Variant Alters Required Warfarin Dose," *Blood,* April 15, 2008 111(8):4106–12.

[22] Wisconsin Manufacturers & Commerce Association, "Innovative Healthcare Solutions: Marshfield Clinic Center for Community Outreach," *Wisconsin Business Best Practices*, http://www.wmc.org/healthcare/index.php.

[23] Marshfield Clinic Indianhead Center, "Improving Access in Primary Care—Virtually," *Improvement Report* (Boston, Mass.: Institute for Healthcare Improvement, 2006).

[24] L. Pelton, "Improvements in Access to Care," presented at the Wisconsin Collaborative for Healthcare Quality*, Fall Forum 2005,* www.wchq.org/pdf/2005Forum/Breakout3.pdf.

[25] Wisconsin Collaboration for Healthcare Quality, "Time to a Third Next Available Appointment," http://www.wchq.org/reporting/third_avail_appt.php, accessed Jan. 9, 2009.

[26] Telehealth is a strategy for bridging geographic gaps between providers or between patients and providers using electronic information and communications technologies such as videoconferencing, transmission of diagnostic test results, and remote monitoring of patient vital signs and clinical conditions. Applications of telehealth include the provision of clinical care (telemedicine) and of supportive services such as continuing medical education for providers or health promotion for patients.

[27] Sources of information on Marshfield Clinic Telehealth included personal communication with Nina M. Antoniotti, Jan. 2009; V. Glaser, "Telethinking with Nina M. Antoniotti," *Telemedicine Journal and E-Health,* 2005 11(5):517–21; N. M. Antoniotti, "TeleHealth and EMRs: Talking the TeleHealth Language" (presentation given at American Telemedicine Annual Meeting, Nashville, Tenn., May 2007); Health Resources and Services Administration, Telehealth Grantee Directory, http://www.hrsa.gov/telehealth/granteedirectory/overview_wi.htm; American Telemedicine Association, "Wisconsin Medicaid and Telehealth," *Policy White Papers,* http://www.americantelemed.org/files/public/policy/MEDICAL_ASSISTANCE_AND_TELEHEALTH.pdf.

[28] "Medical Care Cost Equation," *Dartmouth Atlas of Health Care*, http://www.dartmouthatlas.org.

[29] Marshfield Clinic's history includes several examples in which the market did not reward doing what its physicians considered the "right thing" for patients and the community, e.g., offering community-rated premiums. For more, see: Coombs, *The Rise and Fall of HMOs: An American Health Care Revolution.*

[30] S. Leatherman, D. Berwick, D. Iles et al, "The Business Case for Quality: Case Studies and an Analysis," *Health Affairs,* April 3, 2003 22(2):17–30.

[31] R. E. Hall, "The Marshfield Clinic Experience," presentation at MemorialCare's Forum on Health Care Reform Issues, Irvine, Calif., Sept. 2008, http://www.memorialcare.org/About/gov_relations/pdf/3_reed_hall.pdf.

About the Authors

Douglas McCarthy, M.B.A., president of Issues Research, Inc., in Durango, Colorado, is senior research adviser to The Commonwealth Fund. He supports The Commonwealth Fund Commission on a High Performance Health System's scorecard project, conducts case studies on high-performing health care organizations, and is a contributing editor to the bimonthly newsletter *Quality Matters*. He has more than 20 years of experience working and consulting for government, corporate, academic, and philanthropic organizations in research, policy, and operational roles, and has authored or coauthored reports and peer-reviewed articles on a range of health care–related topics. Mr. McCarthy received his bachelor's degree with honors from Yale College and a master's degree in health care management from the University of Connecticut. During 1996–1997, he was a public policy fellow at the Hubert H. Humphrey Institute of Public Affairs at the University of Minnesota. He can be e-mailed at dm@cmwf.org.

Kimberly Mueller, M.S., is a research assistant for Issues Research, Inc., in Durango, Colorado. She earned an M.S. in social administration from the Mandel School of Applied Social Sciences at Case Western Reserve University and an M.S. in public health from the University of Utah. A licensed clinical social worker, she has over 10 years' experience in end-of-life and tertiary health care settings. She was most recently a project coordinator for the Association for Utah Community Health, where she supported the implementation of chronic care and quality improvement models in community-based primary care clinics.

Sarah Klein has been writing about health care for more than 10 years as a reporter for *Crain's Chicago Business* and *American Medical News*. She serves as a contributing writer to *Quality Matters*, a newsletter published by The Commonwealth Fund. She received a B.A. in Asian studies from Washington University in St. Louis.

Acknowledgments

The authors gratefully acknowledge the following individuals who kindly provided information on Marshfield Clinic and its initiatives during a site visit: Karl Ulrich, M.D., M.M.M., president and CEO; Reed Hall, J.D., M.S., executive director; Theodore Praxel, M.D., M.M.M., medical director for quality improvement and care management; Marilyn Follen, R.N., M.S.N., administrator of quality improvement and care management; Edna DeVries, M.D., medical director of the Clinic's Central Division; Gary S. Plank, Pharm.D., corporate director of pharmacy services; Nina M. Antoniotti, Ph.D., M.B.A., R.N., director of Marshfield Clinic's TeleHealth Network; Humberto Vidaillet, M.D., director of the Marshfield Clinic Research Foundation; Catherine McCarty, Ph.D., M.P.H., director of the Center for Human Genetics; and Peggy Peissig, M.B.A., associate director of the Biomedical Informatics Research Center. We are also grateful to other Marshfield Clinic staff and the authors of previous case studies and reports, which we have cited, for their contributions to documenting the Clinic's practices. The authors thank the staff at The Commonwealth Fund for advice on and assistance with case study preparation.

Editorial support was provided by Joris Stuyck.

This study was based on publicly available information and self-reported data provided by the case study institution(s). The Commonwealth Fund is not an accreditor of health care organizations or systems, and the inclusion of an institution in the Fund's case studies series is not an endorsement by the Fund for receipt of health care from the institution.

The aim of Commonwealth Fund–sponsored case studies of this type is to identify institutions that have achieved results indicating high performance in a particular area of interest, have undertaken innovations designed to reach higher performance, or exemplify attributes that can foster high performance. The studies are intended to enable other institutions to draw lessons from the studied institutions' experience that will be helpful in their own efforts to become high performers. It is important to note, however, that even the best-performing organizations may fall short in some areas; doing well in one dimension of quality does not necessarily mean that the same level of quality will be achieved in other dimensions. Similarly, performance may vary from one year to the next. Thus, it is critical to adopt systematic approaches for improving quality and preventing harm to patients and staff.