

Continuous Innovation In Health Care: Implications Of The Geisinger Experience

Adoption of integrated electronic health systems is the beginning of a long care-transformation journey.

by **Ronald A. Paulus, Karen Davis, and Glenn D. Steele**

ABSTRACT: To achieve the diverse health care goals of the United States, health care value must increase. The capacity to create value through innovation is facilitated by an integrated delivery system focused on creating value, measuring innovation returns, and receiving market rewards. This paper describes the Geisinger Health System's innovation strategy for care model redesign. Geisinger's clinical leadership, dedicated innovation team, electronic health information systems, and financial incentive alignment each contribute to its innovation record. Although Geisinger's characteristics raise serious questions about broad applicability to nonintegrated health care organizations, its experience can provide useful insights for health system reform. [*Health Affairs* 27, no. 5 (2008): 1235-1245; 10.1377/hlthaff.27.5.1235]

FOR DECADES, OBSERVERS OF THE U.S. health care system have watched a struggle against seemingly intractable problems: incomplete and unequal access to care; perverse payment incentives that fail to reward good outcomes; fragmented, uncoordinated, and highly variable care that results in safety risks and waste; a disconnect between quality and price; rising costs; consumer dissatisfaction; and the absence of productivity and efficiency gains common in other industries. These problems have resulted in a loss of value within the health system and have generated various reform proposals, with most focusing on providing greater access to or controlling the costs of care. Although laudable, this focus ignores the fundamental problem: health care value (defined here as outcomes relative to input costs) simply must increase to achieve these diverse goals.

Enhancing value requires both explicit delivery system reform strategies and the associated organizational capacity to execute change. Sustainable health care value is created only when care process steps are eliminated, automated, appropri-

.....
Ronald Paulus (rapaulus@geisinger.edu) is chief technology and innovation officer at the Geisinger Health System in Danville, Pennsylvania. Karen Davis is president of the Commonwealth Fund in New York City and serves on the board of directors of the Geisinger Health System. Glenn Steele is president and chief executive officer of Geisinger.

ately delegated to lower-cost but capable staff, or otherwise improved (that is, when there is innovation). Innovative care-process change occurs when (1) consumers are actively engaged in behavior that mitigates disease or improves purchasing; (2) safer and more effective drugs or devices are developed and adopted; (3) clinicians deliver more rapid, appropriate, and reliable care; (4) unnecessary tests and therapies are eliminated; or (5) supply-chain costs are systematically lowered. These changes are most sustainable within a care system that measures innovation returns, focuses on value creation, and is appropriately rewarded in the market. But how can this kind of innovation occur?

This paper focuses on care-model innovations established at Geisinger Health System. Even if not fully generalizable, the examples of systems such as Geisinger can prove useful for health care leaders seeking to enhance value and can offer potential insight for health system reforms.

Geisinger Health System Background

Building on Abigail Geisinger's founding mission to "make it the best" and buoyed by recent sustained financial success, Geisinger has repeatedly taken risks to produce innovative care and payment models. Geisinger is an integrated delivery system (IDS) located in central and northeastern Pennsylvania comprising nearly 700 employed physicians across fifty-five clinical practice sites that provide adult and pediatric primary and specialty care; three acute care hospitals (one closed, two open staff); specialty hospitals and ambulatory surgery campuses; a 215,000-member health plan; and numerous other clinical services and programs ranging from prenatal outreach to community-based care for the frail elderly.

Geisinger serves a population of 2.5 million people who are poorer, older, and sicker than national benchmarks, with markedly less in- and outmigration. Dispersed across forty-one rural or postindustrial counties, 250 physicians provide primary care; 450 specialty physicians, located primarily in three hubs, provide care to patients referred from both Geisinger and non-Geisinger physicians. A subset of Geisinger physicians are also active in seventeen non-Geisinger hospitals. Geisinger Medical Center in Danville, Pennsylvania, is a closed-staff facility, while the other hospitals are open staff, with a mix of Geisinger and non-Geisinger physicians. This mix requires Geisinger to maintain a combined physician-, patient-, and referral-friendly posture in the market, supporting fertile ground for experimentation.¹

■ **Open yet integrated system.** To understand Geisinger's history of innovation, it is important to appreciate its structure as an open yet integrated delivery system. Unlike so-called closed systems such as Kaiser Permanente, Geisinger actively serves both its own Geisinger Health Plan (GHP) enrollees and non-GHP consumers in its service area. From a payment perspective, GHP accounts for a minority of Geisinger's direct patient care revenue, with two-thirds collected from other payers (such as Medicare, Medicaid, Capitol Blue Cross, Coventry, and

Highmark). From a care delivery perspective, Geisinger physicians provide approximately 40 percent of GHP's patient care services, with the remainder provided by a network of more than 10,000 physicians and forty hospitals.

Geisinger manages through twenty-two systemwide clinical service lines, each co-led by a physician-administrator pair. Geisinger operating units (that is, all service lines as well as each hospital, GHP, and central support functions) are responsible for achieving their own annual quality and financial budget targets. Goals and associated incentives are coordinated across the system and aligned across operating units. Strategic functions such as innovation and quality are centralized, although they retain strong linkages to operational leaders and frequently share common performance-incentive goals.

■ **Electronic record keeping.** A commercial electronic health record (EHR) platform adopted in 1995 is fully utilized across the system for ambulatory services; Geisinger Medical Center has a fully implemented EHR for all inpatient care, and the other hospitals are undergoing phased implementation.² The EHR is made available (as read-only) to non-Geisinger referring physicians and to consumers (selected elements with limited data entry only) via customized Web portals. The Geisinger structure, culture, market characteristics, and EHR infrastructure enable a strategic commitment to providing comprehensive, longitudinal care (primary through subspecialty) within the same integrated system, with most of that care provided close to a patient's home.

Geisinger's Approach To Innovation

In late 2005, Geisinger's board of directors challenged leaders to focus on innovation, leading to targeted strategies around care coordination and transitions, chronic care optimization and illness prevention, transformation of acute episodic care, and engagement of patients. At Geisinger, innovation proceeds most readily in the "sweet spot"—the one-third of patients for whom Geisinger is both financially (via GHP) and clinically (via the provider enterprise) responsible. Although innovation is not limited to this overlap group, it frequently serves as the starting point for initiatives. New GHP payment models enable Geisinger providers to experiment broadly, while GHP is tasked with developing a commercial market for quality- and value-based care.

■ **Highly collaborative.** Innovation at Geisinger is a highly collaborative function. For major innovation initiatives, a diverse group of Geisinger participants (clinical, operational, financial, payer, and increasingly patient or consumer) is convened. Although they are all members of one health system, each has his or her own perspective, incentives, and goals. For each innovation effort, the group seeks to answer a simple yet infrequently asked question: "What realistic care model will most reliably deliver the maximum health care value?" In this context, "care model" is defined as the step-by-step approach to individualized preventive care and the diagnosis, treatment, management, and engagement of ill patients, resulting in enhanced value.

Financial, organizational, and cultural barriers often deter fragmented health care delivery components from pursuing answers to this fundamental question. However, in the Geisinger “sweet spot,” care can be appropriately incentivized, virtual and in-person care can be integrated, and self-care can be emphasized. Successful innovation efforts are then extended clinically to all patients, regardless of payer. However, Geisinger can choose when and how to expand the payment models associated with these initiatives beyond GHP.

■ **Specific targets for redesign.** Geisinger uses various criteria to target specific care models for redesign: those provider services with the largest impact by patient population or resource consumption; those with the greatest amount of unjustified variation; those with evidence-based or consensus-derived best-practice and readily available outcome metrics; those with the most interest from clinical champions or consumers; or those with observed outcomes farthest from expected performance. Among these, health system leaders select initiatives most likely to produce real impact, quickly.

■ **Clinical business case.** Prior to any new care-model design, a clinical business case is developed targeting expected gains along with associated process and outcome metrics and leadership accountability for each component. Design teams work through clinical evidence definition, existing and future workflows, analysis of financial incentives, regulatory and safety reviews, and business-case modeling. Teams directly link redesigned care processes to expected efficiency and quality goals; “hard-wire” clinical evidence and key process steps within the EHR, analytic, or decision-support systems; actively engage patients; and closely track performance metrics for ongoing adaptation and refinement. Finally, with the new clinical-care-model redesign complete, the payment approach, incentives, and nonfinancial rewards required to support and reinforce the design are negotiated between leaders of the clinical enterprise and GHP.

■ **Improvement methodology.** Geisinger uses, but does not focus exclusively on, a particular improvement methodology such as Continuous Quality Improvement, Six Sigma, or lean reengineering. It evaluates the impact of new care models and gleans lessons for subsequent innovation. At each step, participants seek to use (and, equally important, refine for future reuse) features, techniques, or components of previously successful care models. This approach allows each effort to both benefit from and systematically add to Geisinger’s overall “innovation architecture”—creating reusable components and parts (whether human processes, software, technology, or analytics) that make the next care-model design better, faster, or cheaper; this approach parallels the evolutionary rapid development process from software engineering.³ Innovations failing to deliver results are dropped; those meeting or exceeding expectations are advanced. This process is then repeated in a continued drive for the creation of enhanced value.

Geisinger's Innovation Examples

■ **Medical home: Geisinger's Personal Health Navigator.** Geisinger's "patient-centered medical home" initiative is designed to deliver value by improving care coordination and optimizing health status for each individual. Components designed to create a functional "Personal Health Navigator" for consumers include round-the-clock primary and specialty care access; a GHP-funded nurse care coordinator in each practice site; predictive analytics to identify risk trends; virtual care-management support; a person, called a personal care navigator, to respond to consumers' inquiries; and a focus on proactive, evidence-based care to reduce hospitalizations, promote health, and optimize management of chronic disease. Other features include home-based monitoring, interactive voice-response surveillance, and support for end-of-life care decisions.

EHR access. EHR access is provided to all participants, including physicians, care managers, and consumers. Consumer EHR features include Internet-based lab results display and results trending over time, clinical reminders, self-scheduling, secure e-mail with providers, prescription refills, and educational content. A set of "referral providers" capable of delivering high-value care is vetted by both GHP and participating primary care physicians. This value-based referral network includes high-volume, low-cost medical and surgical specialists, imaging facilities, and other ancillary providers from among both Geisinger and non-Geisinger providers; it is operationally linked with the primary care practice to enhance value.

Practice-based payments. To encourage physician engagement and to support the costs of transformation, GHP provides a series of practice-based payments. Monthly payments of \$1,800 per physician seek to recognize the expanded scope of practice; monthly transformation stipends of \$5,000 per thousand Medicare members are also paid to the practice to help finance additional staff, support extended hours, and implement other practice-infrastructure changes. In addition, an incentive pool is created based on differences between the actual and expected total cost of care for medical home enrollees. However, incentive payments from this pool are conditional upon performance in meeting quality indicators, with actual payment amounts prorated based on the percentage of targets met for ten quality metrics. To encourage team-based care and support, incentive payments are split between individual providers and the practice. It is anticipated that over time, these payments will replace the fixed monthly payments described above.

Performance reports. Detailed monthly performance reports of quality and efficiency results are provided to each medical home practice and are reviewed together by an integrated GHP-practice site team monthly. Trends and associated opportunities for improvement are identified; change management plans are created to address any deficiencies. Senior managers from both the community practice service line and GHP participate to identify and rapidly spread best practices

“Financial incentives of up to 20 percent of total compensation per physician are linked to overall improvements.”

.....

across the system.

Early pilot-site results. A primary target outcome for the medical home initiative is reduced hospital use. Early results from first-year experience at two pilot sites have been promising: very preliminary data show a 20 percent reduction in all-cause admissions and 7 percent total medical cost savings. Based on this early favorable experience and participants’ assessment of a strong clinical impact, this program is undergoing expansion to ten additional Geisinger sites and one non-Geisinger practice to cover more than 25,000 Medicare Advantage and fee-for-service Medicare patients. Whether or not this early favorable trend continues over the longer term, and in additional sites, remains to be determined.

■ **Chronic disease care optimization.** Efforts to optimize chronic disease care extend beyond medical home sites to include all Geisinger community practice sites. These initiatives provide a systematic approach to coordinated, evidence-based care for patients with high-prevalence chronic diseases, including diabetes, congestive heart failure (CHF), chronic kidney disease, coronary artery disease, and hypertension. Recently a program focusing on preventive care was initiated.

Each program uses Geisinger’s EHR and data infrastructure to embed care workflows that eliminate, automate, or delegate tasks whenever possible. Clinical practices are standardized using a newly developed nursing tool to capture and summarize information before the patient enters the exam room. Patients’ care plan needs are identified electronically and incorporated into physician order sets along with EHR-based health maintenance alerts. A condition-specific “snapshot report” aggregates all relevant clinical information on a single screen.

Geisinger tracks performance using an “all-or-none bundle approach,” where only full compliance with all individual performance metrics is scored a success. For diabetic patients, the bundle consists of nine discrete evidence-based care elements, including HbA1c, low-density lipoprotein (LDL), and blood pressure testing and target levels; nonsmoking status; urine protein measurement; and influenza and pneumococcal vaccination. Diabetic patients are automatically identified prior to their arrival at the clinic, and a patient-specific, evidence-informed order entry set is generated (including standing orders for routine testing such as for HbA1c and LDL) that can be accepted by the physician with a single click.

Automated reminders are provided to both the clinical team and the patient, and a self-scheduling option is available for more than 100,000 consumers using the Geisinger EHR. An after-visit summary is provided to each patient showing how he or she is doing compared to the goal, along with an explanation of the risks associated with failing to achieve the goal. Performance reports are sent to each

practice, detailing both individual physician and practice-site performance in comparison to the historical trend and peer sites; patients receive their own performance “report card.” Financial incentives of up to 20 percent of total cash compensation per physician are linked to patient satisfaction, quality, and value goals, including overall bundle-score improvements. Initial results from more than 20,000 diabetic patients have been promising, including statistically significant increases in overall diabetic bundle performance, glucose control, blood pressure control, and vaccination rates.⁴ Long-term patient health status, population health metrics, and efficiency are being tracked.

Remote care management is another important part of the optimization of chronic disease care. For example, in managing the common and costly problem of anemia associated with chronic kidney disease, erythropoietin use was redesigned using a pharmacist-driven care model. Developed and piloted via collaboration between Geisinger’s Nephrology and Pharmacy Departments, the care model is now managed by a wholly owned infusion company. As with other chronic disease initiatives, data mining identifies eligible patients, and automated referral requests are sent to accountable clinicians. Under the program, time spent within the hemoglobin target range increased and average erythropoietin units per week fell, resulting in \$3,800 per patient per year in drug cost savings alone.⁵

■ **Acute-episode care: Geisinger ProvenCare.** Optimizing both primary and chronic care is essential for health care value creation, yet some patients will inevitably require acute intervention. To begin to reengineer episodes of acute care, Geisinger created a new model for coronary artery bypass graft (CABG) surgery, consisting of three core components: (1) establishing implementable best practices across the entire episode of care; (2) developing risk-based pricing, including an up-front discount to the health plan or payer for the historical readmission rate; and (3) establishing a mechanism for patient engagement.

For the ProvenCare CABG program, several multidisciplinary teams consisting of Geisinger staff were formed. A clinical leadership team systematically translated professional society guidelines into forty discrete care-process steps.⁶ A multidisciplinary clinical operations team (including clinical, information technology, process improvement, and operations staff) then embedded these steps into both human and electronic workflows to ensure reliability. For example, an EHR flow sheet was created to track key clinical elements, to alert providers if a step was incomplete, and to automatically route related messages and orders to facilitate flow and keep the broader care delivery team informed.

During this same time, a multidisciplinary steering committee established patient outcome goals, tracked progress, performed financial analyses, negotiated payment terms, oversaw claims and program administration, and investigated GHP employer-customers’ preferences. Patient education materials were revamped, and a “patient compact” (signed by both the patient and Geisinger) was developed to highlight the important need for a care partnership between

Geisinger and the patient or family.

Initially it was believed that a best-practice guarantee would motivate employer purchasers, but the number of best-practice elements (forty) and clinical content complexity limited their interest. Ultimately, GHP and its employer customers were most attracted to a single-episode package price that included pre-operative evaluation and work-up, all hospital and professional fees, all routine postdischarge care (for example, smoking cessation counseling and cardiac rehabilitation), and management of any related complications occurring within ninety days of elective CABG surgery.

Out of recognition that not every complication can be eliminated, the episode payment rate included a discount of 50 percent from the average related postoperative readmission cost experienced in a two-year historical comparison group. As a result, the financial risk of managing increased or unchanged rates of complications was transferred wholly to the clinical enterprise. The perceived “warranty” captured significant attention.⁷ Although it overlaps current pay-for-performance (P4P) initiatives, major differences exist (Exhibit 1).⁸

It is important to understand that Geisinger’s baseline CABG performance compared favorably with statewide and national standards prior to the ProvenCare intervention.⁹ As a result, the challenge was to make a good program even better. After implementation, the percentage of patients receiving all forty components of the bundle increased over four months from 59 percent to 100 percent, where it has subsequently remained with few exceptions.¹⁰

For GHP, the ProvenCare program has been expanded to include hip replacement, cataract surgery, and percutaneous coronary intervention; further expansion to bariatric surgery, lower back surgery, and perinatal care is actively under way. To date, only GHP operates under the ProvenCare arrangement. However, as the expanded programs cover a greater proportion of total health care spending, feedback suggests that commercial insurance buyers may become more interested; alternatively, buying decisions may only be influenced by premium price reductions alone.

EXHIBIT 1
Comparison Of Geisinger’s ProvenCare With Current Pay-For-Performance Models

Current pay-for-performance initiatives	ProvenCare
Generally imposed by payer	Provider-initiated, collaborative
Outpatient, primary care focus	Full-episode based, including
Chronic disease management or preventive care emphasis	Acute and chronic care management
Relatively small incentives	Secondary prevention focus
Few “penalties”	Significant incentives
Manually tracked and reported	Serious financial consequences in event of failure
	Electronically managed, to degree possible

SOURCE: Authors’ analysis.

What Can We Learn From This Experience?

It is not important whether Geisinger's innovations are ideal, or even whether every innovation ultimately "works." Geisinger's redesign efforts are focused on developing and refining an innovation infrastructure that can adapt to new evidence, efficiently and rapidly translate that evidence into care delivery, and focus on patient benefit in a setting where many (or most) patients would be excluded from randomized trials because of age, comorbidities, and other limiting factors. It is anticipated that new Geisinger care models eventually will be superseded by changing evidence, technological advances, and ongoing learning. Geisinger's commitment is to create a framework into which it can place (or replace) best-practice components and improve quality and value outcomes.

What are the underlying characteristics that facilitate Geisinger's innovation record? Most important are Geisinger's IDS structure and clinical leadership. Its baseline financial success, ability to align incentives (particularly for its "sweet spot" population), and the enablement created by its EHR and electronic infrastructure are also distinct advantages. Equally important are committed professional staff with an entrepreneurial bent and experience, along with the organizational "permission" to try, fail, learn from failure, and ultimately succeed.¹¹

Geisinger's differences raise serious questions regarding applicability to non-IDS systems and to any system without an EHR, an enterprisewide data warehouse, and clinical leadership with centralized innovation and quality support functions. Exhibit 2 depicts ten primary lessons and associated implications from Geisinger's experience.

Implications For National Policy

Geisinger's innovation experience has three admittedly simple yet not widely enacted national policy implications: (1) aligning incentives to reward the creation of enhanced health care value; (2) recognizing that EHRs are absolutely necessary but not sufficient to create sustainable change in care delivery; and (3) creating policies that encourage greater organization of care delivery and collaboration among payers and providers, to foster propagation of innovation that enhances value.

■ **Aligning incentives.** Geisinger is both a health care delivery system and an insurer. For its "sweet spot" patients, it can align incentives in a manner unlike traditional health care delivery organizations. Because of its group practice model and financial success, it can more easily engage physicians with both financial and nonfinancial incentives and also cross-subsidize important but nonprofitable functions (such as primary care, autism treatment, and so forth). If commercial insurers, Medicare, and Medicaid were to offer new incentives such as acute episode global fees and patient-centered medical home (PCMH) payments, Geisinger's financial incentives would be better aligned for nearly all of its patients, rather than for a dis-

EXHIBIT 2
Ten Primary Lessons And Associated Policy Implications From The Geisinger Experience

Geisinger experience lessons	Organizational/policy implications
Baseline financial success enables an organization to move beyond a day-to-day focus and supports innovation	Health care organizations under financial duress are less likely to innovate; as a result, consideration should be given to payment models that both enable and require innovation
Clinician leadership at all levels, when paired with business partners and engaged clinical champions, supports progress in clinical transformation	Health care organizations should be encouraged to develop clinical leaders and allowed to compensate and reward them for serving in that capacity
The ability to align incentives and provide needed cross-subsidies to support idealized care is critical	Cross-subsidization should be not only allowed but encouraged, to drive idealized care
Diverse stakeholder participation, including active collaboration between payers, clinicians, and provider leaders, enables new, integrated models of care that would be impossible otherwise	Cross-stakeholder collaboration should be not only allowed but encouraged, to drive idealized care
The availability of a functional EHR platform, along with those who know how to use it to alter and maintain clinical process excellence, is foundational	Health IT adoption should be encouraged, but with an understanding that its transformation potential lags adoption and that investments in knowledge transfer across organizations are important
A focus on empirical data mining and direct performance measurement from the beginning of each initiative is essential	Policymakers should continue to pursue thoughtful measurement and reporting requirements that are aligned with care-redesign goals
A businesslike approach to clinical translation—focusing on the rapid application of existing knowledge to deliver real-world change—is essential	Health care organizations should continue to seek lessons from other industries and apply the insights to their business
A willingness to actively engage patients in care design and delivery, even when it is unclear how best to do so, can produce substantial progress	Better research on methods and techniques for consumer engagement is essential; health care organizations must engage consumers and learn as they go
Linking financial and quality budgets together provides an important organizing framework, which parallels many of the desires of pay-for-performance initiatives	Health care value entails both outcomes and resource costs, and it is insufficient to view either in isolation; policies should encourage value creation
The willingness to both take risk and experience failure (and the tremendous insights failure may provide) is crucial to fostering innovation	Policymakers should expect a baseline failure rate, whose absence implies that little real innovation is happening

SOURCE: Authors' analysis.

NOTES: EHR is electronic health record. IT is information technology.

tinct minority.

■ **Electronic infrastructure.** Central to nearly all Geisinger innovation is the use of the EHR and data infrastructure to automate care, remove geographic barriers, empower consumers, and improve reliability. Only within the past few years has Geisinger begun to leverage key benefits from its electronic infrastructure—after a long period of implementation, adoption and usability comfort was created among users. Much of today's policy discussions imply that EHRs will rapidly transform care delivery. The Geisinger experience suggests that this is not the case but, rather, that EHR adoption is the beginning of a long care-transformation journey.

Geisinger has been able to support the adoption and effective deployment of in-

tegrated electronic systems and centralized innovation and quality support that would be difficult, if not impossible, for many freestanding physician practices and small independent hospitals. Its innovation approach translates best practices into discrete care-process steps and incorporates those steps into decision-support and other tools that make it easier to do the right thing, at the right time, every time. It engages patients as partners in care through direct access to electronic health information and provides tools to help consumers manage their own care. From a public policy standpoint, realizing these benefits throughout the health system may require incentives for greater organization of the care delivery system or other mechanisms for providing the infrastructure support for non-IDS care providers that Geisinger is able to provide directly.

■ **Collaboration and integration.** Finally, for many organizations, the spread of value-enhancing collaboration and integration is restricted by regulations that preclude effective collaboration among payers in designing incentive systems and that impede collaboration between hospitals and physicians or among physician practices in a given region. Each payer has its own, largely fee-for-service, payment system—failing to align incentives to enhance value in the way that Geisinger has strived to do. New mechanisms that support collaboration and coordination of policies among private insurers and public programs are needed to achieve replication on a broader scale and sustainability over the longer term.

.....
Special thanks to Sandra Buckley and Katherine Shea for their thoughtful editorial assistance.

NOTES

1. For a diagram of the Geisinger Health System organization, see supplemental Exhibit 1 online at <http://content.healthaffairs.org/cgi/content/full/27/5/1235/DC1>.
2. The EHR platform is EpicCare, produced by the Epic Corporation.
3. Software Productivity Consortium (now Systems and Software Consortium), "Evolutionary Rapid Development," SPC Document SPC-97057-CMC, version 01.00.04, June 1997, <http://stinet.dtic.mil/cgi-bin/GetTRDoc?AD=ADA327979&Location=U2&doc=GetTRDoc.pdf> (accessed 9 June 2008).
4. V. Weber et al., "Employing the Electronic Health Record to Improve Diabetes Care: A Multifaceted Intervention in an Integrated Delivery System," *Journal of General Internal Medicine* 23, no. 4 (2008): 379–382.
5. I.D. Bucaloiu et al., "Outpatient Erythropoietin Administered through a Protocol-Driven, Pharmacist-Managed Program May Produce Significant Patient and Economic Benefits," *Managed Care Interface* 20, no. 6 (2007): 26–30.
6. K.A. Eagle et al., "ACC/AHA 2004 Guideline Update for Coronary Artery Bypass Graft Surgery: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines," *Journal of the American College of Cardiology* 44, no. 5 (2004): 1146–1154.
7. R. Abelson, "In a Bid for Better Care, Surgery with a Warranty," *New York Times*, 17 May 2007.
8. T.H. Lee, "Pay for Performance, Version 2.0?" *New England Journal of Medicine* 357, no. 6 (2007): 531–533.
9. Pennsylvania Health Care Cost Containment Council, *Cardiac Surgery in Pennsylvania 2005*, <http://www.phc4.org/cabg/Default.aspx?year=2005> (accessed 9 June 2008); and Duke Clinical Research Institute, *Data Analyses of the Society of Thoracic Surgeons National Adult Cardiac Surgery Database* (Chicago: Duke Clinical Research Institute, 2000–2006).
10. A.S. Casale et al., "ProvenCare: A Provider-Driven Pay-for-Performance Program for Acute Episodic Cardiac Surgical Care," *Annals of Surgery* 246, no. 4 (2007): 613–621.
11. J.P. Kotter, "Leading Change: Why Transformation Efforts Fail," *Harvard Business Review* 73, no. 2 (1995): 59–67.