THE COMMONWEALTH FUND

The Colorado Beacon Consortium: Strengthening the Capacity for Health Care Delivery Transformation in Rural Communities

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ABSTRACT: The Colorado Beacon Consortium is one of 17 regions participating in the three-year, federally funded Beacon Community Program, which aims to demonstrate how strengthening local health information technology (IT) infrastructure can support improvements in the quality and efficiency of health care. The consortium sponsors a learning collaborative and coaching for 51 primary care practices in seven predominantly rural Colorado counties, helping them to build capacity for using electronic health records and analytic tools and for engaging in team-based quality measurement and improvement. The region's experience with health IT also offers insights on how community stakeholders can help spread health information exchange to improve care coordination among local "medical neighborhoods" of health care providers. Early results indicate increased provision of preventive and chronic care, improved workflow and teamwork in physician practices, and enhanced capability to prepare for health care delivery and payment reforms.

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BACKGROUND

Experts have noted for many years that the health care sector lags other industries in the use of information technology (IT).[1] The practical implications of this deficit are experienced every day by patients and their families when hospitals and physicians are unable to exchange basic medical information on a real-time basis. As patients navigate the health system, they encounter duplicate tests, delayed treatment, and preventable errors.[2]

To speed the adoption of health IT and address these quality gaps, Congress approved the Health Information Technology for Economic and Clinical Health (HITECH) Act and allocated $19.2 billion of the economic stimulus package

enacted in 2009 to strengthen the nation's health IT infrastructure.[3] Of these funds, the federal Office of the National Coordinator for Health Information Technology (ONC) designated $250 million for the establishment of the three-year Beacon Community Program.[4] ONC selected 17 diverse communities that were already leaders in health IT or quality improvement to "demonstrate a vision of the future where hospitals, clinicians and patients are meaningful users of health IT, and together the community achieves measurable improvements in health care quality, safety, efficiency, and population health."[5] Exhibit 1 illustrates the program's aims and enabling factors, as conceived by ONC.

The intent of the Beacon Community Program is to "generate and disseminate valuable lessons learned that will be applicable to the rest of the nation's communities as they strive to build and leverage their health IT infrastructure for healthcare improvement."[6] To advance this goal, AcademyHealth, with support from The Commonwealth Fund, established the Beacon Evidence and Innovation Network, which collaborates with the Beacon communities to share experiences from the field.

This case study describes how one of the 17 Beacon sites, the Colorado Beacon Consortium (CBC), has strengthened the capacity of local health care providers to exchange health data and transform clinical care (Exhibit 2). The CBC, which serves seven predominantly rural counties in western Colorado, was selected for study because of the region's reputation for embracing health IT and its geography, which offers an opportunity to examine how innovation and improvements can spread successfully across distinct and widely dispersed communities. We trace the development of the region's competence in deploying health IT to improve care, examine the challenges inherent in such work, and explore the ways in which the CBC is preparing physician practices and communities for a reformed health system.

The Impetus for Beacon Participation

Grand Junction, Colorado, and surrounding Mesa County (population 146,723) have garnered national attention for its efficient, community-oriented health care system in which physicians provide leadership and collaborate to improve quality and provide equitable access to care for local residents.[7] A key component of its approach is a health information exchange (HIE), created by area stakeholders in 2004 and operational since 2005, which allows health care providers to electronically and securely share patients' medical information to facilitate effective and coordinated care (Appendix A). Since regional referral patterns cross county borders, the HIE—known as Quality Health Network (QHN)—began collaborating with hospitals

Exhibit 1. Beacon Community Program Aims

Build and Strengthen | Improve | Innovate

Source: Office of the National Coordinator for Health Information Technology.
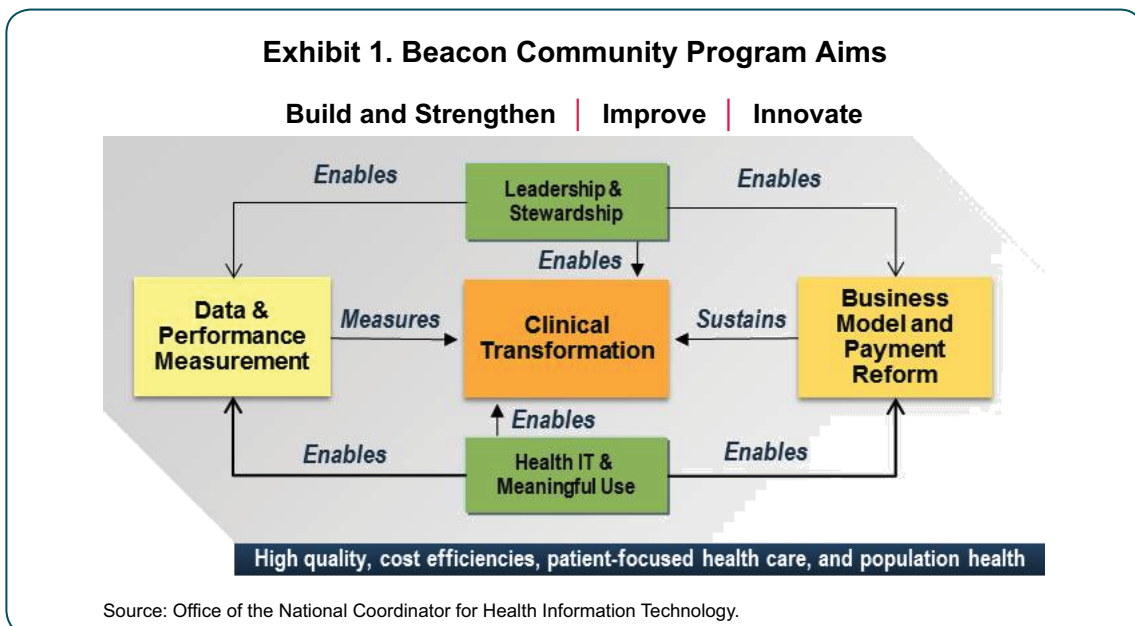

Exhibit 2. Colorado Beacon Consortium at a Glance

Overview: The Colorado Beacon Consortium (CBC) brings together physicians, hospitals, long-term care facilities, behavioral and allied health care providers, a community-based health information exchange (HIE), and a regional health plan to strengthen health information technology and improve primary care in a seven-county region of western Colorado. It is supported by $11.9 million in funding through a three-year cooperative agreement with the federal government as part of the Beacon Community Program.[a]

CBC Sponsors	
Rocky Mountain Health Plans Steve ErkenBrack, CEO Patrick Gordon, CBC director	Nonprofit insurer with the largest share of the regional market; lead sponsor of the CBC and of the CBC's clinical transformation activities; provides financial incentives to primary care practices that participate in the CBC; contributed start-up funds and financially supports QHN.
Quality Health Network (QHN) Dick Thompson, CEO	Nonprofit organization founded by local stakeholders in 2004; operates the HIE for the Western Slope of Colorado; leads the CBC's technical and analytics activities; offers Regional Extension Center technical support to physicians for the meaningful use of electronic health records.[b]
Mesa County Physicians Independent Practice Association Greg Reicks, D.O., president	Represents about 85 percent of Mesa County's physicians; contributed start-up funds and financially supports QHN; provides leadership advice to the CBC on strategies for engaging physicians in HIE and clinical transformation.
St. Mary's Hospital and Regional Medical Center John Beeson, M.D., M.B.A., vice president for medical affairs	Tertiary care referral hospital for the region with 277 staffed beds in Grand Junction; contributed start-up funds and financially supports QHN; provides leadership advice to the CBC on strategies for engaging hospitals in HIE.
Club 20 Steve Reynolds, chairman	Coalition of western Colorado businesses, tribes, and local governments focused on promoting the region's economic prosperity; provides a regional voice to elected officials.
CBC Participants	
Primary care physician practices	Participating practices commit to form a quality improvement (QI) team, hold QI team meetings at least every two weeks, attend quarterly learning collaborative meetings, work with a QI adviser, and submit progress reports and validated QI reports monthly.
Collaborating and Supporting Organizations	
Community hospitals	Create financial sustainability plans for community participation in HIE; act as hubs for building HIE infrastructure and connections; support physician engagement in health IT-enabled clinical transformation.
Community mental health agencies, long-term care facilities, home health agencies, and allied health care providers	Offer tools and training to support patient engagement in care; collaborate to improve coordination of care with physicians and hospitals and to integrate information in the regional HIE.
Colorado Health Foundation	Philanthropy focused on making Colorado the healthiest state in the nation; provides funding to assist providers to connect to the QHN HIE, with emphasis on helping facilitate care for underserved populations.

[a] Colorado Beacon Consortium, About & Mission, http://www.coloradobeaconconsortium.org/about/.
[b] Quality Health Network is one of six organizations that offer Regional Extension Center (REC) services under contract with the Colorado Regional Health Information Organization, the federally designated REC for Colorado. See: http://www.corhio.org/regional-ext-center.aspx.
Source: Colorado Beacon Consortium and authors' interviews with stakeholders.

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and providers in surrounding communities to expand the exchange outside Mesa County in 2009.

Local health care leaders were nonetheless concerned by the slow pace of progress in quality improvement and by continuing increases in health care costs, which strain local economies and threaten access to care. Moreover, they saw a need to extend the HIE's clinical decision support capabilities to realize its transformational potential and to enhance the HIE's financial sustainability through expanded economies of scale. Recognizing the opportunity to build on existing efforts through the Beacon Community Program, local organizations with a history of collaboration joined together to apply for and lead the Beacon effort.

The Goals of Beacon Participation

Through their experience in Mesa County, the CBC's leaders knew that deploying health IT and exchange alone would not be sufficient to achieve desired improvements in population health, quality, and efficiency unless physician practices made supportive changes in clinical workflow to integrate these tools effectively in patient care. Therefore, they designed two complementary but distinct improvement tracks for their community: 1) spread health IT and exchange regionally and fortify the HIE infrastructure with analytic capabilities to support population health management, risk stratification, and predictive modeling; and 2) redesign primary care practices to accommodate meaningful use of electronic health records (EHRs) and increase their capacity for quality improvement and measurement.[8]

The CBC's plan focused on primary care physicians as the key health care decision-makers in rural communities. Within the seven-county CBC service area, two-thirds of the primary care practices (51 of 75) accepted the CBC's invitation to join a learning collaborative and receive coaching on practice redesign; these practices are the official participants in the Colorado Beacon Consortium. Physicians were not required to have an EHR to participate in the CBC (although the majority did); each determined separately whether to participate in the HIE. By the end of 2012, 41 of the 51 practices were using an EHR system (purchased from one of 20 different vendors) and eight were using a Web-based "EHR-lite" portal provided by QHN as an intermediate step to full EHR adoption. As of the end of 2012, more than 100 eligible medical providers in the Beacon area had qualified for federal incentives for the meaningful use of EHRs.[9] Within the QHN service area, a total of 789 medical providers (including specialists) were electronically connected to the regional HIE, either through their EHR or QHN's Web portal (Appendix A).

To demonstrate the value of various approaches to health IT and exchange, each of the 17 Beacon communities established its own mission, objectives, and strategies consistent with the program's overall aims and requirements. The CBC leaders identified four performance objectives that they believed were feasible and necessary to move the region toward the "triple aim"[10] for health system transformation—better care, a healthier population, and lower costs:

- *Cost reductions:* reduce unnecessary emergency room visits and hospital admissions and readmissions for patients with select conditions and overall.

- *Quality improvement:* improve chronic care management among children with asthma and adults with diabetes and heart disease (including screening adults for depression, which often co-occurs with, and can affect treatment of, these chronic conditions).

- *Prevention and population health:* reduce health risks by increasing immunizations, cancer screening, smoking cessation counseling, and weight management.

- *Adoption and meaningful use of health IT:* expand secure, communitywide HIE and promote meaningful use of EHRs by 60 percent of participating primary care physicians.

The Value of Beacon Participation

Leaders of the CBC were attracted to join the Beacon program because it aligned well with their existing goals. They saw the program as an opportunity for western Colorado communities to apply the principles of collaboration, physician leadership, and collective problem-solving that had worked well in Grand Junction, while also promoting greater regional cooperation. Participants interviewed for this case study confirmed that these goals were being achieved to varying degrees within three of the region's medical neighborhoods—subregions in which health care providers make common use of health care facilities and share medical information to coordinate care for a population of patients. This was especially true at the microsystem level of primary care practice teams and increasingly so at the macrosystem level, as physicians,

hospitals, and employers in some communities begin to collaborate to improve care for patients and design a more effective care system.

COMMUNITY CONTEXT: COLORADO'S WESTERN SLOPE

The Western Slope of the Rocky Mountains in Colorado is one of the most sparsely populated areas in the United States. A little more than 300,000 people inhabit the nearly 20,000 square miles in the seven-county region served by the Colorado Beacon Consortium. The region is also geographically and economically diverse, ranging from high desert mesas to mountain river valleys and encompassing agriculture, resource extraction, and skiing and tourism industries. According to local leaders, a culture of interdependence developed in western Colorado as an adaptive response to its geographic isolation and scarce natural resources (such as water). Health care is often viewed through a similar lens, as a limited resource requiring wise management.

Because patient referral patterns connect nearly every western Colorado community, there is a compelling case for sharing health information to promote more efficient and effective care. St. Mary's Hospital and Regional Medical Center in Grand Junction is the only major tertiary care facility in the 500 miles separating Denver and Salt Lake City, receiving referrals for specialized care from a large area spanning western Colorado to eastern Utah. Small critical-access hospitals serve as the front line for acute care in rural communities, referring patients to regional hospitals in Grand Junction, Montrose, or Glenwood Springs when they cannot provide a specialized service.

The hospital referral region surrounding Grand Junction, which encompasses six of the seven counties in the CBC service area, ranks third among 306 U.S. regions on indicators of avoiding unnecessary hospital use, according to The Commonwealth Fund's Local Scorecard on Health System Performance.[11] The region ranks in the second quartile on quality indicators and in the bottom quartile on access to care, a reflection of its relatively high rates of uninsured adults and children.

Compared with other U.S. regions, western Colorado's supply of physicians per capita is higher than the median; in contrast, the supply of hospital beds per capita is lower than the median. While the region's total cost of care per Medicare beneficiary is among the lowest in the nation, the cost of care per commercially insured nonelderly adult is much higher than the median.
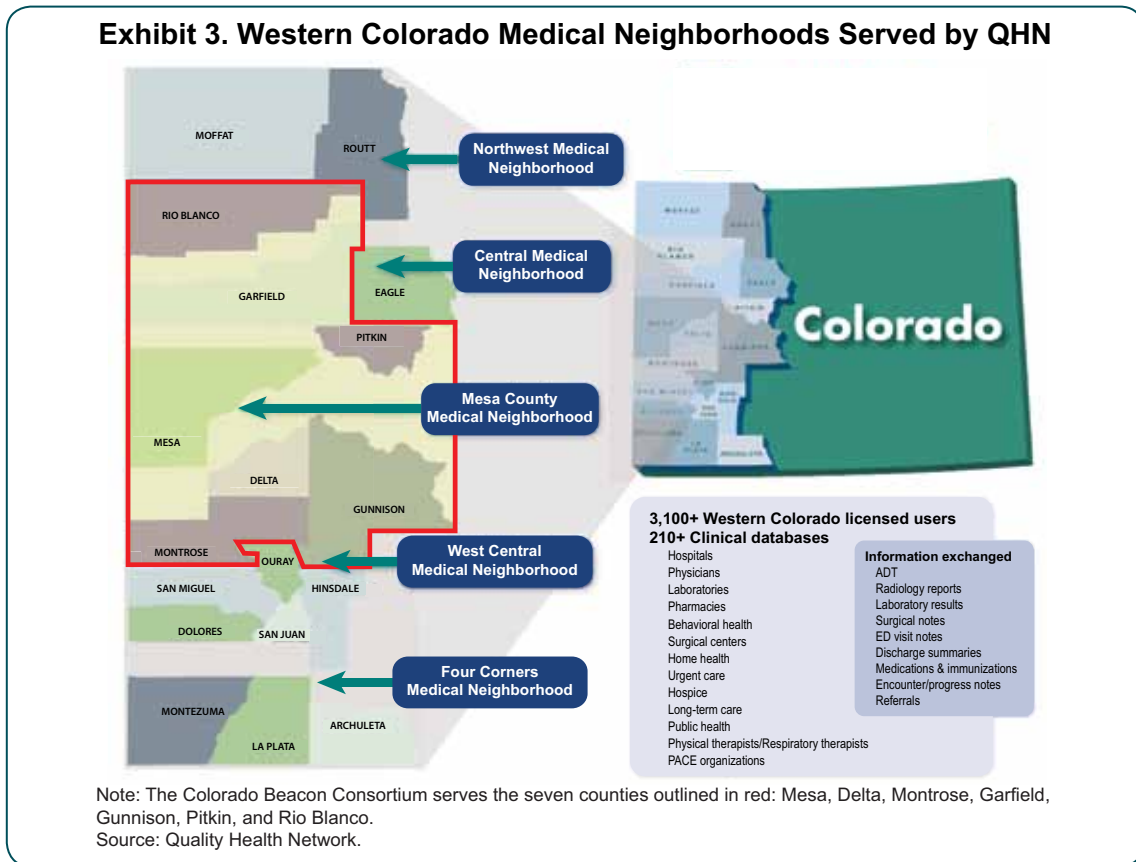
BUILDING ON WESTERN COLORADO'S EXPERIENCE WITH HEALTH IT

At the start of the Beacon program in 2010, the medical neighborhoods (Exhibit 3) of the Western Slope were in various stages of contemplating or adopting health IT and health information exchange. The Mesa County medical community (centered in Grand Junction) was the furthest along, with EHR systems in use at both hospitals, in many medical practices, and in the region's primary mental and behavioral health agency. Other providers had early exposure to health IT by using QHN's "EHR-lite" Web portal, through which they could receive and exchange key patient data for coordination of care. Altogether, QHN estimates that 80 percent of the county's population may have benefited from the use of HIE in some fashion by the end of 2009.

Rocky Mountain Health Plans offers substantial financial incentives to members of the Mesa County Physicians IPA who meet quality standards, such as using a registry tool for population health management. Physicians were able to fulfill the registry criterion, which accounts for a large portion of the incentive pool, by participating in QHN. This enabling factor for the adoption of health IT was not available to physicians outside Mesa County before the advent of federal meaningful use incentives.

Extending Health Information Exchange Throughout the Region

While the Colorado Beacon Consortium focuses on improving primary care as the foundation for health system transformation, QHN's efforts to build a regional infrastructure for secure health information

Exhibit 3. Western Colorado Medical Neighborhoods Served by QHN

3,100+ Western Colorado licensed users
210+ Clinical databases

Hospitals
Physicians
Laboratories
Pharmacies
Behavioral health
Surgical centers
Home health
Urgent care
Hospice
Long-term care
Public health
Physical therapists/Respiratory therapists
PACE organizations

Information exchanged
ADT
Radiology reports
Laboratory results
Surgical notes
ED visit notes
Discharge summaries
Medications & immunizations
Encounter/progress notes
Referrals

Note: The Colorado Beacon Consortium serves the seven counties outlined in red: Mesa, Delta, Montrose, Garfield, Gunnison, Pitkin, and Rio Blanco.
Source: Quality Health Network.

exchange engages providers across the continuum of care. Since 2005, QHN has connected more than 3,000 users in 200 provider organizations of all types across the Western Slope (Exhibit 3)[12] under the premise that all the providers involved in a patient's care must exchange clinical information effectively to facilitate care coordination. QHN also recognizes that attracting a comprehensive set of participants and data sources is critical for inducing physician adoption of HIE.

As custodians of the largest collection of medical information on patients treated in the community, hospitals are a natural hub for building HIE infrastructure in each medical neighborhood. Hospitals can be motivated to invest in HIE as a shared utility that interconnects providers and thus alleviates the expense of establishing separate data connections with each outpatient provider. Electronic delivery also saves the cost of mailing or faxing laboratory test results or discharge summaries. The electronic distribution of hospital discharge alerts to physicians through the HIE can help improve care transitions and reduce the risk of hospital readmission—a point of concern for hospitals since

Medicare began financially penalizing hospitals with higher-than-average readmission rates. This value-added service can enhance the relationship between the hospital and its medical staff. The work also may be driven as part of a hospital's broader efforts to qualify for Medicare and Medicaid meaningful use incentives.

Physician leaders also influence the decision to adopt HIE as they recognize that electronically exchanging clinical data with other providers who care for their patients facilitates more effective referrals and follow-up care. Since QHN's beginning in Mesa County, physicians have served on clinical advisory committees to establish network standards, which provide a forum for physician leadership and communication about integrating HIE in quality improvement activities. Physician leaders from throughout the region have been invited to join these committees as HIE has grown beyond Mesa County.

Altruism can also be a motivation for spreading HIE to help ensure equitable access to care for all residents, as Dick Thompson, the CEO of QHN, explained:

We've encapsulated that thought process throughout the expansion we've been doing with the phrase "no wrong door." So that no matter where a patient seeks care, no matter what their socioeconomic status, no matter whether they're insured or uninsured, or what their medical condition is, they don't enter our health care delivery system through the wrong door. So that any treating clinician has access to appropriate information to help her or him make a better clinical decision, which ultimately results in better care for the patient.

Local leaders say anecdotal evidence of the benefits of HIE, drawn from the experience of communities and practices that have implemented it, can be influential in decision-making about HIE adoption. Businesses in some communities have been supportive of health IT as a way to reduce employee benefit costs by improving care. To avoid costly false starts,

QHN requires communities to establish a financial sustainability plan before moving forward with HIE. The hospital typically takes the lead in creating such a plan. The common and unique community dynamics that drive the adoption and spread of health IT and exchange are illustrated in three case examples from the Western Slope (Exhibit 4).

Providers in Grand Junction and Montrose noted how the use of HIE is naturally diffusing through the medical community as it becomes an expectation for interprovider communication. For example, leaders at Montrose Memorial Hospital described how some electronically connected physician practices have encouraged colleagues and ancillary providers to join QHN as an alternative to faxing medical information back and forth. In this way, physicians can electronically transmit treatment plans to physical therapy providers or home health agencies and receive progress notes in return. Likewise, they can access

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Exhibit 4. Case Examples:
Community Adoption of Health Information Exchange in Western Colorado

Montrose County (population 41,276): After three years of planning, Montrose Memorial Hospital went live on the QHN exchange in December 2009. The county-owned, 75-bed hospital is a referral center for the Uncomprahgre Valley, 60 miles south of Grand Junction. The decision to adopt HIE was driven both by the hospital and progressive local physician leaders who learned of its benefits from peers in Grand Junction. Both saw the value of electronically connecting providers within the community and with referral partners throughout the region. For this reason, the hospital engaged its medical staff and its board in decision-making around HIE adoption. Moving forward required a substantial investment by the hospital as a strategy for subsidizing the cost and lowering the financial barrier to physician participation in the HIE—a model subsequently adopted by other communities. In collaboration with QHN, the hospital designated an experienced staff nurse who served as an intermediary with QHN and a trusted local source of technical support to help physicians adopt HIE.

Pitkin County (population 17,148): Aspen Valley Hospital, a 25-bed critical-access hospital located 120 miles (by car) east of Grand Junction, joined QHN in the autumn of 2009 with financial support from a local foundation. The hospital considered the option of joint contracting to spread a single-vendor EHR platform throughout the community, but it ultimately decided that sponsoring a local HIE hub would be more cost effective and respectful of independent community physicians' autonomy. The collaboration necessary to implement HIE has led to broader discussions among the hospital, physicians, and local self-insured employers who have jointly formed the Valley Health Alliance and a supporting clinical integration committee to work toward achieving the "triple aim" in the community through population health management and by aligning their interests to share in the benefits of higher-value health care delivery.

Garfield County (population 56,389): Ongoing conversations between QHN and key community leaders in Glenwood Springs, 40 miles north of Aspen, led to burgeoning HIE connections in the spring of 2012 with several local providers. These include the 80-bed nonprofit Valley View Hospital, a referral center for the Roaring Fork Valley; Glenwood Medical Associates, a multispecialty practice located adjacent to the hospital; and Mountain Family Health Centers, a federally qualified health center (FQHC) with several clinics in the area. The adoption of HIE in this area appears to have occurred in an organic fashion influenced by several factors including the Beacon program and other health reform initiatives, physicians' experience and comfort level using EHRs, support from tech-savvy practice administrators, the FQHC's participation in collaborative improvement initiatives, and a nudge from local businesses concerned about the rising cost of health care.

Note: QHN = Quality Health Network; HIE = health information exchange.
Source: Authors' interviews with stakeholders.

patient records when making rounds in long-term care facilities.

Smaller, rural communities in the region are in various stages of HIE adoption. On one hand, they may benefit from their small size, since stakeholders already know one another well, and from following in the path of larger communities that were early adopters of HIE. On the other hand, small critical-access hospitals are challenged by fewer technical resources to support health IT implementation projects in their community. As a consequence, they require greater technical support from QHN to deploy HIE, which can make the effort seem less locally driven to stakeholders.

While up to 85 percent of physicians are now electronically connected to the HIE in participating medical neighborhoods, interviews suggest it is unlikely that HIE will be universally adopted throughout the region in the near term. Some physicians, especially those nearing retirement age, remain uncomfortable with health IT and are often reluctant to invest the time to learn a new system. (Some initial loss of productivity can be expected when adopting an EHR system.) Others who are using an EHR and understand the benefits of HIE are nevertheless waiting to see the practical value of interconnecting with a critical mass of their local colleagues, especially in frontier areas.

Overcoming Challenges to the Vision of Interoperable EHRs

Physician connections to QHN typically begin by drawing discrete information from the HIE, such as laboratory test and radiology exam results and clinical progress notes from other providers (Appendix A). QHN aims to achieve fully functional bidirectional data exchange, so that providers can share their patients' clinical histories and achieve the vision of truly interoperable EHRs. Accomplishing this goal has proven more challenging and is taking longer than expected. Given the lack of standards governing data exchange, connecting the wide variety of EHR systems purchased by physician practices is a complex undertaking, one requiring significant resources and

the cooperation of EHR vendors to achieve technical compatibility.

Extracting accurate data from EHRs presents a technical challenge, since many physicians continue to dictate narrative clinical notes that vary in content and use of terminology. To reduce the burden of data entry, many EHR vendors allow the use of free-text fields, which make the EHR more of a word processor than a structured database that can be queried for aggregating and reporting results. Eventually, EHRs might guide clinicians to enter key clinical data elements, using standard terminology in discrete data fields that can be linked from one EHR to another. Alternatively, "natural language processing" algorithms might be used to extract relevant discrete data elements from clinical notes. Until that time, however, the HIE must rely on the electronic transfer of unstructured clinical notes in a format that requires receiving practices to reenter key data in their own EHRs, thus limiting the efficiency gains that can be realized.

Recent collaboration between several Beacon communities and EHR vendors to define standards for data exchange will alleviate some of this burden going forward. In particular, the work group reached consensus on a minimum set of elements enabling the exchange of summary patient records to facilitate care coordination and communitywide performance measurement and reporting.[13] This effort represents a start toward achieving more compatible systems and data practices that are necessary to realize the value of HIE. Linking QHN with nearby regional health information exchanges, including the Colorado Regional Health Information Organization (CORHIO) and the Utah Health Information Network, is another way to make HIE more valuable and attractive to providers in the region. Eventually, these interconnections will enable clinical data exchange when a resident of the Western Slope needs treatment from providers in Denver or Salt Lake City.

Enhancing Clinical Decision Support to Promote Population Health Management

With support from the Beacon program, QHN is deploying clinical decision support tools to promote population health management among participating practices. The first is a master patient-registry tool, known as the Crimson Care Registry, which aggregates data from all providers connected to the HIE so that treating physicians can gain a comprehensive, longitudinal view of care quality for their patients.[14] Based on evidence-based guidelines, the registry enables practices to identify patients who are due for preventive or chronic care services, undertake outreach efforts to schedule appointments for them, offer patients services during office visits, and meet quality reporting requirements.

The CBC's purchase of the Crimson Care Registry from the Advisory Board Company will make it available to all practices using QHN at no cost for up to five years (to date, it is being used by 11 medical practices). This population-based registry tool will fill a vital need, since many existing EHR systems do not include sophisticated disease registry functionality and, absent true EHR interoperability, cannot capture care delivered by other physicians and providers. The tool should also improve physician office efficiency, since staff will no longer have to use a separate registry tool (such as an Excel spreadsheet) to track patients for this purpose.

A second tool being deployed is Archimedes IndiGO, a risk-stratification and predictive-modeling software program.[15] This tool uses algorithms to outline a patient's risk of adverse health events such as stroke or heart attack and to estimate the health impact of treatments, based on evidence from clinical trials. Inputs include health data (e.g., diagnoses, lab results, medications, vital signs) and personal risk factors (e.g., smoking, family history) extracted from electronic records, as well as claims data contributed by Rocky Mountain Health Plans. These predictions are expressed in a graph, which providers can use for decision-making and as a visual aid to engage patients in making lifestyle changes and treatment choices (Exhibit 5).

While enthusiasm is building about the IndiGO tool, its use remains preliminary while data issues are resolved (to date, it has been deployed in three medical practices). For example, the tool requires specific

Exhibit 5. Archimedes IndiGO Risk Prediction Visualization
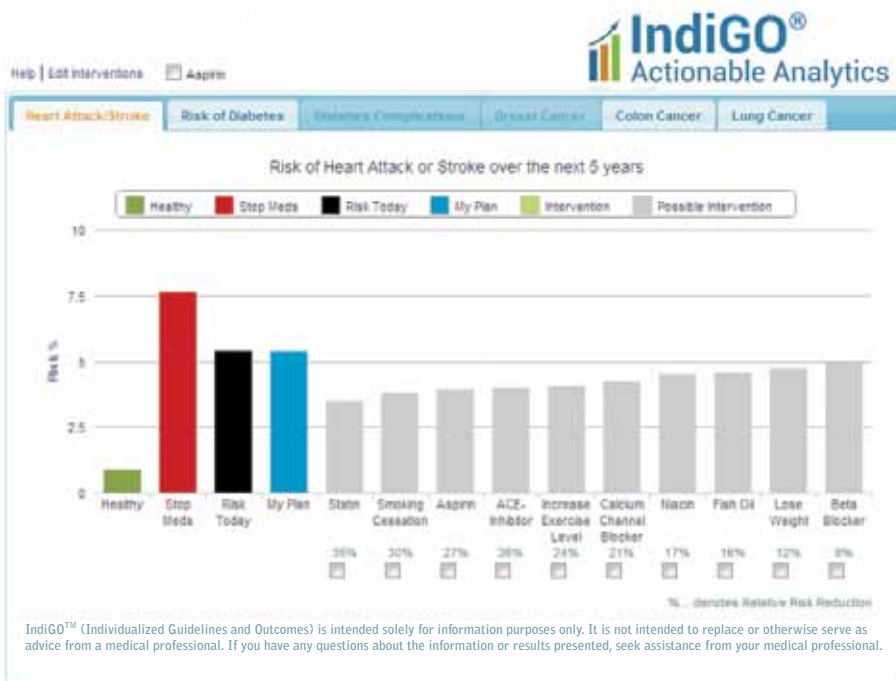
Source: Archimedes, Inc.

dates of disease onset, which may not be consistently recorded in providers' records. Thompson, CEO of QHN, expects that providers will make changes to their data input practices when they see the value of such secondary analytic uses of electronic medical record information. In the meantime, QHN is working on "data normalization" techniques to standardize patient data for use in such applications (Appendix A).

Integrating Mental and Behavioral Health Information

Electronically integrating mental/behavioral and physical health care information can improve the overall quality of patient care.[16] Yet, many factors complicate efforts to do so. Among these are elevated privacy concerns and legal protections for mental and behavioral health information, as well as the involvement of nonmedical providers in mental health care. QHN's operating rules permit only licensed medical providers to query the personal health information of patients for treatment purposes—an approach intended to ensure professional accountability for patient privacy. Behavioral health information cannot be viewed by QHN participants. Consequently, psychiatrists can view only non–behavioral health medication histories from QHN, and non–behavioral health providers cannot view confidential behavioral health information. This data segregation may impede timely coordination of care throughout a medical neighborhood. To help overcome this barrier, the CBC and QHN are collaborating with medical practices to evaluate a process for transmitting authorization forms through QHN that will enable more timely patient consent for sharing medical records among a patient's care team members.

Promoting holistic patient care also requires that providers in each field gain greater knowledge of each other's work. To facilitate such learning, the CBC created a small grant program by which primary care practices can receive training in motivational interviewing techniques, a communication method proven to increase a patient's readiness to change unhealthy behaviors.[17] This training was led by Colorado West's mental health center in Grand Junction. In addition,

Colorado West trains its mental and behavioral health providers, throughout its service area, to understand chronic medical conditions and the interaction between mental status and physical health. The regional mental health agency has placed behavioral health care providers in several health centers, school-based clinics, and physician practices in Western Slope communities to promote early identification and treatment of mental health concerns by integrating physical and behavioral health care. In Montrose, the Midwestern Colorado Mental Health Center has partnered with physician practices to institute a depression screening tool, which can be used by patients in the waiting room. These kinds of collaborative efforts are moving the area closer to a more integrated approach to meeting patients' complete care coordination needs.

TRANSFORMING CLINICAL CARE THROUGH COLLABORATIVE LEARNING

The CBC designed its Community Collaborative to build capacity for quality improvement and to change management in participating primary care practices.[18] The goal was for practices to implement a planned care model for providing evidence-based, patient-centered care supported by health IT. This helped physicians focus more broadly on understanding how they can use information tools to deliver effective care, instead of just receiving meaningful use certification for the sake of gaining incentives. "A big part of the transformation process was helping people become aware of process mapping and the importance of workflows, the importance of understanding data and where you put it" to make effective use of EHRs, says David Herr, M.D., who directed the CBC's Practice Transformation Program in partnership with the Beacon community's quality improvement advisers (whose role is described below).

Practices participated in the Community Collaborative for 12 to 15 months, including a three-month prework phase, three quarterly in-person learning sessions, an action period following each for testing new improvement ideas, and a final summit to share and celebrate successes (Exhibit 6).[19] Participation was

staged through four successive cohorts, which allowed practices to join when they were ready to consider change. This staging also ensured that practices would receive adequate support and opportunity to benefit from interactions with peers. Topics covered in the collaborative's learning sessions included:

- best practices in quality improvement communication with the practice team;

- patient-centered medical home;

- front and back office work flows: best practices in quality care;

- best care for obesity management;

- primary care from a patient's perspective;

- physician engagement in practice transformation; and

- best practices in getting children immunized.

These topics were addressed in the context of an Expanded Care Model, based on Wagner's Chronic Care Model, to describe the relationship between health system and community supports that collectively influence population health management (Exhibit 7).[20] To facilitate the adoption of recommended change concepts associated with the model (Appendix B), the CBC teaches the Model for Improvement, which offers a systematic approach to rapidly testing innovations that may lead to desired improvements.[21]

CBC participants interviewed for this case study reported that collaborative learning provided useful ideas and peer encouragement to begin and sustain

> *"[The CBC's Community Collaborative] brought us above the forest to look over the top of the trees and see the opportunities where significant change can occur in the industry and perhaps be a part of that."*
>
> Tim Burns, Chief Administrative Officer, Glenwood Medical Associates

practice change, such as how to integrate screening for depression in routine clinical workflow. For example, Mountain Family Health Centers, a rural, multisite federally qualified health center with previous experience in quality improvement, reported that participating and reporting on quality metrics renewed the energy of providers and staff and deepened their appreciation for the value of data-driven improvement. Those activities also showed them the importance of validating the accuracy of data coming from the EHR and working to standardize data entry among providers.

Rocky Mountain Health Plans offered CBC practices a financial incentive of up to $10,000 over three years to offset some of the cost associated with undertaking clinical transformation. The incentive was earned in three installments: for participation in the collaborative (25%), for progress in meeting milestones (25%), and for success in achieving outcome targets (50%). Outcome targets were interpreted flexibly to give practices credit for developing competency. Several practices reported that this incentive was important to their participation in the Colorado Beacon Consortium's Community Collaborative, for example,

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Exhibit 6. Timeline for One Cohort in the Colorado Beacon Consortium's Community Collaborative Series

Prework	Learning Session 1 (kick-off)	Action Period 1	Learning Session 2	Action Period 2	Learning Session 3	Action Period 3	Close-Out Summit (reporting and celebration)
Team formation Measures Webinars Storyboard		Tests of change QI advising Webinars Website tools		Tests of change QI advising Webinars Website tools		Tests of change QI advising Webinars Website tools	
Oct. 2011 ⇨	Jan. 2012	⇨	May 2012	⇨	Sept. 2012	⇨	Dec. 2012

Source: Adapted from the Colorado Beacon Consortium, *Practice Transformation Manual.*

by offsetting travel costs and staff time to participate in learning sessions.
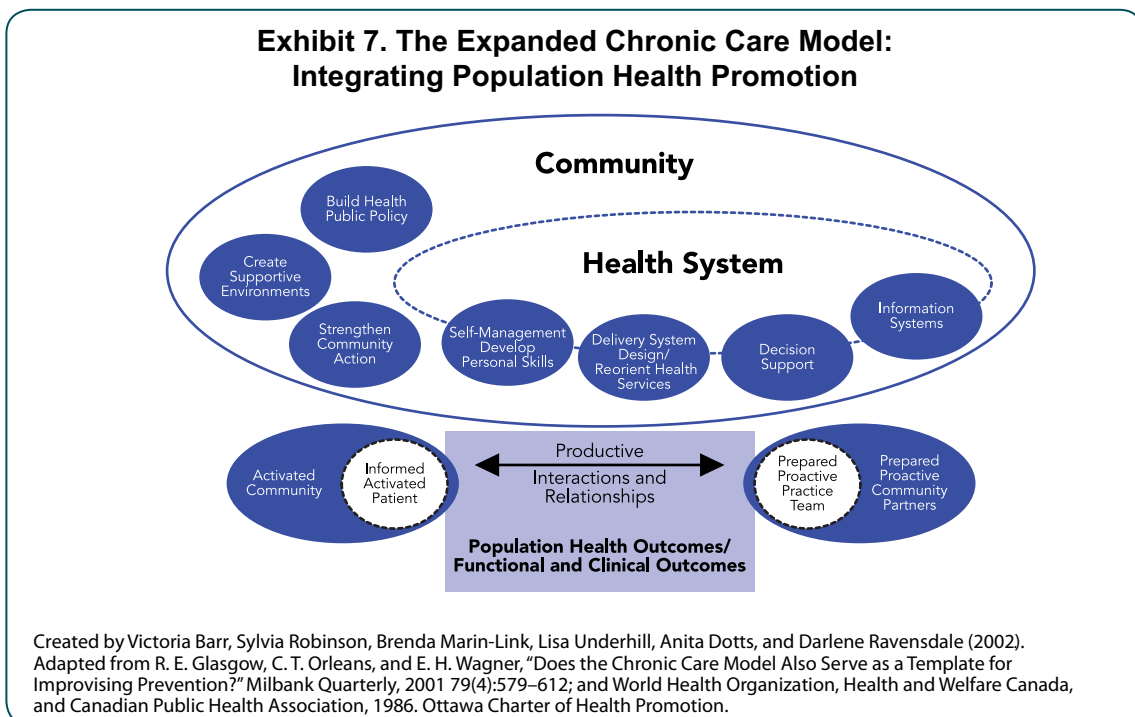
Coaching Practices to Institute Change

Since these quality improvement concepts and skills are new to most physicians and their practice staffs, Rocky Mountain Health Plans designed a practice coaching program for CBC participants. The program, which is based on nationally proven models for partnering with practices to implement evidence-based care, assigns a quality improvement adviser, or a practice coach, to each participating practice within three geographic areas of the CBC service area. Coaches are employed by Rocky Mountain Health Plans as a Beacon Community resource. To quickly build capacity, the initial team went through a weeklong "Coach University Boot Camp" offered by Denver-based HealthTeamWorks.[22]

Before setting out to coach practices, the CBC requested feedback from stakeholders to tailor its outreach and training content to recipients' priorities. This helped the Beacon team and QHN better understand where various providers stood, enabling them to attract new participants by speaking directly to their circumstances. For example, one multispecialty practice, which had been using an EHR for many years, initially declined to participate in the Beacon program because it was in the midst of converting to a new EHR system. The CBC representative subsequently convinced the practice manager that the conversion was an opportune time to apply workflow redesign principles, which could be learned through participation in the CBC's Community Collaborative.

Quality improvement advisers provide a wide range of support to participating practices. For practices that were new to or interested in joining the Beacon program, a team of coaches performed an on-site demonstration of a patient flow observation study to identify opportunities for streamlining work and reducing wasted staff time as well as patient waiting time. This exercise helped physicians see the benefits of quality improvement (QI) methods. Once assigned to a practice, a coach travels to meet with the practice QI team every two weeks. In small practices of one or two physicians, this team typically involves the whole staff. In larger practices, a QI team might consist of a physician champion, the practice manager, and representatives from the front office, back office, and nursing staff (Exhibit 8).

Early coaching focuses on building QI skills, reviewing practice workflows to identify opportunities to standardize work and increase efficiencies,

**Exhibit 7. The Expanded Chronic Care Model:
Integrating Population Health Promotion**

Created by Victoria Barr, Sylvia Robinson, Brenda Marin-Link, Lisa Underhill, Anita Dotts, and Darlene Ravensdale (2002).
Adapted from R. E. Glasgow, C. T. Orleans, and E. H. Wagner, "Does the Chronic Care Model Also Serve as a Template for Improvising Prevention?" Milbank Quarterly, 2001 79(4):579–612; and World Health Organization, Health and Welfare Canada, and Canadian Public Health Association, 1986. Ottawa Charter of Health Promotion.

determining goals for clinical improvement and HIE, and designing a plan to measure and evaluate their progress. Practices also report on a set of standard quality measures. The QI team is encouraged to meet regularly between the adviser's visits. As the team makes progress and becomes more capable of managing its own transformational work, the coach scales back the frequency of visits. Later coaching activities may focus on patient activation techniques, a greater volume of rapid-cycle tests, and analysis of QI data. Advisers are available for remote coaching when requested by a practice.

Quality improvement advisers have provided key insights to the CBC regarding physicians' improvement efforts. Practices have achieved stronger results where the coach understood and worked with their unique strengths, challenges, and priorities. For example, Brooke Thomas worked with the Olathe Medical Clinic to standardize clinical workflows among providers, which ultimately reduced patient cycle times by 45 minutes on average, according to Thomas. Successes were often about helping individuals and teams develop new skills, such as basic computer literacy and a culture of teamwork, which could sustain their efforts to effect change. For practices already experienced in QI, the coach helped with strategizing about ways to organize and advance their improvement efforts. These experiences are consistent with research showing that practice coaching is an effective intervention for improvement.[23]

> *"We've never really had much training in process improvement, in change management and those types of activities. So the coaches came in and taught us . . . how you test change before you implement new policies . . . . Before it was just sort of consensus, 'okay let's do this,' and then we never went back and tested to see if it was really working or not. . . . The Beacon coaches have shown us how you put together a team in your practice to do quality improvement . . . and just how you make change that sticks."*
>
> Greg Reicks, D.O.,
> Foresight Family Practice

Sustaining Change Through Mentorship

As the first cohort of Beacon practices completed its work with the Community Collaborative, several expressed a desire to stay involved. CBC leaders admired their commitment and saw an opportunity to not only help these practices sustain the gains they had made, but also to engage them in mentoring practices that were new to the collaborative. In response, the CBC developed a "Beacon Masters" program. Master practices continue to submit monthly performance reports and to receive coaching from their QI adviser, though on a more limited basis. Mostly, they benefit from interacting with the broad network of innovative practices across western Colorado. The CBC asks continuing practices to choose a specialty track for improvement during a second year in the Community

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Exhibit 8. Role of Key Players in Beacon Clinical Transformation Activities

Physician leaders serve as champions in a practice or community for testing an innovation that may improve the quality of care. They are often early adopters, helping to spread new tools and approaches through modeling, word-of-mouth, and active recruitment.

Practice staff carry out the day-to-day practice workflow changes and clinical interventions, such as outreach to patients who are due for preventive or chronic care services.

Quality improvement advisers are employed by the CBC to coach practices in establishing a sustainable internal quality improvement capability. This may include mapping and standardizing workflows and helping to develop a culture of teamwork within a practice.

QHN support staff provide technical assistance to practices seeking to implement EHRs and HIE. For example, they may help a practice adopt templates for recording standard information on chronic disease care and reporting results.

Note: QHN = Quality Health Network; EHRs = electronic health records; HIE = health information exchange.

Collaborative. Examples include enhancing patient engagement, connecting to a master patient registry, and building a medical neighborhood. To date, over 50 percent of Beacon practices have opted into the masters program, with expectations that this trend will continue among later cohorts.

PRELIMINARY RESULTS

Stakeholders and participants described a number of perceived benefits from the CBC's Community Collaborative and the use of HIE in western Colorado. These can be roughly divided into two summative categories, one related to measurement and health IT, and the other pertaining to quality improvement and population health. (Further details on physician practice experiences and results can be found in Appendix C.)

Perceived improvements related to data management and use of health IT are:

- increased competence in using the EHR for clinical care and performance measurement;

- focused attention on use of data for benchmarking to identify and close performance gaps;

- reduced waste by eliminating duplicate tests, paper faxes, and rework from errors;

- more timely receipt of test results;

- improved referrals and care transitions, which have the potential to reduce readmissions; and

- improved patient safety through medication reconciliation and ability to check for allergies.

Perceived improvements related to collaborative learning and population health management are:

- improved practice efficiency and productivity from workflow redesign;

- transformed culture of teamwork, which empowers staff to participate in quality improvement;

- instituted reliable processes for delivering preventive and chronic care;

- enhanced patient education through the use of shared tools and educational materials;

- generated greater attention to psychosocial aspects of patients' medical conditions and care needs; and

- activated patients who make lifestyle changes such as quitting smoking or losing weight.

The most frequently cited achievement of the learning collaborative was to instill an appreciation among physicians for the value of data feedback on improving the performance of their practices as they identified gaps in care and then sought ways to address them. Participants' perceptions of improved quality of care are substantiated by eight objective quality metrics, which demonstrated relative improvements of 17 percent to 75 percent between the first and last three months that cohorts of primary care practices participated in the collaborative (Exhibit 9). Rocky Mountain Health Plans' leaders believe that the practice redesign promoted by the CBC, together with electronic distribution of timely hospital discharge alerts through the HIE, has contributed to the region's performance in achieving lower-than-expected rates of emergency department visits and hospital readmissions among Medicaid-insured children, adults, and disabled individuals.

LESSONS LEARNED

Beacon leaders and participants suggested that several factors have been important to the success of their efforts to spread health information exchange and promote clinical practice transformation. Chief among these has been physician engagement in leading change, both at the community level and within their own practices. One physician noted that it can be painful to shift from an authoritative leadership style to a more team-oriented approach (which he described as "a captain of the ship who gets more input from the crew"), but the rewards in better productivity and the capability for improvements make this change

worthwhile. Staff, in turn, say they feel motivated by a better understanding of how their role contributes to improved patient care. The CBC's leaders were pleasantly surprised to discover the passion that the project unleashed among participating physicians and their staffs when they were given the training, tools, and support to make improvements in their practices.

Hospitals play a key role in engaging their medical staffs to undertake the improvement journey. Yet, it can be difficult initially for hospital leaders to appreciate the value of participating in a health information exchange, which represents a new way of thinking about the hospital's role within a medical community. These relationships can often be nurtured or brokered through the influence of other community stakeholders, such as physicians and employers. Because of the time required to plan and gain support for HIE implementation, patience is necessary to stay the course, as some physician leaders may be eager to begin the work sooner than may be feasible. Montrose Memorial Hospital found that having a local, trusted community resource to support physicians in HIE adoption may have been equally as important as

financial subsidies in promoting widespread community participation. Moreover, such support can enhance the hospital's stature in the medical community and attract regional referrals and laboratory testing. Facilitating regional referrals and after-care in the community increases the attractiveness of building electronic connections for both senders and receivers.

A combination of effective practice coaching, collaborative learning, data feedback, and participation incentives proved effective for engaging physician practices in clinical transformation. With this support and concerted effort, the practices achieved impressive performance gains in a relatively modest amount of time. This kind of group accountability creates peer pressure to set and attain goals, promoting greater trust and positive relationships across the community. Moreover, the CBC learned that a community does not need to wait for EHRs and HIE to be fully implemented before beginning the clinical improvement journey. These tasks can be undertaken in parallel to prepare practices for redesigned workflow, which supports intelligent use of health IT once it is implemented.

Exhibit 9. Selected Clinical Quality Results from Three Cohorts of Primary Care Physician Practices Participating in the Colorado Beacon Consortium's Community Collaborative

Measure	Count of practices	First three months			Last three months			Change in rate	Target rate	Target status
		Numerator	Denominator	Rate	Numerator	Denominator	Rate			
BMI 18–64 years	11	18,253	59,495	31%	26,301	65,563	40%	30.8%	50%	Not met
BMI 65 years and older	11	9,885	20,735	48%	13,707	23,808	58%	20.8%	50%	Met
Diabetic depression screening	4	1,662	2,438	68%	2,248	2,417	93%	36.4%	50%	Met
IVD LDL control <100	6	838	1,826	46%	1,235	2,298	54%	17.1%	50%	Met
IVD depression screening	3	831	1,540	54%	1,377	1,529	90%	66.9%	50%	Met
Breast cancer screening	6	7,068	22,522	31%	11,539	25,292	46%	45.4%	60%	Not met
Tobacco use screening	10	49,903	78,066	64%	95,334	103,921	92%	43.5%	75%	Met
Tobacco cessation counseling (among tobacco users)	10	2,864	9,967	29%	8,491	16,918	50%	74.7%	75%	Not met

Notes: This table shows the improvement for selected measures, across practices. Because practices were divided into groups and measurement periods were staggered, the chart reflects the first and last three-month periods measured. Actual dates vary by practice. Not all practices participated in each intervention. BMI = body mass index; IVD = ischemic vascular disease; LDL = low-density lipoprotein cholesterol; A1c = glycosylated hemoglobin A1c.
Source: Adapted from Colorado Beacon Consortium 2012 Annual Report, http://cbcannualreport2012.com/quality-improvement-measures.html.

The dynamics of EHR adoption have shifted with the advent of federal meaningful use incentives. QHN's online "EHR-lite" Web portal provided an important transitional path for some physicians to adopt health IT without purchasing a full-blown EHR system. On average, QHN found that physicians used the portal for about two years before transitioning to their own EHR; this time shortened to about a year for more recent adopters. Physicians using the portal could qualify for the first stage of federal meaningful use incentives. However, QHN's technology vendor has decided to discontinue the EHR-lite product in the future because it will not meet the second stage of meaningful use requirements recently announced by the federal government. EHRs will be the single pathway for physicians to adopt health IT, which makes it even more important for regional health information organizations to find an economical way to interconnect them.

Leaders, participants, and observers offered several lines of advice for others undertaking similar work. To get the work started, they emphasize the importance of identifying key stakeholders and bringing them to the table to define and solve collective problems, while acknowledging that it may take time to build trust and find common interests. For example, independent physicians in rural communities often approach health care from the perspective of small businesses rather than as part of a system of care; their participation can be encouraged by appealing to a shared motivation for making the community an attractive place to live and work. Constructively engaging payers like Rocky Mountain Health Plans allows them to contribute expertise, tools, and resources to support the effort. On the other hand, to find agreement among stakeholders with potentially conflicting interests, it is better not to start with a payment model but to design the payment model to support community goals, according to Laurel Walters, Rocky Mountain Health Plans' chief operating officer (see Policy Implications on next page).

These respondents urged others who might undertake similar collaborative improvement work to

> "You are selling a concept—a better way of doing things—not a product."
>
> Mike Lloyd, R.N., B.S.N.,
> Montrose Memorial Hospital

set realistic expectations of the time required for planning and build-out based on task complexity. Getting the job done requires agreeing on milestones to reach end goals, while also expecting some setbacks along the way. At the outset, stakeholders should agree on common quality indicators for tracking aggregate results. One leader suggested the region might have achieved EHR interoperability goals more quickly had stakeholders also reached similar community consensus on a narrow set of preferred EHR vendor choices, thereby limiting the resources required to achieve technical compatibility. Along these lines, the CBC found it useful to collaborate with HealthBridge, an HIE leading the Cincinnati Beacon Community, to pool efforts in engaging with software vendors and thereby realize synergies in implementing common solutions to shared technical needs.

From a technical perspective, the CBC's experience points to the value of:

- engaging with the Office of the National Coordinator for Health Information Technology and interregional communities of practice to devise common solutions to technical challenges such as standards for interoperability;

- exploring data practices to understand how providers are using their EHRs;

- coaching providers to improve their data practices, such as entering a stop date in the EHR to indicate that a medication was discontinued, rather than deleting the medication from the electronic record;

- standardizing data practices to avoid back-end technical workarounds, which can be necessary in the short-run to make the system functional; and

- maintaining a feedback loop to keep providers informed of this process.

Finally, to gain their understanding and support, the CBC's leaders advised educating health care providers and the community, including consumers and employers, early on about the purposes and value of the initiative. To overcome natural skepticism about EHRs and HIE among those who have little experience with information technology, it is helpful to remember that "you are selling a concept—a better way of doing things—not a product," says Mike Lloyd, R.N., B.S.N., who serves as a liaison with QHN at Montrose Memorial Hospital. The value of this approach can be seen in communities such as Aspen, where the implementation of health information exchange has become a springboard for engaging with providers and employers to discuss mutually beneficial ways of redesigning the community care system.

POLICY IMPLICATIONS

Beacon Community Program leaders recognize that business and payment reform are necessary to sustain the work of the program beyond its conclusion (Exhibit 1). Looking forward, local stakeholders in the Colorado Beacon Consortium hope to develop new models to sustain funding for health IT and clinical transformation, join other health reform demonstrations, broaden the health information exchange network, and incorporate newer tools to improve the care delivered to each patient.

While the CBC and innovative providers across western Colorado have put remarkable effort into enhancing the local health system, they still face pressure to document the positive results of this work. Patrick Gordon, director of the CBC, and other stakeholders say they are "racing the clock" to achieve a critical mass of participation and create enough "data liquidity" through the HIE to support virtually integrated care in the region. They view delivery system transformation as a vital means to ensure equitable access to care that defines the community-oriented approach for which the region is admired. Assuming that the clinical transformation work can be sustained

through continuing reform efforts, the national and local investment in the Beacon program and in HIE is likely to pay off over many years to come as local communities in western Colorado realize the continuing benefits of the infrastructure, skills, and capabilities that have been created.

Many practices are using their participation in the Beacon program as springboard to other delivery system reform opportunities. A number of practices have received varying levels of certification as primary care medical homes, and interest in this avenue remains strong, given the potential for payment incentives from health plans. Likewise, the Beacon experience allowed many practices to apply to participate in the Comprehensive Primary Care (CPC) initiative sponsored by the Center for Medicare and Medicaid Innovation. Colorado is one of seven regions selected to participate in the CPC demonstration, in which Medicare is partnering with private payers and state insurance plans to reward efficient, high-quality, coordinated care. Several Beacon practices were among the 73 selected from Colorado to participate in the program, which will further demonstrate how payment reforms can help achieve the potential of primary care medical homes and meaningful use of EHRs.

The CBC's experience demonstrates the critical role of a "macrointegrator" that can bring stakeholders together for delivery system transformation in a community or region. Rocky Mountain Health Plans partnered with Quality Health Network (the HIE) and other sponsors to fulfill this role for the Colorado Beacon Consortium. The insurer "demonstrated extraordinary leadership by facilitating and promoting conversation" among stakeholders to "figure out how all the pieces fit together" for system transformation in the region, says Sue Williamson, portfolio director for health care at the Colorado Health Foundation. State Medicaid policy can also play a role in promoting regional integration. The state of Colorado recently established a Medicaid Accountable Care Collaborative program and designated seven Regional Care Collaborative Organizations (RCCOs) to improve coordination of care for Medicaid patients.

The Western Slope of Colorado, roughly the area covered by QHN, comprises one RCCO administered by Rocky Mountain Health Plans. This model is helping to promote clinical transformation of primary care for low-income populations.[24]

At the subregional level, physicians and other stakeholders in some medical neighborhoods have discussed the possibility of forming an accountable care organization (ACO) or virtual primary care "group practice without walls." However, small Medicare patient panel sizes make it difficult to reach a critical mass for a Medicare ACO in geographically isolated rural areas. Moreover, historically low Medicare reimbursement rates and efficient hospital use means the opportunity to realize savings may not be sufficient to fund the needed infrastructure investment to establish a Medicare ACO. The creation of a private-sector ACO may be feasible in some Western Slope communities through the collaboration of health providers and local employers.

In a 2012 report, the Commonwealth Fund Commission on a High Performance Health System proposed that the federal government and other stakeholders create "Health Improvement Communities" where "providers, payers, and other local stakeholders [would] work collaboratively to redesign payment policy, enhance primary care access and health information technology, and create accountable care arrangements." By building on reform initiatives such as the Beacon Community Program, such an initiative could potentially reduce health care spending by up to $184 billion over 10 years, according to estimates.[25]

CONCLUSION

Although the Colorado Beacon Consortium benefited from the experience and infrastructure created in Grand Junction, stakeholders were careful to note that the initiative was not intended to replicate Grand Junction's particular approach to delivery system reform. Rather, it drew upon universal principles of collaboration, physician leadership, and community action to help empower each medical neighborhood to define its own approach using common tools and technology. This distinction is an important one as the nation considers how to apply success stories and lessons gleaned from local areas to benefit the country at large. The goal is not to find a recipe for success, but rather to gain an understanding of how each community can adapt local circumstances to achieve improved care, better health, and reduced costs. For policymakers, this means that it will be important to set broad aims for improvement while allowing communities flexibility to meet them in ways that satisfy local needs.

APPENDIX A. OVERVIEW OF THE QUALITY HEALTH NETWORK

Headquartered in Grand Junction, Colorado, Quality Health Network (QHN) is a nonprofit organization operating a health information exchange (HIE) that aims to improve the health of area residents, improve health care efficiency, and increase provider and patient satisfaction. QHN was founded in 2004 by the Mesa County Physicians Independent Practice Association and four nonprofit organizations: Rocky Mountain Health Plans, Community Hospital, St. Mary's Regional Medical Center, and Hilltop Resources. Together, these stakeholders contributed $2.75 million in seed capital, the bulk of which came from the settlement of a lawsuit with the state over Medicaid under-payments. QHN is expanding its network in western Colorado through a $4 million grant from the Colorado Health Foundation.

QHN's technology system, purchased from the vendor OptumInsight (formerly Axolotl), uses components of a federated, real-time electronic distribution model to identify, collect, and distribute clinical data from across the community to medical providers of record (Appendix Exhibit A). When a treating physician wishes to view a patient's record of services received from multiple providers, the system securely compiles a virtually aggregated view of the data that remains segregated and under the control of each provider in accordance with federal privacy regulations. Clinical data shared via the HIE include diagnostic lab and radiology exams, ambulatory and acute care progress/encounter notes, transcription, registration data, emergency department reports, outpatient surgery center reports, hospital discharge summaries, medication lists, pharmacy "fill" information, and public health department data.

QHN participants are given secure access to browser-based electronic tools to facilitate clinical data-sharing. QHN is also establishing interfaces with EHRs for this purpose; to date, interfaces have been built with 15 of the more than 30 EHR systems being used by physician practices in its service area. These 15 EHR systems are used by more than 50 of the region's physician practices (some of which are Beacon participants), accounting for more than 350 of the 789 medical providers connected to QHN.[26] Transactions supported include electronic clinical messaging, electronic prescribing, lab ordering, electronic referral and authorization, electronic chronic care and population

Appendix Exhibit A. Quality Health Network: Technical Model to Support Beacon Objectives

Note: HIE = health information exchange; EHR = electronic health record; ADT = admission, discharge, and transfer; TRN = transcription; Lab = laboratory; Rad = radiology.
Source: Quality Health Network.
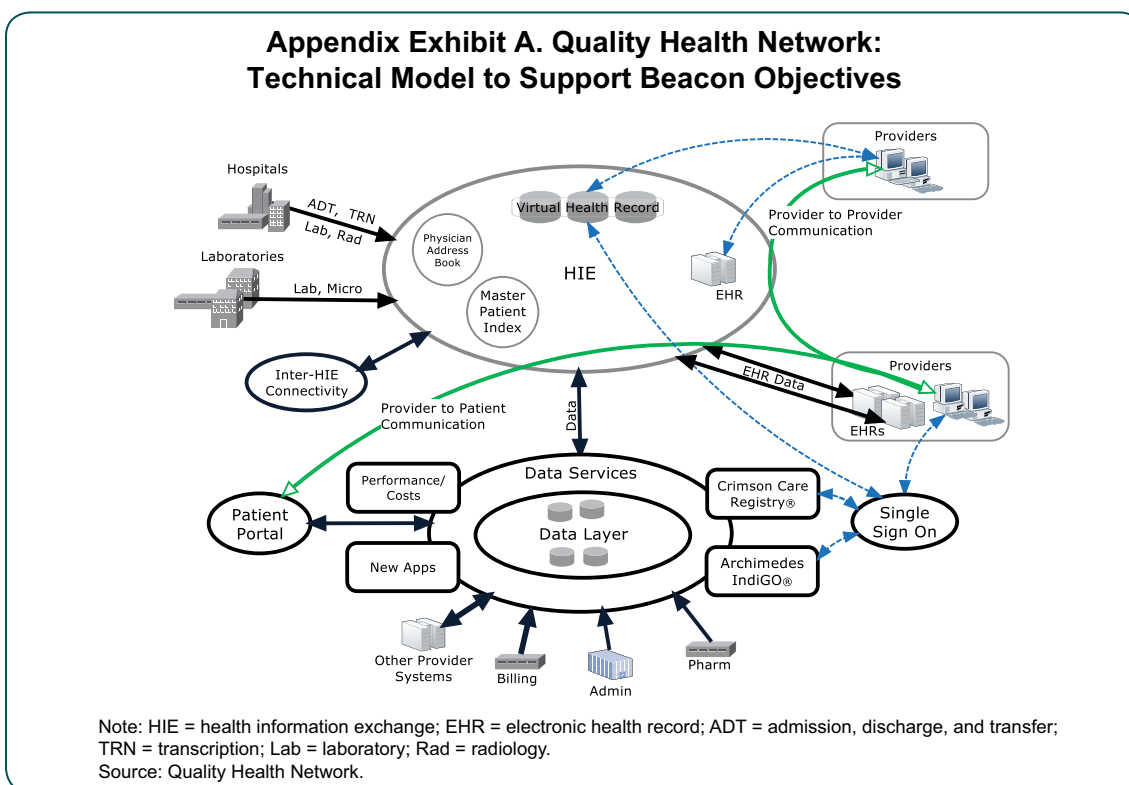
management, and immunization and other preventive care tracking. Each input or request for information is authenticated and logged.

Implementation of population-based analytic tools through the Beacon Community Program has required that QHN build a new central data repository, or "data layer," that aggregates patient information from the federated provider data sources connected by the HIE (Appendix Exhibit A). QHN is partnering with HealthBridge, the lead agency for the Greater Cincinnati Beacon Community, to share software and services to support this work. QHN reports quality metric data, pursuant to physician agreement, to Rocky Mountain Health Plans, which uses the data for population management, care coordination, and pay-for-performance purposes.

APPENDIX B. COLORADO BEACON CONSORTIUM'S COMMUNITY COLLABORATIVE CARE MODEL CHANGE CONCEPTS

Health Care Organization
- Include measurable goals for population health and chronic illness in the business plan
- Have senior leaders visibly support improvement in population health and chronic illness care
- Use effective improvement strategies aimed at comprehensive system change and community transformation
- Promote population health and good chronic illness care through benefit packages
- Encourage better population health and chronic illness care through provider incentives
- Maximize health care reform incentive programs such as the Physician Quality Reporting System and meaningful use
- Engage the community in establishing health and health care systems that are available to all citizens
- Consider establishing an accountable care organization (ACO) model within your community

Community Resources and Policies
- Identify effective community programs; inform and encourage patients and families to participate
- Form partnerships with community organizations to support or develop evidence-based programs
- Support and promote implementation and use of HIE at the community level
- Coordinate services with broader community and medical neighborhood for effective care transitions
- Standardize the referral process between primary care and specialist physicians

Self-Management Support (SMS)
- Emphasize the patient's central role in managing their health and illness
- Incorporate patient and family preferences in shared care-planning development
- Assess patient self-management knowledge, behaviors, confidence, and barriers
- Implement tools for assessing patient's ability to be successful in their change (e.g., patient activation measure)
- Provide effective behavior change interventions and ongoing support with peers or professionals
- Assure collaborative care-planning and problem-solving by the team

Decision Support
- Embed evidence-based guidelines, which describe stepped-care, into daily clinical practice
- Integrate specialist expertise into primary care
- Use proven provider education modalities to support behavior change
- Inform patients about guidelines pertinent to their care

- Implement clinical decision support tools in health information technology (health IT)

- Integrate available population- and practice-based data into standardized practice work flows

Delivery System Design
- Define roles and delegate tasks among team members

- Maximize team to implement standardized care processes

- Use planned visits to support evidence-based care

- Build effective care coordination and case management functionality into practice

- Assure continuity by the primary care team

- Assure assessment and appropriate follow-up

Clinical Information Systems
- Include clinically useful and timely information on all patients in a registry

- Provide reminders and feedback for providers and patients

- Identify relevant patient subgroups and provide proactive care

- Facilitate individual patient care-planning through the registry functionality

- Implement technology standards identified by meaningful use including e-prescribing

- Maximize health IT in practice to support safe, evidence-based care delivery

Source: Colorado Beacon Consortium, *Practice Transformation Manual*.

APPENDIX C. SELECTED PHYSICIAN PRACTICES PARTICIPATING IN THE COLORADO BEACON CONSORTIUM

Practice	MidValley Family Practice	Glenwood Medical Associates (GMA)
Location	Basalt, a small rural community between Glenwood Springs and Aspen.	Glenwood Springs (Garfield County).
Setting and staffing	Glenn Kotz, M.D., leads this solo practice supported by a full-time nurse, part-time physician assistant, part-time mental and behavioral health counselor, a practice manager, and an office administrator.	Multispecialty group practice serving 12,400 patients with 100 staff, including 24 providers (13 physicians) in family/internal medicine and other specialties. Governed by a physician board.
Health IT	The practice began using an EHR in 2005 and has been receiving data through QHN for more than two years. Perceived benefits include eliminating paper records, reducing duplicate work, and freeing up space in the office. Challenges include interfacing with other EHRs, having to manually enter data received from other physicians' clinical notes, and incomplete participation of area physicians in the HIE.	Adopted an EHR 15 years ago; switched EHR vendors in 2011 to meet federal meaningful use requirements. Interfaced the EHR to QHN in 2012 to share data with the local hospital (e.g., electronic notification when patients are admitted or discharged), obtain insurance eligibility data, and facilitate regional referrals. Going paperless has lowered staffing costs and improved confidentiality controls.
Clinical transformation	MidValley previously received virtual QI coaching, through Colorado's *Improving Performance in Practice* program, to implement the Chronic Care Model for diabetes patients. Now, years into Beacon participation, the team's onsite QI adviser has been vital to the success of their practice redesign—so much that they hired the coach to stay on. Beacon-supported training in Motivational Interviewing engaged the entire staff to act as a team in supporting patient self-management by focusing on meeting the patient's agenda.	Established a QI work group of frontline staff from across nine departments to conduct rapid-cycle improvements and redesign work and data flow, e.g., establishing a standard referral process so specialists know why referrals are being made; streamlining the integration of lab data into the EHR for quality reporting. Created a program to provide outreach to diabetic patients, including offering informational meetings and group visits for disease support.
Results and value of Beacon participation	The CBC's Community Collaborative provided Kotz the opportunity to communicate with other doctors who share similar goals and learning needs, which increased his appreciation for the importance of thinking about a community system of care. Clinical staff reported that Beacon, together with other QI programs, enhanced teamwork by helping them acquire greater knowledge, awareness, and appreciation of each other's work. Engagement with health IT and QI has helped MidValley achieve certification as a Level 3 Primary Care Medical Home from the National Committee for Quality Assurance and selection as one of 73 Colorado practices to participate in the CMS Comprehensive Primary Care Initiative (see Policy Implications).	GMA has steadily increased care quality to meet the CBC goal of closing performance gaps by 15 percent. The value of Beacon participation has come from measuring and benchmarking performance to identify and address gaps; solving common problems with other practice teams (e.g., how to incorporate depression screening in clinical workflow); speeding implementation of health IT and leveraging it for clinical transformation; and preparing for payment reform. Sharing performance data with physicians and engaging midlevel providers in QI has been critical to the success of clinical teams in process improvement. Sharing financial rewards with nonphysician staff spreads the motivation to the entire team.

APPENDIX C. SELECTED PHYSICIAN PRACTICES PARTICIPATING IN THE COLORADO BEACON CONSORTIUM (CONTINUED)

Practice	Mountain Family Health Centers	Foresight Family Physicians
Location	Four clinical sites in Glenwood Springs, Rifle, Basalt, and Black Hawk.	Grand Junction (Mesa County)
Setting and staffing	Federally qualified health center with 18 providers (including nurse practitioners, physician assistants, dentists and dental hygienists, and five physicians) across the four clinics serving 8,000 primarily low-income patients (uninsured and Medicaid-insured).	Small group of three family physicians, a nurse practitioner, and physician assistant providing the full spectrum of primary care services to approximately 7,500 patients. One of the physicians, Greg Reicks, D.O., is president of the Mesa County IPA and chairman of the QHN board.
Health IT	Adopted an EHR six years ago. Getting connected to QHN, which will be useful for receiving hospital data on their patients, especially when patients visit hospitals in Grand Junction. Implementing Archimedes IndiGO tool for patient education.	Adopted QHN's "EHR-lite" portal in 2005, which enabled two-way exchange of patient information, electronic prescribing, and clinical notes. Transitioned to full EHR in 2007.
Clinical transformation	Medical assistants make outreach calls to patients due for chronic and preventive care services (focusing on one condition or service each week using a list of patients produced by the EHR). Clinical team uses a morning huddle for in-reach, i.e., to identify patients' chronic and preventive care needs so that they are prepared to address them during the visit. Use regular QI team meetings to discuss gaps in care, surface new ideas, and run improvement cycles; discuss results during all-staff meetings to disseminate changes and/or learning.	Began weekly QI meetings to review performance data, identify areas for improvement, design tests of change, and review their results using rapid tests of change (Plan-Do-Study-Act cycles). The whole staff attends and contributes, moving then from a traditional top-down leadership culture to engaging, team-based care and QI. Foresight focuses on improving chronic disease management, including diabetes, depression, obesity, tobacco use, and cardiovascular disease. Now runs registry reports to find high-risk patients with diabetes in need of outreach.
Results and value of Beacon participation	The CBC's Community Collaborative built on past collaborative QI work, helping them renew their energy for data-driven QI and spread it more effectively throughout the practice, including office staff who had not been involved in previous collaborative work. This validated for providers and staff that there was an important reason for the improvement work they were doing. Performance reporting brought home the importance of ensuring that clinical data is accurately and consistently entered in the EHR; standardizing data practices across providers is difficult and resource-intensive.	The QI adviser walked them through the process of building a structure for the practice's QI team. Staff learned process improvement methods for the first time and feel included in advancing patient care. The practice has benefited from better utilizing each employee's skills and learning how to make changes "stick." For clinical outcomes, the practice reports having more patients with diabetes under good control. Depression screening among patients with diabetes and cardiovascular disease rose from low rates to 100 percent. Similar large improvements were achieved in cessation counseling for tobacco users.

APPENDIX C. SELECTED PHYSICIAN PRACTICES PARTICIPATING IN THE COLORADO BEACON CONSORTIUM (CONTINUED)

Practice	Lars Stangbye, M.D.	Town Clinic of Crested Butte
Location	Montrose (Montrose County)	Crested Butte, a frontier mountain resort community north of Gunnison
Setting and staffing	Solo family physician in practice since 1993, supported by a nurse, medical assistant, and receptionist. Shares call with other family doctors in town. Formerly chief of staff of Montrose Memorial Hospital.	Two-physician practice started by Eric Thorson, M.D., in 2010 through a merger with an existing sports medicine clinic. Staff includes two part-time medical assistants and an office manager. Expect about 3,000 patient visits in 2012.
Health IT	Recently switched EHR vendors to enable better quality reporting. Has not yet connected to QHN because of the lack of an interface with the EHR.	Uses an EHR, supplemented by an Excel disease registry and e-faxing as needed. The EHR offers a patient portal for refilling prescriptions, viewing lab results and bills, and downloading forms. Has not yet connected to QHN; waiting to see if other Gunnison-area providers will join the HIE.
Clinical transformation	Weekly team huddles to review population health management goals and QI for specific conditions, such as workflow changes to prioritize what gets done during the visit with diabetes patients. Recently Stangbye began discussing obesity with patients: first identifying the problem by showing them their BMI (body mass index) chart and color-coded risk for chronic disease; then being ready to help with weight management by setting realistic goals for weight loss and using the "Lose It" website for calorie-counting when the patient is ready to make a change; or by exploring why they are not ready and the barriers to making a change.	Current efforts focus on 1) identifying smoking status and referring smokers to cessation resources, and 2) outreach to patients due for mammography screening (each project assigned to a medical assistant). The small number of diabetic patients limits the opportunity for chronic disease management. The practice engages in some patient comanagement with specialists in Montrose. Rocky Mountain Health Plans incentives for participating in Beacon were critical to cover staff time and travel costs to attend quarterly collaborative meetings in Grand Junction, which required closing the clinic for a day-and-a-half each quarter.
Results and value of Beacon participation	The CBC's Community Collaborative provided accountability for working toward goals and offered a "skyview" to get out of the trenches and generate improvement ideas, benchmark performance, learn from experts, and get encouragement from peers, according to Stangbye. Stangbye finds it "tremendously rewarding" to be part of patients' success and see them build self-confidence for making lifestyle changes; some are able to come off of blood pressure medications as they lose weight. Motivational Interviewing training has helped the team assist patients, but success also came by simply being willing to engage with patients.	The practice has experienced an increase in documenting smoking status (to 100% of patients) and in cessation counseling and mammography screening outreach. Technical assistance from a QHN data analyst helped set up reporting templates for meaningful use and primary care medical home certification. Thorson recommends that practices: 1) map and establish staff roles to achieve efficient EHR use; 2) empower clinic staff to make a difference by engaging in QI; and 3) use data to track progress and reinforce the value of QI.

NOTES

1   Work Group on Computerization of Patient Records, *Toward a National Health Information Infrastructure* (Washington, D.C.: U.S. Department of Health and Human Services, 2000); and Institute of Medicine, *Crossing the Quality Chasm: A New Health System for the 21st Century* (Washington, D.C.: National Academies Press, 2001).

2   P. C. Smith, "Missing Clinical Information During Primary Care Visits," *Journal of the American Medical Association*, Feb. 2, 2005 293(5):565–71; and S. Kripalani, F. LeFevre, C. O. Phillips et al., "Deficits in Communication and Information Transfer Between Hospital-Based and Primary Care Physicians: Implications for Patient Safety and Continuity of Care," *Journal of the American Medical Association,* Feb. 28, 2007 297(8):831–41.

3   The HITECH Act was incorporated as Title XIII of the American Recovery and Reinvestment Act of 2009, http://www.gpo.gov/fdsys/pkg/PLAW-111publ5/pdf/PLAW-111publ5.pdf. The bulk of the funding is directed to financial incentives, paid through the Medicare and Medicaid programs, for providers who demonstrate the ability to make "meaningful use" of certified electronic health record systems to improve health care.

4   Office of the National Coordinator for Health Information Technology, Beacon Community Program, http://www.healthit.gov/policy-researchers-implementers/beacon-community-program.

5   U.S. Department of Health and Human Services, *Recovery Act—Beacon Community Cooperative Agreement Program*, http://www07.grants.gov/search/search.do?oppId=50455&mode=VIEW.

6   Ibid.

7   A. Gawande, "The Cost Conundrum," *The New Yorker,* June 1, 2009; L. M. Nichols, M. Weinberg, and J. Barnes, *Grand Junction, Colorado: A Health Community That Works* (Washington, D.C.: New America Foundation, Aug. 2009); M. Thorson, J. Brock, J. Mitchell et al., "Grand Junction, Colorado: How a Community Drew on Its Values to Shape a Superior Health System," *Health Affairs,* Sept. 2010 29(9):1678–86; and T. Bodenheimer and D. West, "Low-Cost Lessons from Grand Junction, Colorado," *New England Journal of Medicine,* Oct. 7, 2010 363(15):1391–93.

8   According to ONC, "meaningful use is a recognition that better health care does not come solely from the adoption of technology itself but through the exchange and use of health information to best inform clinical decisions at the point of care." See http://www07.grants.gov/search/search.do?oppId=50455&mode=VIEW.

9   Centers for Medicare and Medicaid Services, EHR Incentive Programs, http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/index.html.

10 D. M. Berwick, T. W. Nolan, and J. Whittington, "The Triple Aim: Care, Health, and Cost," *Health Affairs,* May/June 2008 27(3):759–69.

11 D. C. Radley, S. K. H. How, A. K. Fryer, D. McCarthy, and C. Schoen, *Rising to the Challenge: Results from a Scorecard on Local Health Performance, 2012* (New York: The Commonwealth Fund, March 2012).

12 Quality Health Network, *QHN-HIE Implementation Dashboard*, Jan. 2013, http://qualityhealthnetwork.org/about.

13 Office of the National Coordinator for Health Information Technology, *Beacon Community and EHR Vendor Collaboration: A Catalyst for Interoperability and Exchange*, http://www.healthit.gov/sites/default/files/pdf/ehr-vendor-beacon-topic.pdf.

14 The Advisory Board Company, *Improving Patient and Population Health Management: Crimson Case Study,* http://www.advisory.com/Technology/Crimson-Continuum-of-Care/Members/Case-Study/Posters-Crimson-Summit-2012/Colorado-Beacon-Consortium.

15 Archimedes IndiGO, https://archimedesmodel.com/indigo.

16 Institute of Medicine, "Ensuring the National Health Information Infrastructure Benefits Persons with Mental and Substance-Use Conditions," Chapter 6 in: *Improving the Quality of Health Care for Mental and Substance-Use Conditions* (Washington, D.C.: National Academies Press, 2006).

17 B. W. Lundahl, C. Kunz, C. Brownell et al., "A Meta-Analysis of Motivational Interviewing: Twenty-Five Years of Empirical Studies," *Research on Social Work Practice,* 2010 20(2):137–60; and http://www.motivationalinterview.org.

18 The Collaborative was modeled on the Institute for Healthcare Improvement, *The Breakthrough Series: IHI's Collaborative Model for Achieving Breakthrough Improvement,* IHI Innovation Series White Paper (Boston: IHI, 2003), http://www.IHI.org.

19 Colorado Beacon Consortium, *Practice Transformation Manual.*

20 V. J. Barr, S. Robinson, B. Marin-Link et al., "The Expanded Chronic Care Model: An Integration of Concepts and Strategies from Population Health Promotion and the Chronic Care Model," *Hospital Quarterly,* 2003 7(1):73–82, http://www.longwoods.com/content/16763.

[21] G. J. Langley, R. Moen, K. M. Nolan, et al., *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance* (San Francisco: Jossey-Bass, 2009).

[22] HealthTeamWorks, Coach Training, http://www.healthteamworks.org/coach-training.

[23] K. Grumbach, E. Bainbridge, and T. Bodenheimer, *Facilitating Improvement in Primary Care: The Promise of Practice Coaching* (New York: The Commonwealth Fund, June 2012).

[24] D. Rodin and S. Silow-Carroll, *Medicaid Payment and Delivery Reform in Colorado: ACOs at the Regional Level* (New York: The Commonwealth Fund, March 2013).

[25] D. Blumenthal, "Performance Improvement in Health Care—Seizing the Moment," *New England Journal of Medicine*, April 26, 2012 366(17):1953–55; Commission on a High Performance Health System, *The Performance Improvement Imperative: Utilizing a Coordinated, Community-Based Approach to Improve Care and Lower Costs for Chronically Ill Patients* (New York: The Commonwealth Fund, April 2012).

[26] Quality Health Network, *QHN 2012 Success at a Glance*, Jan. 2013, http://qualityhealthnetwork.org/about.

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