THE COMMONWEALTH FUND

Case Study

Organized Health Care Delivery System • August 2009

Mayo Clinic: Multidisciplinary Teamwork, Physician-Led Governance, and Patient-Centered Culture Drive World-Class Health Care

Douglas McCarthy, Kimberly Mueller, and Jennifer Wrenn
Issues Research, Inc.

ABSTRACT: The Mayo Clinic is the world's oldest and largest integrated multispecialty group medical practice, combining clinical practice, education, and research at the regional, national, and international levels for the benefit of individuals with routine as well as complex health care needs. Mayo's model of integrated care is one of multidisciplinary practice with salary-based compensation that fosters team-oriented patient care and peer accountability, a supportive infrastructure allowing physicians and other caregivers to excel at clinical work, and a physician-led governance structure promoting a patient-centered culture. Full integration of the hospital and clinic and the use of a shared electronic medical record across inpatient and outpatient settings also have been critical to realizing efficiencies and promoting clinical excellence. Mayo fosters a learning environment in which teams of medical professionals use information technology and systems engineering to learn from each other and improve care in tandem with clinical practice.

The mission of The Commonwealth Fund is to promote a high performance health care system. The Fund carries out this mandate by supporting independent research on health care issues and making grants to improve health care practice and policy. Support for this research was provided by The Commonwealth Fund. The views presented here are those of the authors and not necessarily those of The Commonwealth Fund or its directors, officers, or staff.

For more information about this study, please contact:

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

To learn more about new publications when they become available, visit the Fund's Web site and register to receive Fund email alerts.

Commonwealth Fund pub. 1306
Vol. 27

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).

Mayo 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 Mayo Clinic and for one exemplary organization within Mayo Health System, the regional system affiliated with Mayo Clinic.

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 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 patient 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.

Information was gathered from interviews with health system leaders and from a review of supporting documents.[2] The case-study sites exhibited the six attributes in different ways and to 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

The Mayo Clinic is the world's first and largest integrated multispecialty group medical practice. From its roots in the nineteenth-century family medical practice of William Mayo and his sons, Mayo by the 1920s had developed the key attributes that distinguish it today: private, not-for-profit status, a salaried staff, and a mission to "provide the best care to every patient every day through integrated clinical practice, education, and research." The Mayo Clinic Model of Care defines core expectations for clinical practice at Mayo Clinic today as the institution has evolved the forms through which it fulfills the philosophy of its founders (Exhibit 3).[4]

Mayo Clinic annually serves 520,000 individual patients (many of whom have multiple episodes of care) from across the country and around the world. A staff of almost 55,000, including more than 3,400 clinic physicians and researchers representing nearly every medical discipline, provides comprehensive inpatient and outpatient care in four owned hospitals and outpatient facilities on three major campuses: Rochester, Minn.; Scottsdale, Ariz.; and Jacksonville, Fla. (Exhibit 4). The nonprofit Mayo Foundation owns the facilities and other assets.

Mayo Health System, created in partnership with Mayo Clinic beginning in 1992, is an affiliated regional system and referral network with almost 800 physicians and 13,000 allied health staff who serve 2.4 million patients in 17 owned and two managed hospitals, eight owned and one managed nursing homes, and clinics in 70 communities in Minnesota, Iowa, and Wisconsin.[5]

Research and education are considered essential to delivering the best care at Mayo Clinic, through both formal educational programs and ongoing knowledge dissemination. The formal educational mission is carried out through five schools of biomedical education including the Mayo Graduate School and the Mayo Schools of Medicine, Graduate Medical Education, Health Sciences, and Continuing Medical Education. Mayo funds about half of its $400 million research portfolio internally, including basic, clinical, and translational research activities.

Exhibit 2. Case Study Highlights

Overview: Mayo Clinic is the world's oldest and largest integrated, not-for-profit, multispecialty group medical practice, with more than 3,400 clinic physicians and scientists serving 520,000 patients in four owned and managed hospitals and outpatient facilities on three major campuses (Rochester, Minn.; Scottsdale, Ariz.; and Jacksonville, Fla.) and five schools of biomedical education. Mayo Health System is an affiliated network of 17 owned hospitals and clinics with almost 800 physicians serving 2.4 million patients in 70 communities in Minnesota, Wisconsin, and Iowa.

Attribute	Examples from Mayo Clinic and Mayo Health System
Information Continuity	EHR accessible by all clinicians at each Mayo Clinic site, with Web-based cross-site linkages. Implementing EHR portal for referring physicians to upload patient information and receive results of the patient visit. Clinicwide telephonic paging system for rapid consultations. Enhanced decision support tools and patient portal currently in development.
Care Coordination and Transitions; System Accountability*	Every Mayo Clinic patient is assigned a coordinating physician who ensures that there is an appropriate care plan, that ancillary services and consultations are scheduled in a timely fashion, and that the patient receives clear communication throughout and at the conclusion of the visit. Experiments are under way to reorganize outpatient visits to increase time with patients through the use of midlevel practitioners, with electronic communication and monitoring to engage patients in self-care between visits. Luther Midelfort–Mayo Health System instituted a population-based care management initiative for diabetes patients that broadens the traditional patient-visit paradigm to encompass telephonic outreach to patients who are not making regular visits, previsit planning to identify patient needs and schedule laboratory testing, and patient education and follow-up to promote treatment adherence between visits.
Peer Review and Teamwork for High-Value Care	Clinical Practice Committees are responsible for quality of care at each Mayo Clinic site, including dissemination of expert-developed clinical protocols. Systemwide Clinical Practice Advisory Group reconciles protocols across sites and is responsible to the board of governors for overall system quality. The EHR is open to all authorized Mayo physicians and invites comment and collaboration from care team members. Quality is reported internally and externally to drive improvement.
Continuous Innovation	Mayo is seeking to create "the future of patient care" through the ongoing application of systems engineering and process improvement principles to enhance systems and processes supporting efficient and effective care delivery. Center for Translational Science Activities creates innovative systems for delivering benefits of research discoveries into day-to-day medical practice. An electronic learning system is being built to spread medical knowledge systemwide, in addition to existing grand rounds, online curricula, and an in-house journal. Consultative resources are in place for systems engineering and improvement. Local teams undertake pilots; successful projects are taken to scale (e.g., improving the timeliness of heart attack treatment, reducing medication documentation discrepancies).
Easy Access to Appropriate Care	Patient scheduling system uses algorithms to assign new patients to physicians and orchestrate a patient's time at the Clinic; it takes into account the patient's availability, the specific time and sequencing requirements of office consultations, laboratory tests and procedures, and the travel time between appointments. Several primary care clinics offer same-day or next-day appointments. Cardiovascular clinic used "lean" methodology to reduce patient waiting time and missed appointments and increase value-added time with patients.

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

Exhibit 3. Mayo Clinic Model of Care

Patient Care
• Collegial, cooperative, staff teamwork with true multispecialty integration
• An unhurried examination with time to listen to the patient
• Physicians taking personal responsibility for directing patient care over time in partnership with the local physician
• Highest-quality patient care provided with compassion and trust
• Respect for the patient, the family, and the patient's local physician
• Comprehensive evaluation with timely, efficient assessment and treatment
• Availability of the most advanced, innovative diagnostic and therapeutic technology and techniques
Environment
• Highest-quality staff mentored in the culture of Mayo and valued for its members' contributions
• Valued professional allied health staff with a strong work ethic, special expertise, and devotion to Mayo
• A scholarly environment of research and education
• Physician leadership
• Integrated medical record with common support services for all outpatients and inpatients
• Professional compensation that allows a focus on quality, not quantity
• Unique professional dress, decorum, and facilities

Source: Mayo Clinic.

The organization is physician-led at all levels and operates through physician committees and a shared governance philosophy in which physician leaders work with administrative partners in a horizontal, consensus-driven structure. Physicians serve in rotating assignments on committees and in leadership roles to promote broad participation and development of the workforce. A board of governors comprising primarily physician leaders provides high-level enterprise governance under the oversight of the Mayo Board of Trustees.

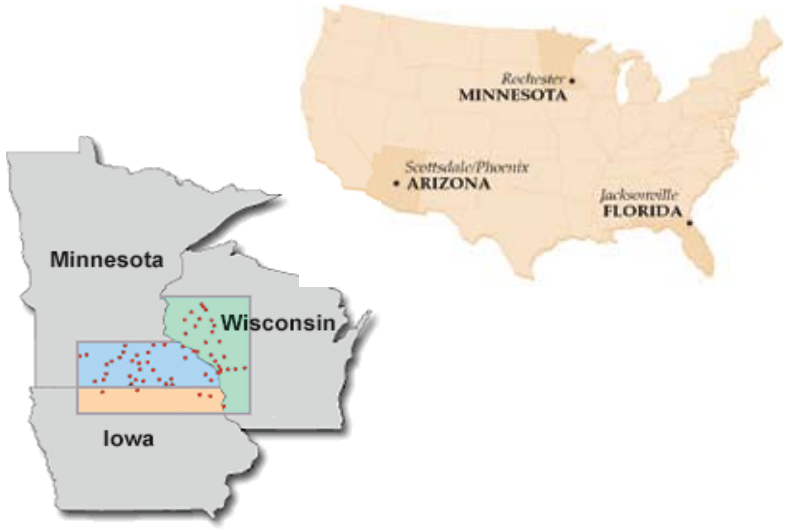
INFORMATION CONTINUITY

The longitudinal medical record, which follows a patient across encounters with different physicians, was first conceived by Mayo Clinic physician Henry Plummer in 1907. Today, Mayo's electronic health record (EHR) system holds more than 6.2 million records of Mayo patients treated since 1907, providing a cumulative account of patients' medical symptoms, diagnoses, tests, treatment plans, procedures, and stored images across disciplines in both inpatient and outpatient settings. The EHR prompts physicians on routine tests and alerts them to potential risks, generates reminders and educational material for patients, and serves as a resource for research.

- EHR terminals are located in every office, work area, and exam room. Electronic charts are routinely shared with patients at the point of care, and are used in virtual consultations with other physicians and providers.
- CarePages, a free Web service for all patients while they are at Mayo, helps patients keep in touch with family or friends wherever Internet access is available. A full patient portal is under development.
- Mayo is working to merge six different EHR systems in use at different clinic sites. In the meantime, physicians use Web portals to view patient records from another site when patients are receiving treatment in multiple locations.

An EHR portal for referring physicians enables a patient's home physician to upload pertinent medical history and test results so that they are available to

Exhibit 4. Mayo Clinic and Mayo Health System Locations



Source: Mayo Clinic.

treating Mayo physicians, thus avoiding duplication of tests. At the conclusion of the visit, the portal communicates the results of the consultation back to the patient's home physician, ensuring continuity of care.

A Web portal for Emergency Department (ED) personnel synthesizes information from disparate information systems (e.g., patient registration, laboratory, pharmacy) into a coherent "dashboard" that facilitates situational awareness and patient monitoring. The portal (called YES) displays patients' presenting complaints, demographic and vital signs, waiting times, the status of incoming ambulance services and the patient they are transporting, and other essential data.[6]

Mayo physicians can use a unique paging system, developed for the Mayo Clinic by AT&T Labs, for rapid consultations. Physician-specific paging tones allow a physician to immediately contact a colleague to ask a question, without the need to schedule an appointment. "If I'm treating a patient with urologic symptoms and I have a question about the best urologic test, I can page a urologist by dialing a five-digit number," said Mayo Clinic vice president Nina Schwenk, M.D. "Their pager rings, they go to any phone on the campus, dial their pager number, and we are immediately connected. I say, 'I'm here with a 55-year-old patient with these symptoms; what is your best advice?' I don't need to leave a message; there's no phone tag. It's immediate, person-to-person communication."

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

Team-Based Care Coordination. Mayo Clinic specializes in the diagnosis and treatment of complex patient illness in an environment in which physicians from every medical specialty work collaboratively to meet individual patient needs, often during the same patient visit. "We try to bring the very best of our entire system to the service of every single patient no matter where that patient is in the system," said Dawn Milliner, M.D., chair of the Mayo Clinical Practice Advisory Group.

Every Mayo patient is assigned a coordinating physician whose job is to ensure that the patient has an appropriate plan of care, that all ancillary services and consultations are scheduled in a timely fashion to meet the patient's needs, and that the patient receives clear communication throughout and at the conclusion of a visit. A Mayo patient typically retains the same coordinating physician throughout the course of treatment and different types of care, but there is a formal handoff procedure for cases in which a different physician would be more appropriate to coordinate the patient's clinical needs.

A current pilot is testing ways of reorganizing the outpatient visit to increase efficiency and the amount

of time that physicians can spend with patients, such as through the use of midlevel practitioners, Web-based communication, and chronic disease monitoring to better engage patients in self-care between visits.

Population-Based Chronic Care Management. The Mayo Health System undertook the Diabetes Translation Project during the late 1990s, which found that a planned-care model (including implementation of guidelines, support for patient self-management, and use of a clinical information system) led to improved diabetes care and metabolic outcomes.[7]

More recently, Luther Midelfort—a division of Mayo Health System serving the west-central region of Wisconsin—embarked on a population-care management initiative to better meet the needs of its patients who have diabetes.[8] This effort builds on the organization's earlier work to develop a team-based planned-care model for chronic disease, using Wagner's Chronic Care Model as a conceptual framework.[9] The approach broadens the traditional patient-visit paradigm to encompass elements such as:

- telephonic outreach to patients who are not making regular visits
- previsit planning to identify patient needs and schedule laboratory testing
- patient education and follow-up to promote treatment adherence between visits

Teamwork is central to this change in practice, with expanded roles for the practice nurse, who conducts outreach and previsit planning, and for the receptionist, who acts as the diabetes registry coordinator. A primary care council—consisting of the departmental chairs of internal medicine, family medicine, pediatrics, and urgent care—identifies and shares best practices and designs care models to create a consistent patient experience across primary care sites. An expert team led by an endocrinologist leverages the expertise of primary care physicians, nurses, and diabetes educators, who together develop and share common patient education tools.

Luther Midelfort's EHR facilitates information sharing as patients move between care settings. The clinic uses a third-party registry program to systematically track patients who are due for visits or tests or who are not meeting goals for disease control. Patients receive a reference card listing five key goals (Exhibit 5), which they can hang on the refrigerator as a reminder of the importance of maintaining their treatment regimen. The card doubles as a checklist for clinicians when conducting patient education and also serves as a notation tool for indicating medication changes and other treatment measures.

Exhibit 5. Five Goals for Diabetes Care

Hemoglobin A1c < 7 percent
Aspirin daily
Smoking cessation
Blood pressure < 130/80
Cholesterol < 100

Luther Midelfort uses an "all-or-none" performance measure (all five goals must be met for a patient's care to be counted as meeting standards) for system-level benchmarking to other organizations within Mayo Health System. Performance data for individual physicians are shared in an "unblinded" manner at the departmental level to promote accountability among physician teams. The clinic has seen substantial improvement in the all-or-none measure since undertaking the initiative in January 2008, with its rate almost tripling in 16 months, from 5.6 percent in January 2008 to 16.1 percent in April 2009.

PEER REVIEW AND TEAMWORK FOR HIGH-VALUE CARE

Mayo has nurtured a culture of teamwork and collaboration among its professional staff since its earliest days (Exhibit 6), a tradition that it preserves through a rigorous hiring and enculturation process. As Texas A&M professor Leonard Berry observes, "The culture makes it okay for highly-trained providers to ask

Exhibit 6. Mayo Philosophy of Team-Based Care

"The sum total of medical knowledge is now so great and wide-spreading that it would be futile for any one man...to assume that he has even a working knowledge of any part of the whole.... The best interest of the patient is the only interest to be considered, and in order that the sick may have the benefit of advancing knowledge, union of forces is necessary.... It has become necessary to develop medicine as a cooperative science; the clinician, the specialist, and the laboratory workers uniting for the good of the patient, each assisting in elucidation of the problem at hand, and each dependent upon the other for support."

William J. Mayo, 1910

for help; the technology makes it easy to provide the help."[10] For example, the shared clinical record serves as an "open book" means of continual peer review in which clinicians can give one another feedback that promotes ongoing group accountability for clinical excellence. Likewise, the paging system (described above) facilitates ad hoc consultations when physicians have questions as to the best treatment for a patient.

Salary-based compensation and shared system resources remove barriers to teamwork that tend to exist in other reimbursement models. Centrally held discussions and decisions about resources help reduce competition or infighting among departments or disciplines. "Peer-review pressure," rather than productivity incentives, creates group expectations for physicians to see the right number of patients, said Dr. Schwenk.

Each of the three Mayo Clinic sites (Arizona, Florida, Minnesota) has a Clinical Practice Committee (CPC), composed of and led by physicians, that is responsible for the quality of care delivery across settings of care, including the infrastructure supporting dissemination of expert-developed clinical protocols. For example, the Rochester, Minnesota, CPC has 18 subcommittees responsible for topics such as accreditation, medical records, and quality of care. To illustrate the work of the CPC, Dr. Milliner described a scenario in which diabetes experts developed a protocol for chronic disease management that required ongoing patient communication. To meet this need, the CPC's medical record subcommittee examined various options and engaged enterprise resources to develop a Web portal for patients to communicate with the care team.

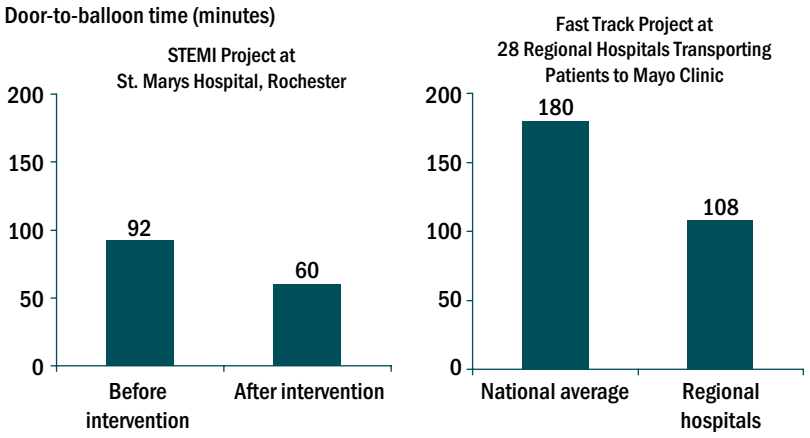
The systemwide Clinical Practice Advisory Group, made up of leaders from each of the site-specific CPCs, is responsible for the overall delivery of care across all Mayo Clinic sites under the oversight of the board of governors. Reconciling clinical protocols and standards across sites affords these peer leaders the opportunity to review approaches being taken across the enterprise and to identify and address gaps or inconsistencies. As a result of developing common protocols for organ transplantation, for example, a patient can have pre-transplant workup done at Mayo Clinic Rochester, then undergo surgery at Mayo Clinic Arizona, if needed.

The Mayo committee process may take longer to reach consensus leading to action than would a traditional "top-down" management structure, Dr. Schwenk acknowledged. On the other hand, she said, it provides a systematic mechanism for vetting proposed changes to increase the odds of success, making implementation of decisions easier because physician buy-in has already been achieved.

CONTINUOUS INNOVATION

Mayo is seeking to create "the future of patient care" through the ongoing application of systems engineering as well as process improvement principles and expertise to enhance the systems and processes that support efficient and effective care delivery, such as exam room design, patient flow, appointment scheduling, and patient check-in procedures. The Mayo Clinic Quality Office offers consultative resources and workforce education for quality improvement, including the internal Mayo Clinic Quality Academy. Quality is

Exhibit 7. Mayo Clinic: Minimizing Treatment Delays for Heart Attack



Note: STEMI=ST-elevation myocardial infarction. Door-to-balloon time represents elapsed time from the patient's arrival at the emergency room to receipt of balloon angioplasty to open a blocked cardiac artery. STEMI project conducted at St. Marys Hospital, Rochester between 2004 and 2006. Regional hospitals participating in the Fast Track project are those within 200 miles of the Mayo Clinic, Rochester.
Source: Mayo Clinic 2006 Annual Report.

measured and reported internally by department, division, and institution to promote mutual accountability and drive improvement. When local teams undertake pilot projects, those demonstrating success are taken to scale in broader systemwide initiatives.

The following are several examples of specific improvement activities and initiatives.

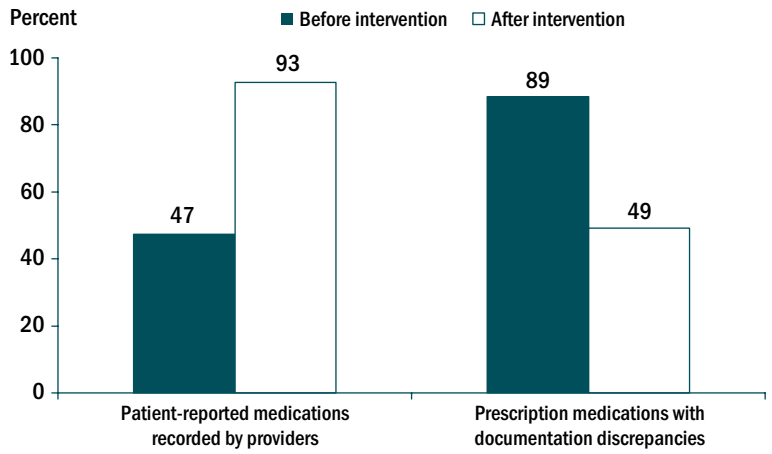
Improving asthma management. An internal medicine team headed by Kaiser Lim, M.D., developed a population-based intervention to improve asthma care and control. The team first examined quality metrics and identified a need to measure patient-focused outcomes, such as how well patients are controlling their asthma symptoms.[11] The team then developed an asthma registry that can be populated from existing patient diagnostic data. A patient survey found baseline asthma control was 72 percent to 81 percent, short of the goal of 95 percent. Airway "peak flow" measurement and asthma severity documentation also were deemed unsatisfactory. To improve these measures, the team developed an intervention and tools to review asthma during routine primary care visits.[12]

By linking the asthma registry to the scheduling calendar, the team developed a standard procedure to identify asthma patients in advance of primary care appointments. An electronic prompt alerts staff in the study clinic to the asthma assessment needs of those patients. Patients are screened and treated with the help of the validated Asthma Control Test and electronic Mayo Asthma Plan and Asthma Flowsheet, which help to identify and guide the care of patients in need of assistance in controlling their asthma.[13] Use of these tools in the study clinic resulted in substantially higher documentation of peak flow rates (84% vs. 0%) and asthma severity (63% vs. 12%) as compared with control sites.

An assessment found that opportunities to intervene with asthma patients were limited because some patients do not schedule primary care visits during the year, and because of limited time during the primary care visit to address asthma management. To overcome these barriers, the team developed two enhancements that are currently being tested: 1) a case management protocol that employs allied health professionals as physician extenders in the asthma screening, education, and monitoring process during and after primary care visits; and 2) population management techniques that invite asthma patients for targeted visits centered on teaching the use of a written action plan to attain symptom control, followed by a short prescribing visit with the primary care physician.

The experiential learning methods employed by the asthma initiative team serve as a template for

Exhibit 8. Mayo Clinic: Results of an Intervention to Improve Medication Reconciliation Procedures



Source: P. Varkey, J. Cunningham, and S. Bisping, "Improving Medication Reconciliation in the Outpatient Setting," *Joint Commission Journal on Quality and Patient Safety*, May 2007 33(5):286–92.

other quality improvement initiatives. Using a "plan, do, study, act" approach, quality teams follow a logical progression of steps to establish baseline performance, decide on valid quality indicators, deploy standardized processes for gathering data and implementing interventions, identify limitations of the approach, and refine the process through repeated cycles.

Improving the timeliness of heart attack treatment. Redesigning care processes reduced the average time it takes heart attack patients entering the emergency room to receive lifesaving angioplasty treatment that opens clogged arteries (known as the "door-to-balloon" time) from 92 minutes to 60 minutes at St. Marys Hospital, Rochester, between 2004 and 2006. Mayo's Fast Track for Heart Attack project expanded this approach to the regional level, achieving a door-to-balloon time of 108 minutes (as compared with a national average of 180 minutes) among 28 regional hospitals transporting patients to Mayo Clinic Rochester (Exhibit 7). Process innovations included: prioritizing electrocardiogram acquisition at the regional hospital; implementing standard guidelines for selecting reperfusion strategy and adjunct pharmacotherapy; and, upon arrival from the regional hospital, transferring the patient directly to the catheterization lab for intervention.[14]

Improving outpatient medication reconciliation. The Mayo Clinic Rochester preventive medicine clinic designed a multifaceted intervention to reduce medication errors by requesting that primary care patients bring all prescription and over-the-counter medications or a current medication list with them to their clinic visit, asking patients to correct any discrepancies in the clinic's medication list (contained in the EHR) during the office visit, and providing physicians with education and feedback on medication reconciliation procedures. This process significantly improved the recording of patient-reported medications from less than half to almost all patients, and reduced by 45 percent the frequency of missing medication lists and medication documentation discrepancies that can lead to errors (Exhibit 8). Other Mayo primary care and specialty clinics are replicating the intervention to enhance patient safety across the Mayo system.[15]

Collaborating to promote service excellence. Since 2005, more than 80 clinical and operational departments across the Mayo system have participated in an internal collaborative to improve service for both internal and external Mayo clients. Bringing together teams of individuals from departments such as neonatology, thoracic medicine, and information technology, the collaborative provides a coach for each team and

employs a dedicated Web site to facilitate communication and training. Teams identify service-oriented targets to work on, such as improving the availability of specialized wheelchairs for patients upon entering the hospital. Organizational leaders afford teams the time needed to plan, implement, and evaluate their interventions. Some teams have achieved improvements to a degree of 50 percent or more in selected pre- and post-intervention targets.[16]

Translating research into practice. Mayo's Center for Translational Science Activities (CTSA) creates innovative systems for disseminating the benefits of research discoveries so they can be efficiently implemented into day-to-day medical practice. For example, Mayo recently launched an individualized medicine initiative with the goal of "link[ing] clinical and biological data to improve our ability to predict an individual's susceptibility to disease, onset and progression of disease, and likely response to therapy."

The Mayo Health System Practice-Based Research Network, developed in 2007, helps Mayo Clinic better understand the health care needs of the population of its service area as it extends research opportunities to providers and residents of local communities, which are often in underrepresented or isolated rural areas. Several studies led by primary care physicians and nurse practitioners are examining the management of diabetes, orthostatic hypotension, and end-of-life care.

Developing systems for sharing knowledge. Mayo's Education Learning Center is creating an electronic learning system (ELS) to promote a professional learning environment in which all physicians and health professionals stay up to date with the latest medical knowledge they need to treat a given patient. To that end, the ELS customizes content, or "knowledge objects," to meet the needs of users (general internists, nurses, medical students, etc.), including frequently asked questions and the names and pager numbers of Mayo's top five experts on the relevant topic. This system will supplement traditional mechanisms for sharing professional knowledge, such as clinical grand rounds and online curricula resources.

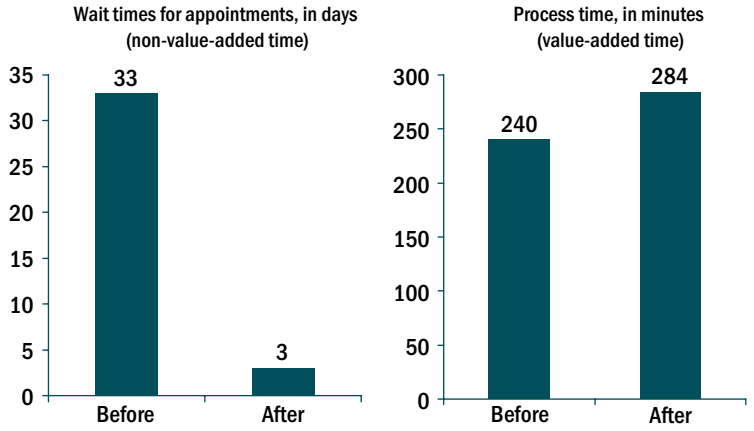
EASY ACCESS TO APPROPRIATE CARE

Mayo has developed its own sophisticated patient scheduling system that uses complex rules and algorithms to assign new patients to physicians and orchestrate a patient's time at the clinic (the typical patient has five to seven appointments during the day). The system automatically takes into account the patient's availability, the specific time and sequencing requirements of office consultations, laboratory tests, and procedures, and the travel time between appointments. When a patient has a radiology appointment or stress test, for example, each preceding physician's notes are already in the EHR and available to the cardiologist or the radiologist before the test, along with the results of any tests previously ordered and the results of the physical examination.

Several Mayo primary care clinics have adopted an "advanced access" model of appointment scheduling enabling them to offer same-day or next-day appointments. Following this approach, the Community Pediatric and Adolescent Medicine team reduced the average waiting time for routine appointments from 45 days to within two days, for example.[17] An evaluation assessing advanced access scheduling in Mayo family medicine clinics found that this approach sometimes increased the likelihood of patients with stable chronic conditions being scheduled for multiple preventive visits during the year, but the effects varied among clinic sites.[18]

The Mayo Cardiovascular Health Clinic applied "lean" methodology to improve patient access and operational effectiveness. The systems of scheduling patients into the clinic and providing comprehensive, multidisciplinary care were enhanced by redesigning and standardizing the processes of accepting referrals, stratifying patients by risk category, and ordering relevant diagnostic studies. This redesign better aligned demand and supply of clinic services and reduced waste (Exhibit 9), such as the waiting time to obtain

Exhibit 9. Mayo Clinic Cardiovascular Health Clinic: Results of Applying "Lean" Methodology to Improve Patient Access



Note: A process is a set of actions or steps each of which must be accomplished properly in the proper sequence at the proper time to create value for the patient.
Source: A. M. Wills, R. J. Thomas, H. H. Ting et al., "Cardiovascular Health Clinic Patient Journey: A Lean Approach to Improve Effectiveness," Improvement Report (Boston, Mass.: Institute for Healthcare Improvement, 2005).

an appointment (from 33 days to three days on average) and patient no-shows or missed appointments (from 30 percent to 10 percent of appointment slots). Concurrently, the redesign increased the provision of value-added process time for patients (from 240 to 284 minutes on average). The Cardiology Outpatient Value Stream Map serves as a framework to guide future lean initiatives.[19]

Mayo Clinic has used linguistic interpreters for more than 75 years to meet the needs of its multicultural clientele. Mayo's 78 interpreters speak 23 languages and also provide sign-language interpreting.[20]

RECOGNITION OF PERFORMANCE

In addition to the results of the specific interventions described above, Mayo 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).

Researchers at Dartmouth Medical School recently reported that Mayo Clinic's flagship St. Marys Hospital in Rochester, Minnesota, delivered care to Medicare patients with severe chronic illnesses in a generally more efficient manner than did many other integrated academic medical centers with similar reputations.[22] They noted that:

> [Mayo Clinic's St. Marys Hospital] is not the least costly hospital, but it enjoys a strong national reputation for quality, while simultaneously keeping utilization and costs relatively low. It is part of a well-organized health care system. These qualities make it a credible model for other academic medical centers to emulate as they begin to rethink how they might more efficiently allocate such resources as beds and physicians.

The *Dartmouth Atlas* found that, as compared with chronically ill Medicare patients at U.S. hospitals overall, those who received the majority of their care at Mayo Clinic/St. Marys from 2001 to 2005 had, on average, similar Medicare spending per person in their last two years of life but fewer hospital days (90%) and physician visits (73%).[23]

The identification of areas of excellence does not mean that the Mayo Clinic has achieved perfection, however. Like the other organizations in this case-study series, Mayo has room for improvement in several areas of care. For example, the affiliated regional medical groups that constitute the Mayo

Exhibit 10. Selected Externally Reported Results and Recognition*

Inpatient Care Quality[21] (CMS Hospital Compare Jan.–Dec. 2007)	*Four-topic clinical composite* (24 measures): Five Mayo Clinic and Mayo Health System hospitals ranked in the top quartile, and two of these in the top decile, of U.S. hospitals evaluated. *Heart attack treatment* (8 measures): Five Mayo Clinic and Mayo Health System hospitals ranked in the top quartile, and two of these in the top decile, of U.S. hospitals evaluated. *Heart failure treatment* (4 measures): Six Mayo Clinic and Mayo Health System hospitals ranked in the top quartile of U.S. hospitals evaluated. *Pneumonia treatment* (7 measures): Seven Mayo Clinic and Mayo Health System hospitals ranked in the top quartile, and five of these in the top decile, of U.S. hospitals evaluated. *Surgical care improvement* (5 measures): Seven Mayo Clinic and Mayo Health System hospitals ranked in the top quartile, and three of these in the top decile, of U.S. hospitals evaluated. *Overall patient rating of care* (HCAHPS): Seven Mayo Clinic and Mayo Health System hospitals ranked in the top quartile, and four of these in the top decile, of U.S. hospitals reporting in 2007. Four large hospitals ranked in the top decile of large hospitals.
National Recognition and Ratings	*Thomson/Solucient 100 Top Hospitals*: National Benchmarks for Success (Mayo Clinic Hospital, Ariz., in 2003; Mayo Clinic/Rochester Methodist Hospital, Minn., in 2005; Mayo Clinic/St. Marys Hospital, Minn., in 2003, 2004, and 2008). *HealthGrades Distinguished Hospitals for Clinical Excellence*: Mayo Clinic Hospital, Ariz., in 2005–2009; Mayo Clinic/St. Luke's Hospital, Fla., in 2007, 2008; Mayo Clinic/St. Marys Hospital, Minn. in 2005–2008. *Leapfrog Group Top Hospitals*: Mayo Clinic Hospital, Ariz., in 2008; Mayo Clinic/St. Luke's Hospital, Fla., in 2007; Mayo Clinic/St. Marys Hospital, Minn., in 2006, 2007. *US News & World Report* Best Hospitals: Mayo Clinic Hospital, Ariz., in 2005–2008; Mayo Clinic/St. Luke's Hospital, Fla., in 2007, 2008; Mayo Clinic/St. Marys Hospital, Minn., in 2005–2008. *National Research Corporation's Consumer Choice Award*: Mayo Clinic Hospital, Ariz., in 2003/2004 and 2004/2005; Mayo Clinic/St. Marys Hospital, Minn., in 2003/2004–2007/2008. *National Committee for Quality Assurance*: Diabetes Physician Recognition Program (Mayo Clinic, Minn.). *American Medical Group Association*: Preeminence Award (2004) to Albert Lea Medical Center; Acclaim Award (2005) to Luther Midelfort, Wis., for its Planned Care for Chronic Disease program.

* See the *Series Overview, Findings, and Methods* for analytic methodology and explanation of performance recognition. CMS = Centers for Medicare and Medicaid Services; HCAHPS = Hospital Consumer Assessment of Healthcare Providers and Systems (large hospitals means 300 or more beds and patient surveys). National Committee for Quality Assurance Quality Compass data were not available because the system does not own a health plan.

Health System ranked below the regional average on eight of 12 ambulatory-care quality topics evaluated by the Minnesota Community Measurement scorecard for 2008.[24] Likewise, the Dartmouth researchers found "surprising variation" in the intensity of care at the end of life among Medicare patients treated in different Mayo Foundation hospitals, indicating opportunities for realizing more consistent performance.[25] Mayo's nearly 100-year history, together with the evidence of improvement capabilities described above, suggests that it will continue to innovate so as to achieve higher levels of performance.

INSIGHTS AND LESSONS LEARNED

The success of Mayo Clinic's model of integrated care flows from three primary and interrelated influences, according to Dr. Schwenk. First, multidisciplinary practice with salary-based compensation fosters team-oriented patient care and peer accountability. Second, the supportive organizational and technologic infrastructure permits physicians and other caregivers to excel at the clinical work they were trained to do. And third, a physician-led governance structure inculcates a culture that filters all decisions through the lens of patients' interests.

The full integration of hospitals with the Clinic (Mayo acquired its two Rochester, Minnesota, hospitals—with which it had long-standing relationships—in 1986, and built hospitals in Arizona and Florida) and the use of a shared medical record across inpatient and outpatient settings have been critical to realizing efficiencies and promoting clinical excellence. This operational integration is successful because it is tied to a cultural philosophy of doing the best for the patient. "Integrated care means that when you come to Mayo, we take care of *you*, not the disease that you may have. The radiologist, the lab pathologist, the surgeon, the internist—all work together to make sure that patients get what they need," Dr. Schwenk said.

Mayo's consensus-driven decision-making and budgeting process means that resources and operations are deployed to serve the mission and cohesive functioning of the entire organization. Although the committee process may take more time to reach decisions than would a top-down management approach, it engenders acceptance of decisions and a spirit of teamwork across specialties. Resources are held centrally rather than by individual sites or departments, thus avoiding infighting. "We don't have that here because everyone's working for one goal, and that's the patient," observed Dr. Milliner. The words of founder William J. Mayo—"The best interest of the patient is the only interest to be considered"—are the touchstone for decisions of all sorts ranging from conducting research to establishing the dress code, or designing equipment or a new hospital.

Mayo has served as a model for other institutions, such as the Cleveland Clinic in Ohio and the Lahey Clinic in Massachusetts, and many lessons from its experience may be applicable to other practices—although building a culture of excellence is certainly a long-term project. The Mayo Health System offers insights into how some of the advantages of the Mayo Clinic model of group practice can be adapted to community-based delivery systems. At Luther Midelfort, for example, multispecialty group practice demonstrates the built-in advantages to adoption of population-based diabetes care. "We can bring collective wisdom to bear to share what works and encourage improvement over time," said Jill Lenhart, M.D., chair of Midelfort's Primary Care Council.

Sustaining change in clinical practice requires aligning management structure and care processes both horizontally and vertically across the organization, said Terrance Borman, M.D., Luther Midelfort's medical director. For example, the Midelfort Clinic's early work on a planned-visit approach did not achieve universal adoption across all primary care sites because coordinating mechanisms were lacking. Creating the Primary Care Council to bring together physicians from across clinical sites allowed the Clinic to spread knowledge and innovations throughout the organization. Realizing the value of the chronic care model as an organizing principle for clinical work also requires paying attention to workflow design and standardization of schedules to achieve consistent patient flow across departments. This means that physicians

must be willing to give up some of their accustomed autonomy for the greater good, said Borman.

A common saying at Mayo is, "No one of us is as smart as all of us." Mayo leadership strongly believes in the critical importance of creating and maintaining a learning organization in which "teams of medical professionals use information technology and systems engineering to learn from each other in a timely way and do it as part of the ongoing activity of clinical practice," said Mayo CEO Denis Cortese, M.D. Mayo physicians are attracted to the idea of improving the science of health care delivery, which includes translational research and technologic innovations that feed vital information to both physicians and patients at the point of service. This approach supports what Cortese calls developing "true professionals" who are "prepared to pass on a body of knowledge through teaching and mentoring, and contribute to that knowledge through basic research or quality improvement research or anything in between."

Dr. Cortese said that the ultimate benefit of an integrated system such as Mayo Clinic is its ability to deliver high-value health care. Because Mayo Clinic does not participate in contracts that require patients to see its physicians, "every single patient who comes to see us is there by choice," he notes. "In that environment, we have to provide a reason for people to come to us, something they think they are getting: outcomes, service, safety, quality, [lower cost], and coordinated care." Focusing on value aligns individual interests with population health improvement goals. "No matter how you look at this, it's about how you manage patients one-on-one," he said. "By accumulating better care for individuals, you improve population health."

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 Mayo Clinic was synthesized from a presentation by CEO Denis Cortese, M.D., to the Commission on a High Performance Health System meeting in Minneapolis, July 2007, and from telephone interviews with Nina Schwenk, M.D., vice president of Mayo Clinic and vice chair of the Mayo Clinic Board of Trustees, Dawn Milliner, M.D., chair of the Mayo Clinical Practice Advisory Group, Terrance Borman, M.D., medical director of Luther Midelfort—Mayo Health System, Jill Lenhart, M.D., chair of the Luther Midelfort Primary Care Council, and Kaiser Lim, M.D., Division of Pulmonary and Critical Care Medicine at Mayo Clinic; from documents on the Mayo Clinic Web site (www.mayo.edu), and from other sources noted below.

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 Health Care Delivery Systems—Series Overview, Findings, and Methods* (New York: The Commonwealth Fund, July 2009).

4 K. D. Olsen and M. E. Brown, "Preserving the Core of Quality Care as the Practice Evolves: The Mayo Clinic Model of Care," *Group Practice Journal,* Apr. 2001 50(4):11–19.

5 For additional background on Mayo Health System, see K. E. Smith, "Mayo Health System: Development of an Integrated Delivery System in Southern Minnesota, Northern Iowa and Western Wisconsin," in J. W. Appling, ed., *Integrated Health Care: Lessons Learned* (Englewood, Colo.: Medical Group Management Association, 1999), and P. W. Carryer and S. Sterioff, "Mayo Health System: A Decade of Achievement," *Mayo Clinic Proceedings,* Aug. 2003 78(8):1047–53.

6 V. Smith, A. Boggust, and B. Staven, *'YES' Application, Department of Emergency Medicine*, presentation at the National Forum for Quality Improvement in Healthcare, Dec. 2008.

7 V. M. Montori, S. F. Dinneen, C. A. Gorman et al., "The Impact of Planned Care and a Diabetes Electronic Management System on Community-Based Diabetes Care," *Diabetes Care,* Nov. 2002 25(11):1952–57.

8 Luther Midelfort consists of the 300-bed Luther Hospital in Eau Claire, three critical-access hospitals in neighboring communities, the Midelfort Clinic—a multispecialty group of 200 physicians practicing in 11 communities—and related services. The clinic and hospital merged and joined the Mayo Health System in 1992.

9 J. Rozich, "Luther Midelfort–Mayo Health System: Planned Care for Chronic Disease," *Group Practice Journal,* Nov./Dec. 2005 54(10):12–21.

10 L. L. Berry, "The Collaborative Organization: Leadership Lessons from Mayo Clinic," *Organizational Dynamics,* Aug. 2004 33(3):228–42. For additional perspective, see L. L. Berry and K. D. Seltman, *Management Lessons from Mayo Clinic* (New York: McGraw-Hill, 2008).

11 K. G. Lim, A. M. Patel, J. M. Naessens et al., "Flunking Asthma? When HEDIS Takes the ACT," *American Journal of Managed Care,* Aug. 2008 14(8):487–94.

12 B. Thorsteinsdottir, G. W. Volcheck, E. Madsen et al., "The ABCs of Asthma Control," *Mayo Clinic Proceedings,* July 2008 83(7):814–20.

13 R. A. Nathan, C. A. Sorkness, M. Kosinski et al., "Development of the Asthma Control Test: A Survey for Assessing Asthma Control," *Journal of Allergy and Clinical Immunology,* Jan. 2004 113(1):59–65.

14 Results were taken from the Mayo Clinic 2006 annual report. For a description of the improvement process (and early results), see L. Haro, P. Geerdes, C. Rihal et al., "Reducing Door to Balloon Time for Acute Myocardial Infarction (AMI) in a Tertiary Emergency Department," *Improvement Report* (Boston, Mass.: Institute for Healthcare Improvement, 2004), and H. H. Ting, M. R. Bell, C. S. Rihal et al., "Fast Track Protocol for ST-Elevation Myocardial Infarction (STEMI) to Minimize Treatment Delays," *Improvement Report* (Boston, Mass.: Institute for Healthcare Improvement, 2005).

[15] P. Varkey, J. Cunningham, and S. Bisping, "Improving Medication Reconciliation in the Outpatient Setting," *Joint Commission Journal on Quality and Patient Safety,* May 2007 33(5):286–92.

[16] J. A. Fleischmann, K. Illg, and G. Dankbar, *Moving to New Levels of Service through Collaboration*, presentation at the National Forum for Quality Improvement in Healthcare, Dec. 2008.

[17] M. Murray and C. Tantau, "Same-Day Appointments: Exploding the Access Paradigm," *Family Practice Management*, Sept. 2000 7(8):45–50.

[18] J. E. Rohrer, M. Bernard, J. Naessens et al., "Impact of Open-Access Scheduling on Realized Access," *Health Services Management Research,* May 2007 20:134–39.

[19] A. M. Wills, R. J. Thomas, H. H. Ting et al., "Cardiovascular Health Clinic Patient Journey: A Lean Approach to Improve Effectiveness," *Improvement Report* (Boston, Mass.: Institute for Healthcare Improvement, 2005).

[20] M. Stolle, "Interpreters Play a Critical Role in the Health Care System," *Rochester Post-Bulletin*, Jan. 31, 2009.

[21] Rankings for CMS Hospital Compare clinical topics (heart attack, heart failure, and pneumonia treatment and surgical care improvement) included hospitals that reported on all measures and recorded at least 30 patients in each topic. Only results in the top quartile are noted. Six Mayo Foundation hospitals were evaluated on the four-topic clinical composite and on the heart attack topic, 10 on the heart failure topic, 13 on the pneumonia topic, and nine on the surgical care topic. Twelve Mayo Foundation hospitals (including four large hospitals) reported HCAHPS results. The overall patient rating of care means a patient rating of 9 or 10 on a 10-point scale. Results do not include managed hospitals.

[22] J. E. Wennberg, E. S. Fisher, D. C. Goodman et al., *Tracking the Care of Patients with Severe Chronic Illness: The Dartmouth Atlas of Health Care 2008* (Hanover, N.H.: The Dartmouth Institute for Health Care Policy & Clinical Practice, 2008). The analysis focused on the last two years of life among Medicare patients with one of nine chronic conditions who died between 2001 and 2005, controlling for differences in patients' age, sex, race, and primary chronic diagnosis.

[23] Ibid.

[24] The Minnesota Community Measurement *Health Care Quality Report* (www.mnhealthscores.org) relies primarily on HEDIS (Healthplan Effectiveness Data and Information Set) measures defined by the National Committee for Quality Assurance that are aligned with clinical guidelines established by Minnesota's Institute for Clinical Systems Improvement, of which Mayo Clinic is a member. The measures have been adapted for use to track and report the performance of medical groups in Minnesota and surrounding areas. Results for the Mayo Clinic, Rochester, may not be comparable since it does not have the opportunity to address ongoing needs of patients who visit for onetime expert evaluation or treatment.

[25] Wennberg, Fisher, Goodman et al., *Tracking the Care of Patients with Severe Chronic Illness,* p. 61.

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 and is a contributing editor to the bimonthly newsletter *Quality Matters*. On behalf of The Commonwealth Fund, he has conducted more than 40 case studies on high-performing health care organizations and initiatives. His 25-year career has spanned research, policy, operations, and consulting roles for government, corporate, academic, and philanthropic organizations. He has authored and coauthored reports and peer-reviewed articles on a range of health care–related topics. *A Chartbook on the Quality of Health Care in the United States*, coauthored with Sheila Leatherman, was named by AcademyHealth as one of 20 core books in the field of health outcomes. 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.

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.

Jennifer Wrenn has 12 years of experience as a professional grant and technical writer and consultant in the fields of medicine, teaching, youth and family services, and immigrant services, with clients in Washington State and Colorado. Her work in the medical field has included writing case studies on high-performing health care organizations, securing funding for local health care access projects such as a promotora (lay health worker) program and clinic serving immigrant and low-income clients, and working locally with the Citizens Health Advisory Council to research and implement an accessible and affordable community-based integrated health system. She previously worked as a physician assistant, focusing on care for the underserved and women's health. Ms. Wrenn holds a B.S. in zoology from Colorado State University (Phi Beta Kappa) and a B.S. in medicine (physician assistant program) from the University of Iowa School of Medicine.

Acknowledgments

The authors gratefully acknowledge the following individuals who kindly provided information for the case study: Denis Cortese, M.D., president and CEO of Mayo Clinic; Nina Schwenk, M.D., vice president of Mayo Clinic and vice chair of the Mayo Clinic Board of Trustees; Dawn Milliner, M.D., chair of the Clinical Practice Advisory Group; Terrance Borman, M.D., medical director of Luther Midelfort—Mayo Health System; Jill Lenhart, M.D., chair of the Luther Midelfort Primary Care Council; Kaiser Lim, M.D., Division of Pulmonary and Critical Care Medicine at Mayo Clinic; and Joan Gorden, public affairs consultant in the Mayo Clinic Center for Translational Science Activities. The authors also thank the staff at The Commonwealth Fund for advice and assistance in case-study preparation.

Editorial support was provided by Joris Stuyck.