Necessary But Not Sufficient:

The HITECH Act and Health Information Technology's Potential to Build Medical Homes

Authors:
Lorenzo Moreno, Ph.D.
Deborah Peikes, Ph.D.
Amy Krilla, M.S.W.

Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

HEALTH IT   PREVENTION/CARE MANANAGEMENT

None of the investigators has any affiliations or financial involvement that conflicts with the material presented in this report.

Acknowledgments

Abstract

The recent Health Information Technology for Economic and Clinical Health (HITECH) legislation for adoption of health information technology (IT) in public insurance programs could be harnessed to help practices operationalize and implement the technology and support key principles of the patient-centered medical home (PCMH) to improve health care quality and efficiency. HITECH, as well as recently enacted health reform legislation, supports many facets of the PCMH model. Three policy recommendations—developing PCMH-specific certification criteria for electronic health records; including PCMH functionalities in the meaningful-use concept; and extending the role of HITECH's Regional Extension Centers to provide technical assistance to primary care providers on medical home principles—would increase the ability of health IT to support transformation by primary care practices to the PCMH model.

Keywords: HITECH Act; electronic health records; patient-centered medical home; transformation of physician practices; health-information-technology policy; Patient Protection and Affordable Care Act.

Contents

Tables

Introduction

The patient-centered medical home (PCMH) is a promising model of care that aims to strengthen the primary care foundation of the health care system by reorganizing the way primary care practices provide care.[1,2] Rapidly emerging interest in the PCMH model reflects a growing recognition that the U.S. health care system has become highly fragmented, with advances in medical technology and increased specialization leading to an erosion of primary care and care coordination.[3] In addition, recent evidence shows that areas with fewer primary care providers are plagued by higher health care costs and, perversely, lower-quality care.[4-9] Furthermore, low payment for primary care, together with the heavy demands on its workforce, are leading fewer medical school residents to select primary care.[10-14] Policymakers and others hope that reorganizing primary care into medical homes and increasing payments will help rebalance the system and reconfigure it in ways that improve patient and provider satisfaction, control costs, and improve quality.[15-19] Stakeholders, including Federal and State agencies, insurers, providers, employers, and patient advocacy organizations, are striving to refashion the landscape of primary care in this country through medical home demonstrations and pilots.[20-28]

Adoption of the PCMH model calls for fundamental changes in the way many primary care practices operate, including adoption of health information technology (IT) both for internal processes and for connecting the practice with its patients and with other providers. Health IT has been promoted as a "disruptive innovation" that offers tremendous promise for transforming health care delivery systems, including primary care.[29] The Health Information Technology for Economic and Clinical Health (HITECH) Act of the American Recovery and Reinvestment Act of 2009 (ARRA) allocated $19.2 billion to promote the adoption of use of health IT by eligible providers who serve patients covered by Medicare and Medicaid. In addition, the use of technology is rewarded, and in some cases required, for primary care practices to qualify to be medical homes for both public and private initiatives.[30-32] As substantial investments are being made to advance both the medical home model and IT adoption, understanding how best to promote adoption of health IT in a way that fosters improved primary care delivery is important.

The first half of this paper discusses the potential role the HITECH Act in general, and health IT in particular, can play in improving primary care through support of the PCMH model. It does not assess whether the PCMH or health IT can improve quality and reduce costs. The first half describes (1) the medical home model; (2) examines how health IT can support specific features of the medical home model for providers and potentially improve patient care; and (3) highlights the barriers and facilitators to health IT adoption and improved delivery of care by primary care practices as revealed in the literature. The second half of the paper describes how the HITECH programs, as well as other related legislation, may address these barriers and ways they may need to be supplemented to better support practices as they seek to provide improved primary care.

The Potential Role of Health IT in Improving Primary Care Through Support of the Medical Home Model

The Medical Home Aims to Improve Primary Care

The medical home model is a promising approach to improve primary care by requiring that primary care practices deliver care differently. While individual definitions of the medical home as a model of the organization of primary care vary, all agree that the medical home encompasses five principles:

1. **A patient-centered orientation** toward the "whole person" that requires understanding the patient's and the family's preferences and providing the patient's entire range of care needs

2. **Comprehensive, team-based care,** which relies on a team of providers that might include physicians, nurses, pharmacists, nutritionists, social workers, information technology specialists, and practice managers, to meet the patient's care needs

3. **Care coordinated** and/or integrated across all elements of the complex health care system (both medical and behavioral health care), including specialists, hospitals, and skilled nursing facilities; home health workers; community services and supports; and the panoply of other providers who see the patient

4. **Continuous access to care,** with shorter waits to get appointments, enhanced hours, and alternative methods of communication such as E-mail and telephone

5. **A systems-based approach to quality and safety,** some important aspects of which are (a) the practice uses evidence-based medicine and clinical decision-support tools to guide decisionmaking, (b) the practice and patients and families participate in performance measurement and improvement, (c) patient satisfaction is measured and acted upon, and (d) the practice participates in population health and management

The Agency for Healthcare Research and Quality (AHRQ) also emphasizes the central role of health IT in successfully operationalizing and implementing the key features of the PCMH, and supporting ongoing quality improvement, patient education, and enhanced communication as core PCMH activities.

Currently, private and public insurers and employers throughout the country are testing different models of what constitutes a medical home, and providing varying levels of technical assistance, wraparound supports, financial payments, and, in some cases, payment for improvements in process-of-care or clinical outcomes. These pilots, demonstrations, and programs are testing the effectiveness of the medical home model on the cost and quality of care, as well as on patient and provider satisfaction.

How Health IT Might Support Primary Care Practices
Acting as Medical Homes

Although providers could implement the PCMH model without health IT, this technology can be a strong facilitator to the establishment of this model of care, as demonstrated by growing evidence of the impacts of health IT on quality of care.[33] However, it remains unclear how health IT will contribute in practice to enabling operation as a medical home.[34]

Available evidence on the ability of health IT to support the medical home is mixed. Some evidence suggests that it improves the cost-effectiveness, efficiency, quality, and safety of medical care delivery, although there is not yet strong, broad evidence of success.[35-37] Critics of health IT, however, argue that "if you computerize an inefficient system, you will simply make it inefficient, faster," and have warned proponents of this technology to resist "magical thinking"— that is, the belief that health IT alone will positively transform primary care delivery systems.[38,39]

To avoid these pitfalls, experts have argued that, rather than identify health IT as a solution to the problem of transforming practices into medical homes, a more realistic and fruitful approach is to identify the specific health IT capabilities that could help practices become successful medical homes.[40]

Among the different IT applications for health care, policy experts envision electronic health record (EHR) systems as the cornerstone of health care transformation. These systems vary widely on the functionalities they offer, as well as across care settings and the provider's specialties. An EHR system typically consists of the following four sets of functionalities (and subfunctionalities):

- **Electronic Clinical Documentation:** patient demographics, provider notes, nursing assessments, problem lists, medication lists, discharge summaries, and advanced directives
- **Results to View:** laboratory reports, radiology reports, radiology images, and consultant reports
- **Computerized Provider Order Entry (CPOE):** laboratory tests, radiology tests, medications, consultation requests, and nursing orders
- **Decision Support:** clinical guidelines, clinical reminders, drug-allergy alerts, drug-drug interactions alerts, drug-laboratory interactions alert, and drug dosing support

As the Office of the National Coordinator for Health Information Technology (ONC) at the U.S. Department of Health and Human Services defines it, a *basic* EHR system includes only electronic clinical documentation (except advance directives); viewing of laboratory and radiology reports, and of test results; and medication CPOE. In contrast, a *comprehensive* EHR system includes all the functionalities and subfunctionalities listed above.[41] These definitions are likely to change soon as recent health IT rules on the use of EHRs, certification, and standards are finalized.[42] Likewise, as the functional model for EHRs evolves from an integrated, stand-alone system to modular functionalities for PCs, Web-based systems, and smart phones, the typology above could become irrelevant.

The appropriate use of two other technologies could also help transform health care. First, personal health records (PHRs), which are owned by the patient, typically document electronically (1) health and demographic information, including medical and behavioral health contacts and health insurance information; (2) drug information; (3) family health history; (4) a patient diary or journal; and (5) documents and images. PHRs are the patient counterpart to EHRs, although EHRs are far more common right now and are receiving the bulk of attention from Federal and State government, as well as the private sector. If adopted more broadly, PHRs have the potential to help primary care providers empower patients, and enhance the continuity of care provided, important determinants of health care transformation.

Second, telemedicine systems typically include the following functionalities: (1) remote clinical monitoring; (2) videoconferencing; (3) Web-based educational materials; (4) chat rooms; and (5) patient-provider communications in an integrated and secure environment. The use of this technology for patient care is growing rapidly as a viable option to improve access to care for patients who live in remote areas or are institutionalized, as well as to deliver confidential services, such as mental health care. Telemedicine also is gaining traction in Federal and State government, and in the private sector. This technology can make appropriate health care more accessible. Presumably, the content of care provided through telemedicine, as well as more traditional means, would be documented in the EHR, enhancing its value.

Experts in the development of the PCMH model have identified five capabilities that health IT in general, and EHRs in particular, would need to have to support the PCMH model: (1) collect, store, manage, and exchange relevant personal health information; (2) allow communication among providers, patients, and the patients' care teams for care delivery and care management; (3) collect, store, measure, and report on the processes and outcomes of individual and population performance and quality of care; (4) support providers' decisionmaking on tests and treatments; and (5) inform patients about their health and medical conditions, and facilitate their self-management with input from providers. Table 1 shows a crosswalk of the five medical home principles, the technological capabilities, the general functionalities required of the technology, and an illustrative list of the applications capable of supporting the PCMH model.

Table 1. Medical home principles, technological capabilities for supporting the PCMH model, required health IT functionalities, and illustrative health IT applications

Medical Home Principle	Technological Capability	Required Health IT Functionality	Examples of Health IT Applications
Patient-centered, whole-person orientation	- Uniquely identify patients, including language preferences - Identify the patients' care preferences and preferred learning mode, and facilitate their self-management with input from providers	- Access to patient health records and preferences - Support for patient self-management	- EHRs - PHRs - Telemedicine
Comprehensive, team-based care	- Collect, store, manage, and exchange relevant general medical and behavioral health information	- Collect standardized, accurate, and essential data elements - Facilitate medication reconciliation - Allow registry views for monitoring by patients	- EHRs - PHRs - Patient registries - Telemedicine
Coordinated care	- Collect, store, manage, and exchange relevant general medical and behavioral health information	The above, plus: - Support care coordination - Incorporate data from outside systems - Allow linking to other resources	- EHRs - PHRs - Patient registries - Telemedicine
Continuous access to care	- Communication among practice team and patients	- Allow access via secure Web portal, E-mail, or PHR	- Web portals - Secure E-mail - PHRs - Telemedicine
Systems-based approach to quality and safety	- Collect, store, measure, and report on the processes and outcomes of individual and population performance and quality of care - Uniquely identify patients in the practice - Support providers' decisionmaking on tests and treatments	- Allow automated quality measurement - Allow improved interfaces with public health services - Allow outcomes evaluation - Allow evidence-based CDS at the point of care - Allow risk stratification of patients for performance measurement	- EHRs - Patient and population registries - Pay-for-performance outcomes databases - Telemedicine - PHRs with decision support tools

Source: Mathematica's adaptation from the Patient-Centered Primary Care Collaborative, 2009, pp. 7-14.
Key: CDS = clinical decision support; EHR = electronic health record; PHR = personal health record.

In sum, comprehensive EHRs, and to a lesser extent basic EHRs, can support the medical home in important ways. Likewise, PHRs can support all five medical home principles, though given the Federal Government's overwhelming focus on EHRs, this technology is unlikely to reach widespread dissemination and acceptance soon. Other, less-sophisticated technologies, such as patient population registries, can also address some of the medical home principles at relatively low cost. Thus, the question is how practices are currently implementing health IT, and particularly EHRs, so policymakers can better understand what support practices need to ensure that it contributes to the PCMH.

Recent Experience With The Implementation of EHRs in Ambulatory Care Settings

The promise of health IT is substantial and widely touted.[43] However, "going all-digital is easier said than done" for many providers, particularly those in solo or small (five or fewer physicians) practices, which represent 78 percent of office-based primary care physicians.[44,45] Critics have argued that EHRs should "not be seen as a cure-all," and have supported their arguments by documenting widely publicized health IT implementation flaws in different care settings.[46,47] In contrast, proponents of health IT point to the evidence from a growing number of providers who have implemented full-featured EHR systems in their practices and who, after a difficult transition that included strong initial resistance from providers, high costs, and decreased productivity, do not want to go back to the old system and lose improvements in efficiency, reductions in costs, and increased patient satisfaction.[48]

This section examines several factors influencing the adoption of an EHR system by practices in the real world, including lessons learned, to illustrate the barriers and challenges involved in adopting an EHR. The goal is to identify what types of health IT–related supports primary care practices, small and large, need to convert into a PCMH.

Organizational Factors

At the core of EHR implementation, as well as transformation to PCMH, is the redesign of workflows. Computer systems embody the implicit assumptions of their creators about how work is done and by whom.[49] System vendors often make assumptions about the capabilities of the practice, such as the existence of dedicated IT staff, as well as the support of administrative staff for reorganizing workflow according to the operational assumptions embedded in the system in question. However, the day-to-day operations of practices are guided by other assumptions, which reflect the knowledge and experience that physicians and staff have accumulated over many years, and may reflect the desired goal of providing team-based care. The introduction of an EHR system often results in a clash of these assumptions and cultures about who should do certain tasks and when. For off-the-shelf systems, practice workflows may have to be reconfigured a short time after EHR installation, which has been equated to "redesigning an airplane in flight."[50] Furthermore, physicians may resent EHRs when the workflow reorganization results in a loss of professional autonomy due to the structural features of the system, such as when a clinical-decision-support subsystem results in numerous interruptions to the physician's decisionmaking process, as well as to the physician-patient interaction during an encounter. Likewise, EHR systems may pose a threat to the practice's culture of collaboration, particularly if individual clinicians did not buy into the EHR-adoption decision made for the practice.

Provider Training and Competence Factors

One of the most important barriers to EHR implementation is the disparity in IT dexterity among clinicians and staff, even within the same practice. Consequently, vendors must tailor their EHR training to the broad range of IT experience in the practice, which is costly.[51]

Practice teams often work more hours and can see fewer patients during the transition because training requires that team members take time from their busy schedules, and many practices, particularly small ones, lack the redundancy to permit this. Furthermore, despite adequate training, studies suggest that EHR implementation can temporarily reduce productivity—with important financial implications for the practice—and can create a "culture of blame" among staff if things are not going well.

Provider-Patient Relationship Factors

During the implementation period, EHRs typically result in longer workdays or fewer patients seen, or both.[52] Several studies report that many physicians using EHRs spend more time per patient for long periods after system implementation, sometimes spending "more time interacting with the computer than with the patients." In other words, the EHR can become "much like a third party to a conversation," with providers interacting more with the technology product than the patient, reducing patient satisfaction and the quality of the encounter.[53-55] Patients can eventually benefit from legible prescription or laboratory refill orders, clearer information about their treatment regimens, and the reduced time and effort required to ensure that tests results and clinical documentation have been shared with their other providers. However, getting to that point typically follows a period of great burden and stress for clinicians and practice staff, and for the patients themselves.[56]

Technical Factors Require Additional Staff or Consultants

Most current EHR systems require the design and implementation of a complex computer network that has to be supported, maintained, and operated after hours by expensive staff. Even highly regarded, industry-leading EHR systems add complexity to practices' operations.[57] In addition, problems with system usability require that physicians and support staff take the time to learn effective ways to use the EHRs, potentially reducing the time they can spend on quality improvement.[58-61] Although vendors offer technical support to practices, such services are costly, particularly for small practices and those treating underserved populations.

Financial Factors

Virtually all small and medium sized practices, and even some large ones, that have installed an EHR system, whether "off the shelf" or customized, complain of the high initial (hardware, software, installation, training, productivity loss) and ongoing (hardware upgrades and maintenance, software maintenance, IT staff and consultants, and refresher training) costs. For instance, recent estimates put the average initial EHR costs at $44,000 per full-time-equivalent provider, and ongoing costs at an average of $8,500 per provider per year.[62]

Added concerns include (1) the risk of investing in an EHR before official standards for exchange of medical data with other providers are fully developed; (2) purchasing a proprietary system from a vendor that subsequently goes out of business; (3) purchasing a technology whose business model could change rapidly, making the purchase obsolete (for example, integrated EHR systems evolving into modular systems); and (4) acting when there are a lack of incentives to incur the substantial costs of EHR implementation (as before the HITECH Act).[63] In contrast, the advantages of computerized systems may increase the practice's income: improved coding of

procedures and services; savings on the costs of transcription due, in theory, to easier and faster preparation of patient notes; and streamlined billing to insurers.[64,65] However, it is unclear whether this added revenue will be enough to make up for the large initial and ongoing costs, in terms of both money and staff time, of running an EHR system.

Early Lessons Learned From Implementation: Practices Need Assistance Adopting Health IT

Most health IT innovators—that is, early implementers of EHR systems in small to medium-sized ambulatory care practices—agree that it is "naïve to assume that small practices will move [to adopt this technology] without a variety of support, one of which is certainly financial."[66] The challenge may be greater in community health centers and other safety net providers, where the financial and technical resources to launch and operate an EHR system are even scarcer than in practices serving patients with private insurance.[67] However, safety-net providers also seem to have better access to other funding streams, such as foundations or government grants and technical assistance than equivalent private practices.

Advances in the adoption and use of EHRs in primary care require financial and technical support from the Federal Government, professional associations, and foundations to address the barriers to successful adoption described above. Furthermore, this support is central for the adoption of the PCMH model in primary care practices, because ineffective adoption of health IT, and in particular EHRs, often creates outcomes in direct conflict with specific principles of medical homes. For instance, the patient-centered, whole-person principle could be compromised if providers spend more time dealing with the technology than with the patient. Likewise, the coordinated-care principle could be compromised if EHR-interoperability is difficult to achieve or slow to implement because providers do not trust that data exchanges with other providers are secure. Finally, the comprehensive, team-based-care principle could be compromised if EHRs codify workflows and roles or decrease direct communication between team members. The next section discusses the Federal Government's current plans.

THE POTENTIAL ROLE OF THE HITECH STIMULUS FUNDING TO HELP PRACTICES BECOME MEDICAL HOMES

Adoption of health IT in the United States is highly variable, and the nation is well behind the progress made in other countries.[68-70] Recognizing the unrealized potential surrounding health IT to improve the quality and delivery of health care, Congress passed the HITECH Act as part of ARRA to promote the adoption of health IT.

HITECH's Stimulus Funds

The HITECH legislation contains a broad menu of measures to promote health IT adoption. The bulk of these funds are targeted to eligible providers serving Medicare fee-for-service beneficiaries, who can receive a total maximum of $41,000 each ($44,000 for those who adopt early, in 2011) over 4 years through Medicare Part B if they adopt and "meaningfully use" certified EHRs beginning in 2011.* Incentive payments are phased out over time and, beginning in 2015, replaced by financial penalties for providers not using certified EHRs. In addition, HITECH authorizes a 100 percent Federal match (Federal Financial Participation) for State payments to certain qualifying providers serving Medicaid patients who acquire and use certified EHRs. Furthermore, HITECH includes provisions that expand the current privacy and security requirements under the Health Insurance Portability and Accountability Act (HIPAA). Finally, the Act funds a variety of grants (1) to States, to promote health IT adoption and create loan funds for providers to procure and implement health IT; (2) to academic institutions, to include health IT in clinical curricula; and (3) to various organizations, to promote educational outreach and technical support to assist in the adoption of health IT.[71,72] As of this writing, most of the mandated HITECH programs were still under development or in early implementation.

The Concept of Meaningful Use of EHRs

This section discusses HITECH's centerpiece—meaningful use of EHRs—because the disbursement of the bulk of the stimulus funds for adoption and use of the technology hinges on this concept and will affect HITECH's support of practices becoming medical homes.
In the months since ARRA was signed into law, there has been much debate over the definition of "meaningful use" of EHR systems, a key concept for deciding how the stimulus funds shall be allocated among eligible providers. This debate has generated numerous proposals made by provider and health IT professional organizations to ONC, and hearings held by ONC's HIT (Health Information Technology) Policy Committee and the National Committee on Vital and Health Statistics Executive Subcommittee, among others. The Centers for Medicare & Medicaid Services (CMS) released draft regulations for the definition and operationalization of the meaningful-use concept on January 13, 2010, beginning a 60-day commenting period after which CMS will issue final regulations. These regulations are expected by late summer 2010.
The HITECH Act specifies two criteria for defining meaningful use of EHRs: (1) demonstrating to the satisfaction of the Secretary the use of a *certified EHR technology in a meaningful manner* (emphasis added), including e-prescribing and using a health information exchange to improve health care quality; and (2) using such certified EHR technology to report on clinical quality measures, as selected by the Secretary.

Most organizations and stakeholders agree that the requirements for meaningful use of EHRs by practices should include (1) the use of a certified EHR, (2) use of a health information exchange, (3) use of e-prescribing, and (4) demonstrated reporting of quality and patient safety data to CMS. There is also consensus that there should be incremental introduction of meaningful-use requirements, and all stakeholders emphasize that meaningful use should focus on information stored in the EHR, not on the technology itself.[73-76]

---

*The legislation also includes incentive payments for hospitals through Medicare Part A to eligible acute-care hospitals that are meaningful users of EHRs.

Policy Priorities Embedded in the Concept of Meaningful Use

The HITECH-created HIT Policy Committee has provided recommendations to ONC on how to define the concept of meaningful use.[77] These recommendations assume an incremental evolution between 2010 and 2014, the target year for achieving the goal of meaningful use of certified EHRs for each person in the United States. These priorities set the goals for EHR systems at three different points in time (2011, 2013, and 2015), which correspond to the years for assessing meaningful use of an EHR system, not the years for qualifying for the incentive payments, and may be changed in subsequent regulations.

HITECH supports some, but not all, facets of the medical home (Table 2). Most notably, the core principle of comprehensive, team-based care and collaboration among staff within a practice is not explicitly covered by the meaningful-use concept. Also, the requirements do not address continuous access to care in terms of shorter wait times (but they do support patient-provider communications via E-mail). These two omissions may be addressed by the meaningful-use regulations (which have not been announced yet), or upcoming health reform legislation. Another potential limitation is that while practices are required to submit data electronically to public health agencies, it is unclear whether the agencies will have the capabilities to receive and process the information.[78]

Table 2. Goals for EHR systems in 2011, 2013, and 2015, by medical home principle and meaningful use policy priority

Medical Home Principle	Meaningful-Use Policy Priority	Period for Assessing Meaningful Use of EHRs		
		2011	2013	2015
Patient-centered, whole-person orientation	Engage patients and families	- Give patients secure electronic access to their health information and patient-specific education resources - Provide clinical summaries at each encounter	- Record patient preferences (for example, preferred communication media and treatment options) - Incorporate data from home monitoring devices - Offer patients access to PHR populated in real time	- Give patients access to self-management tools and electronic reporting on experience of care
Comprehensive, team-based care	Not specified	- Not applicable	- Not applicable	- Not applicable
Coordinated care	Improve care coordination	- Perform medication reconciliation, especially when patient moves from one health care setting or provider to another	- Retrieve and act on electronic prescription fill data - Produce and share electronic summary of care record for every transition in care	- Access comprehensive patient data from all available sources

Table 2. Goals for EHR systems in 2011, 2013, and 2015, by medical home principle and meaningful use policy priority (continued)

		Period for Assessing Meaningful Use of EHRs		
Continuous access to care	Engage patients and families	- None	- Provide secure patient-provider messaging capability - Access for all patients to a PHR populated in real time with health data	- None
Systems-based approach to quality and safety	Improve quality, safety, and efficiency, and reduce health disparities	- Use CPOE for all orders - Implement drug-drug, drug-allergy, and drug-formulary checks - Maintain lists of allergies and diagnoses - Record pertinent patient information - Incorporate laboratory test results into EHR - Report ambulatory quality measures to CMS - Document each encounter and check insurance eligibility	- Use evidence-based order sets - Record family medical history - Manage chronic conditions using patient lists - Use clinical decision support at the point of care - Specialists report to external disease or device registries, approved by CMS	- Achieve minimal levels of performance on quality, safety, and efficiency measures - Implement clinical-decision support for national high-priority conditions - Maintain medical device interoperability
	Adequate private and security protection for personal health information	- Comply with HIPAA privacy and security rules and fair data-sharing practices	- Use summarized or de-identified data when reporting for public health purposes	- Provide patients with accounting of treatment, payment, and health care operations
	Improve population and public health	- Submit electronic data to immunization registries where required and accepted - Submit electronic surveillance data to public health agencies according to applicable law and practice	- Receive immunization histories and recommendations from immunization registries - Receive health alerts from public health agencies - Provide de-identified electronic surveillance data to public health agencies	- Generate ad hoc quality reports - Automate real-time surveillance - Provide clinical dashboards - Use epidemiological data derived from EHRs

Source: Mathematica's mapping of ONC's policy priorities and timeline (Health IT Policy Council Recommendations to National Coordinator for Defining Meaningful Use. Final August 2009) to AHRQ's medical home principles.
Key: CMS = Centers for Medicare & Medicaid Services; CPOE = computerized provider order entry; EHR = electronic health record; HIPAA = Health Insurance Portability and Accountability Act; PHR = personal health record.

Other Policy Priorities in HITECH and Related Legislation

Other HITECH provisions, as well as related Federal legislation, could support or hinder practice transformation to medical homes.[79] Though there is some uncertainty as to how statutes will ultimately be implemented, in some cases enough is known to make explicit the linkages and disconnects between the programs or regulations mandated by the legislation and the PCMH model. To this end, we summarize whether or not each of the medical home principles

(discussed in the previous sections) is covered by the corresponding HITECH programs, or others planned by health reform legislation (see Table 3).

Table 3. Medical home principles by HITECH Programs and other legislation that could enable the PCMH model

Medical Home Principle	HITECH Programs	Other Legislation
Patient-centered, whole-person orientation	- SHARP Program - Curriculum Development Centers - Community College Consortia to Educate Health IT Professionals	- None
Comprehensive, team-based care		
Coordinated care	- State Health Information Exchange Program - Beacon Community Program	- Patient Protection and Affordable Care Act (P.L. 111-148): Federal Coordinated Health Care Office within CMS; Community-based Collaborative Care Network Program; Allows pediatric medical providers to organize as ACOs within Medicare
Continuous access to care	- None	- None
Systems-based approach to quality and safety	- Regional Extension Centers Program - Beacon Community Program - State Health Information Exchange Program	- Anti-kickback (Stark) safe-harbor provisions - Patient Protection and Affordable Care Act (P.L. 111-148): Innovation Center within CMS; Community-based Collaborative Care Network Program
	- Extension of HIPAA provisions - SHARP Program	- HIPAA
	- Beacon Community Program - SHARP Program	- Patient Protection and Affordable Care Act (P.L. 111-148): National Prevention, Health Promotion, and Public Health Council - Task forces on Clinical Preventive Services and Community Preventive Services

Key: ACO = accountable care organization; CMS = Centers for Medicare & Medicaid Services; HIPAA = Health Insurance Portability and Accountability Act; SHARP = Strategic Health IT Advanced Research Projects.

Patient-Centered, Whole-Person Orientation

The health reform legislation does not include any direct action related to the medical home principle of whole-person orientation. However, if well implemented, the same HITECH programs described above under team-based care could support a whole-person orientation. Special attention would have to be given to support behavioral-health inclusion in this principle, since care for behavioral disorders and substance use is typically segregated from general medical care. Further, the ability to coordinate this care would be challenging, because the use of health IT by behavioral-care providers lags in comparison to that of medical care providers.

Comprehensive, Team-Based Care

Two HITECH programs that could advance the policy objective of team-based care are (1) ONC's Strategic Health IT Advanced Research Projects (SHARP) Program, which will fund research focused on achieving breakthrough advances in "patient-centered cognitive support" for

providers; and (2) ONC's Community College Consortia to Educate Health IT Professionals, jointly with the Curriculum Development Centers Program, to integrate health IT into the clinical education of health care professionals.[80] These initiatives could be invaluable for offering would-be primary care providers detailed information about the medical home concept, how to operationalize it, and how health IT could support the building process. However, it is not yet clear whether these programs will explicitly support team-based care.

Offer Coordinated Care

HITECH does not include programs that would explicitly facilitate care coordination or integration across all elements of the complex health care system, as required by the medical home's corresponding principle (see Table 1). Indirectly, the legislation proposes measures to mitigate the risk that providers will develop their own computer silos that do not interact with those of other providers—that is, will not be interoperable—by fostering the adoption of health IT standards and the secure exchange and use of health information.[81,82] However, the legislation is silent about how primary care providers will be able to communicate with the practice's "medical neighborhood" (the other providers seen by the patients), either from a technical or a legal (agreement on data-sharing) perspective. These provisions also are likely to give new impetus to regional health information organizations, the entities working to establish data exchanges, most of which are funded through grants and large contributions from participating organizations.[83]

To develop health IT standards, HITECH established an HIT Standards Committee, which since its inception in spring 2009 has been making recommendations to ONC on these policies. In addition, HITECH Infrastructure Grants will be used by several Federal agencies to support the nationwide electronic exchange of health information in a secure, private, and accurate manner; develop an infrastructure for telemedicine; promote interoperability of clinical data repositories and registries; and develop technologies and best practices for protecting health information. All these are factors that could make it easier for practices to coordinate care across providers and settings, and to conduct the population-level health measurement and tracking needed to ensure a systems-based approach to quality, as required by the PCMH model. Finally, HITECH awarded planning and implementation grants to States or qualified State-designated entities to facilitate and expand the exchange of electronic heath information. Likewise, cooperative agreements have been awarded through the State Health Information Exchange Cooperative Agreement Program to States and qualified State Designated Entities to develop and advance mechanisms for information-sharing across the health care system.[84]

ONC's Beacon Community Program will provide funding to communities to demonstrate the "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, and efficiency.[85] Thus, this program has the potential to coordinate care for the patient's entire range of care needs.

Not surprisingly, support for care coordination comes from the health reform legislation (the Patient Protection and Affordable Health Care Act [P.L. 111-148]). Specifically, the legislation creates an office for coordinating health care within CMS; a Community-Based Collaborative Care Network Program; and allows medical providers to organize as Accountable

Care Organizations (ACOs) within Medicare. This should foster better coordination across providers. Thus, these provisions open the door to improve the ability of medical home practices to coordinate care across providers and provide incentives to implement them.[86]

Continuous Access To Care

There are neither specific HITECH programs nor health reform legislation that explicitly addresses this medical home principle. The expansion of health insurance coverage would address it indirectly by making it easier for patients to see a primary care provider, but meaningful use does not ensure that the provider will fit in patients with urgent needs.

Improve Quality, Safety, and Efficiency, and Reduce Health Disparities

Three HITECH programs address this broad principle. In addition to the Beacon Community's emphasis on whole-person orientation and the State Health Information Exchange Program, ONC has proposed the HIT Extension Program. This initiative will assist providers in adopting and using certified EHR systems through HIT Regional Extension Centers (RECs). Furthermore, the legislation established a national Health Information Technology Research Center (HITRC), which will gather and share relevant information on best practices in EHR adoption, effective use, and provider support and help convene the collaboration of regional centers. The extension program will establish at least 70 regional centers, each serving a defined geographic area. The RECs will support at least 100,000 primary care providers, through participating nonprofit organizations, in achieving meaningful use of EHRs and enabling nationwide health information exchange.[87] This ambitious program will require that RECs (1) educate and reach out to providers on the effective strategies and practices to select, implement, and meaningfully use certified EHR technology to improve quality and value of health care; (2) assist providers with vendor selection and group purchasing of the technology; (3) provide project management support over the entire EHR implementation process; (4) facilitate practice and workflow redesign necessary to achieve meaningful use of EHRs; (5) help providers connect to available health information exchange infrastructure; (6) provide training and assistance in attaining meaningful use; and (7) promote integration of health IT into the initial and ongoing training of health professionals and supporting staff. Although it is too early to predict the implications of this ambitious and comprehensive program, it clearly includes many of the right elements for fostering the transformation of primary care practices into medical homes, because it addresses several of the medical home principles discussed above.

HITECH also addresses concerns about privacy and security of personal health data by extending the corresponding HIPAA regulations to health information vendors not previously covered by the law. For instance, the added vendors would include businesses such as Google and Microsoft, when they collaborate with health care providers to create PHRs for patients. The legislation also requires that health care organizations notify patients when personal health data have been compromised, and it limits the commercial use of those data. Although there is controversy about HITECH's HIPAA provisions, particularly those regarding notification of information breaches, the new provisions are likely to assuage concerns of patient and consumer advocates about the risks of sharing personal health information among providers, a helpful option for successful PCMH implementation. In addition, by facilitating the certification of EHR systems, HITECH includes provisions to help assure providers that their health IT investments

will not be wasted on bad systems. This certification would provide a "seal of approval" for the EHR technology that vendors offer providers, including measures for protecting the privacy and security of health information. Finally, HITECH's SHARP Program will address well-documented problems that have impeded EHR adoption, such as security and privacy barriers. Other Federal legislation has already addressed facilitating the legal donation of EHRs and e-prescribing technologies and training services: anti-kickback (Stark) safe-harbor provisions.[88,89] This would allow, for example, a hospital to donate such technologies and services to practices of physicians with admitting privileges, thus saving practices, particularly small ones, from incurring the costs of procuring a system, selecting a winning bid, and negotiating a contract with the supplier. In addition, for more than a decade, HIPAA has regulated a broad range of factors related to the generation, storage, transmission, and exchange of personal health information.

The health reform legislation includes provisions that could also facilitate the improvement of population and public health: (1) the development of a National Prevention, Health Promotion, and Public Health Council; and (2) the development of task forces on clinical preventive services and community preventive services. These provisions have the potential to help medical homes fulfill their mission of improving public health, though the likelihood of their implementation remains uncertain.

Finally, health reform legislation requires the creation of an Innovation Center within CMS, which will test, evaluate, and expand in Medicare, Medicaid, and CHIP different payment structures and methodologies to reduce program expenditures while maintaining or improving quality of care.

In sum, all these HITECH programs and current Federal legislation are necessary, but not sufficient, elements for providers considering the adoption of the medical home model, such as Federal qualified health centers and other safety net providers, and those serving Medicare, Medicaid, and CHIP beneficiaries. Therefore, in the following section we discuss the potential policy levers that could facilitate the transformation of primary care practices into medical homes, as well as the potential unintended consequences of the current legislation.

Conclusions

Discussion

HITECH has the potential to contribute to "cohesive, broad-based policy changes . . . that could lead to improved absolute and relative performance," including the transformation practices need to act as PCMHs.[90] While HITECH programs and other Federal legislation are necessary, they are not sufficient factors for providers considering the adoption of the PCMH model. As noted by a panel of experts consulted for this project, HITECH's funding is not enough to support adoption and meaningful use of EHRs, let alone the broader transformation in care delivery needed to build PCMH. Other funding sources will be needed. Thus, although meaningful use of EHRs and other HITECH programs may contribute greatly to the adoption of a PCMH model, it seems clear that other factors beyond meaningful use are needed to attain this model of care, such as reform of systems for health delivery and health provider payment. In

particular, reform of the latter would align the incentives of the PCMH model to increase accountability for total costs across the continuum of care, most notably between primary care providers and specialists, a feature conspicuously absent in the meaningful-use policy priorities. As one expert noted at the technical expert panel meeting January 15, 2010, "Absent provider payment reform, HITECH will not, by itself, stimulate the widespread formation of medical homes." An assessment of the effectiveness of HITECH will not be possible before the second half of this decade. Because the legislation is just being implemented, evidence about the likely success of implementation of the HITECH's programs and, in particular, of the meaningful-use concept and its role in promoting the PCMH model, is limited to a few studies, such as CMS's Medicare Care Management Performance (MCMP) Demonstration and Electronic Health Records Demonstration (EHRD).[91,92] These two demonstrations are testing the impact of financial incentives on the adoption and use of EHRs and on quality of care. Although they were not set up to test the meaningful-use concept or the medical home model, they will measure the actual use of EHRs with a survey of office systems. Furthermore, the interventions both target small to medium-sized practices serving Medicare beneficiaries with certain chronic conditions, similar to the settings targeted by HITECH. For these reasons, findings from these demonstrations offer the best opportunity for obtaining an early glimpse of the implementation of the meaningful-use concept in Medicare and of the barriers and facilitators to attaining meaningful use of the technology in medical homes. However, only findings from MCMP will be available by 2011, the first year of implementation of the meaningful-use concept; findings from EHRD are expected in 2015.

Although this paper focuses on the *intended* consequences of HITECH programs on the adoption of health IT and medical homes by primary care practices, *unintended* consequences also matter. For example, linking provider reimbursement to meaningful use of EHRs, with the consequent increases in financial and staff costs, may unwittingly slow PCMH adoption if practices focus exclusively on EHR adoption and not on other components of improved primary care. Likewise, the EHR Incentive Program could crowd out some private investment by practices who would have used their own resources to adopt EHRs. In addition, the resources (in both money and time) needed to implement EHRs might supplant resources that could otherwise have been directed at quality improvement. Finally, emphasizing health IT as the solution to physician practice problems stemming from poor organization or suboptimal care processes may result merely in greater investment in ineffective changes. Table 4 highlights these and other unintended consequences. Given the broad nature of the systemic changes proposed by HITECH and other legislation, it may take 5 to 10 years to figure out the full unintended effects of health IT on transforming practices into medical homes.

Table 4. Potential unintended consequences of the HITECH Act and their relation to the PCMH Model

- Promotion of EHRs as the solution to physician practice problems, such as suboptimal processes, may result in squandering resources on ineffective changes.
- If physicians oppose HITECH's EHR Incentive Program, PCMH adoption may be unwittingly slowed.
- If certified EHRs don't address aspects of running a practice not specifically defined by meaningful-use criteria, hedging the practice's transformation into the PCMH model on health IT could be more challenging.
- The EHR Incentive Program could crowd out some private investment by practices who would have used their own resources to adopt EHRs.
- The resources (both money and time) needed to implement EHRs may supplant resources that might otherwise have been directed at quality improvement activities.
- The "digital divide" among providers might paradoxically broaden if large practices, or those that have sufficient expertise and interest in technology or have already taken some steps toward EHRs, use the incentives to increase use of this technology, while other practices that are smaller or lack the technical expertise or financial resources do not use them.
- Replacement of the integrated EHR model with modular applications that are either Web-based or hosted in mobile communications devices (such as smart phones) could undermine the feasibility of the business models likely to be used by RECs, which would likely charge fees and promote certain types of EHRs.
- If the process for collecting data on EHR meaningful use is administratively and financially burdensome to practices, or if the use measures are not clinically relevant and evidence based, there could be a backlash against the incentive program.
- Failure to include behavioral health disorders in the meaningful-use criteria would perpetuate the segregation between general medical care and care for behavioral and substance use disorders.
- If other transformations are required of practices during the learning-curve period, the adoption of the PCMHmodel could be delayed several years or abandoned in favor of more pressing priorities.

Source: Mathematica's analysis, with input from the expert panel.
Key: EHR = electronic health record; RECs = Regional Extension Centers

Policy Implications

Accelerating adoption of health IT and enhancing primary care are two key infrastructure policy changes that are widely assumed to improve the quality and efficiency of health care.[93] With HITECH at the early stages of implementation, and with health reform legislation at its heels, discussion of the intended and unintended consequences of this legislation is merely speculative. However, there are two concrete actions that could easily be integrated to positive effect with HITECH and a third, worth considering, that could expedite the adoption of the PCMH model, with health IT support (Table 5).

Table 5. Potential policy actions that could facilitate practices' adoption of the PCMH model with health IT support

Action	Policy Vehicle	Feasibility of Implementation
Include PCMH-specific certification criteria in the EHR certification criteria embedded in the meaningful-use regulations	HITECH: meaningful-use regulations for Stage 1	High to moderate
Include specific medical home functionalities in the meaningful-use criteria	HITECH: meaningful-use regulations for stages 2 and 3	High to moderate
Add PCMH technical assistance to REC Program	HITECH: Regional Extension Centers Program	Moderate to low

Source: Mathematica's analysis, with input from the expert panel.
Key: RECS = Regional Extension Centers

Include PCMH-specific certification criteria in the EHR certification criteria embedded in the meaningful-use regulations. Such merging of criteria would define those that the EHR must meet for primary care practices to operate as PCMHs, and for other providers to interact with the PCMH in a way that supports care coordination. For example, the certification criteria could require that EHR systems mandate that (1) the primary care provider's medical neighborhood produce data in machine-readable format (for example, standardized data formatted such that an EHR can compute laboratory test values versus receiving these data as a PDF or in an E-mail); and (2) primary care and specialty providers use EHRs to generate data for estimating the quality measures required to assess performance of the PCMH model. There is precedent for tailoring the criteria specifically for medical home providers, such as CCHIT's experience developing certification criteria for a wide range of ambulatory EHRs, including preliminary ones for meaningful use. This experience could facilitate developing requirements to ensure that EHRs support the PCMH model.

Because of its relatively low development costs, as well as the potential efficiency of certifying PCMH standards concurrently with meaningful-use EHR standards, the suggested strategy seems promising. With ONC approval and oversight, and the support of AHRQ, CMS seems the natural choice for implementing this suggested policy, given its responsibility for overseeing the implementation of the meaningful-use and PCMH concepts for Medicare and Medicaid. Buy-in from primary care physicians on this added certification step is critical for putting this proposition into practice.

Include specific medical home functionalities in the meaningful-use criteria for stages 2 and 3. We turn from EHR certification criteria to meaningful-use criteria. Specifically mandating that the meaningful-use criteria for the last two stages of its implementation period (2011-2014) require the use of the PCMH model, such as coordination between primary care providers and specialists and integration of medical and behavioral health services, would boost the likelihood that HITECH can truly facilitate the transformation of primary care practices.

This integration could benefit from the experience of several pilots that are testing this approach, such as New York City's Primary Care Information Pilot.[94] Furthermore, one of the provisions of the health reform legislation calls for a primary care extension program, which would be the natural choice for ensuring close coordination between AHRQ and CMS in implementing this relatively low-cost policy option.

Take advantage of the REC Program to develop a plan to provide technical assistance to primary care practices to implement the PCMH model. The REC Program is an initiative to provide technical assistance to practices, primarily those delivering primary care, that want to adopt and meaningfully use EHRs. This program will be implemented in at least 70 centers. Among the program's goals, two are particularly relevant for the PCMH model: (1) reach out to primary care providers and disseminate knowledge about the effective strategies to implement meaningful use of certified EHR technology to improve quality and value of health care, and (2) train providers in attaining meaningful use. As noted in the previous sections, gradual attainment of meaningful use of EHRs may allow primary care practices to support several principles of the

PCMH model, and tailoring the definition of meaningful use to the PCMH model would enhance the synergy here.

In contrast to the first two suggested policy actions, adding responsibilities to the RECs is not straightforward, for several reasons. First, RECs are funded for only 2 years and do not cover the entire Nation. Second, although RECs could adjust some of their mandated activities, such as assist with practice redesign, workflows, and staffing, their staffs would have to be trained to make such assistance more specific to the PCMH model. Third, funding would have to increase, as the workload of the centers' advisors would expand to cover the additional PCMH assistance. Finally, several experts, including W. Hersh, commented at the technical expert panel meeting on January 15, 2010, that the additional responsibilities are not even feasible, given the numerous responsibilities currently required of the centers. As a result, to fully move the country to a PCMH-based primary care foundation may take more than adding responsibilities to the RECs and could require an extension of the program in the future.

To make the proposed policy action happen, AHRQ and other stakeholders, such as the physician societies and the Patient-Centered Primary Care Collaborative, would need to work closely with ONC to identify resources for what implementing the PCMH model entails. In addition, they would need to come up with financial resources to pay for the additional work that the RECs, as well as the HIT Resource Center that supports them, would have to do. Furthermore, the U.S. Department of Health and Human Services would have to decide whether ONC or another agency would monitor the added program. In addition to the resource issues, buy-in from primary care providers on the combination of goals is critical for putting this proposition into practice.

In Closing

HITECH, the health reform legislation, and other pre-HITECH legislation are highly relevant to PCMH, as well as extensively intertwined. This unique alignment of policies raises hopes that there can be positive synergies in the immediate future—necessary *and* sufficient—to build a solid basis for the PCMH in the Nation. But as noted, health IT is just one potential enabler of the PCMH model. Other major policy changes, such as delivery-system and provider-payment reform are needed to support the transformation of practices into medical homes by aligning the right incentives with the delivery systems that can ensure better quality of care and lower costs. Likewise, major changes among practice staff, ranging from culture to service-delivery models, are also needed to achieve the goals of the PCMH model.

References

1. Fiscella K, Geiger HJ. Health information technology and quality improvement for community health centers. Health Aff (Millwood) 2006;25(2):405-12.
2. Rittenhouse DR, Shortell SM, Fisher E. Primary care and accountable care—two essential elements of delivery-system reform. N Engl J Med 2009;361(24):2301-3.
3. Starfield B, Shi L, Macinko J. Contributions of primary care to health systems and health. Milbank Q 2005;83(3):457-502.
4. Baicker K, Chandra A. Medicare spending, the physician workforce, and beneficiaries' quality of care. Health Aff (Millwood) 2004;Suppl Web Exclusives:W184-97.
5. Fisher ES, Wennberg DE, Stukel TA, et al. The implications of regional variations in Medicare spending. Part 1: the content, quality, and accessibility of care. Ann Intern Med 2003;138(4):273-87.
6. Kravet SJ, Shore AD, Miller R, et al. Health care utilization and the proportion of primary care physicians. Am J Med 2008;121(2):142-8.
7. Starfield B, Shi L. Policy relevant determinants of health: an international perspective. Health Policy 2002;60(3):201-18.
8. Fisher ES, Wennberg DE, Stukel TA, et al. The implications of regional variations in Medicare spending. Part 2: health outcomes and satisfaction with care. Ann Intern Med 2003;138(4):288-98.
9. Hackbarth GM. Reforming the health care delivery system. Statement of Chairman, Medicare Payment Advisory Commission before the Ways and Means Committee, U.S. House of Representatives; April 1, 2009.
10. Bodenheimer T, Berenson RA, Rudolph P. The primary care-specialty income gap: why it matters. Ann Intern Med 2007;146(4):301-6.
11. Colwill JM, Cultice JM, Kruse RL. Will generalist physician supply meet demands of an increasing and aging population? Health Aff (Millwood) 2008;27(3):w232-41.
12. Gold M, Felt-Lisk S. Using physician payment reform to enhance health system performance. Washington, DC: Mathematica Policy Research; Dec 2008. Policy brief.
13. Medicare Payment Advisory Commission. Medical education in the United States: supporting long-term delivery system reforms. In Report to Congress: Improving Incentives in the Medicare Program. Chapter 1. Washington, DC: MedPAC; June 2009.
14. Tu HT, Ginsburg PB. Losing ground: physician income 1995-2003. Tracking report no. 15. Washington, DC: Center for Studying Health System Change; June 2006.
15. American Academy of Family Physicians, American Academy of Pediatrics, American College of Physicians, American Osteopathic Association. Joint principles of a patient centered medical home. Mar 2007. Available at: http://www.aafp.org. Accessed November 12, 2009.
16. Enthoven AC, Crosson FJ, Shortell SM. Redefining health care: medical homes or archipelagos to navigate? Health Aff (Millwood) 2007;26(5):1366-72.
17. Kaye N, Takach M. Building medical homes in state Medicaid and CHIP programs. New York: Commonwealth Fund and National Academy for State Health Policy; June 2009.
18. Medicare Payment Advisory Commission. Section 2A: promoting the use of primary care. In Report to Congress: Reforming the Delivery System. Washington, DC: MedPAC; June 2008.
19. Shih A, Davis K, Schoenbaum SC, et al. Organizing the U.S. health care delivery system. New York: Commonwealth Fund; August 2008.
20. Maxfield M, Peikes D, Shapiro R, et al. Design of the CMS medical home demonstration: draft report. Washington, DC: Mathematica Policy Research; June 19, 2008.
21. Berry E. Large health plans work together on medical home pilots. American Medical News July 2009. Available at: http://www.Ama-assn.org/amednews. Accessed October 29, 2009.
22. Carrier E, Gourevitch MN, Shah NR. Medical homes: challenges in translating theory into practice. Med Care 2009;47(7):714-22.
23. Adams J, Grundy P, Kohn MS, et al. Patient-centered medical home: what, why, and how. Somers, NY: IBM Institute for Business Value; May 2009.
24. Centers for Medicare & Medicaid Services. Medical home demonstration fact sheet. Baltimore, MD: CMS; January 9, 2009.
25. Deloitte Center for Health Solutions. The medical home: disruptive innovation for a new primary care model. Washington, DC: Deloitte Development LLC; 2008.

26. Kaiser Health News. Enthusiasm for medical homes gradually picks up. July 2009. Available at: http://www.kaiserhealthnews.org/Daily-Reports. Accessed July 24, 2009.

27. Patient-Centered Primary Care Collaborative. Patient centered medical home. July 2009. Available at: http://www.pcpcc.net. Accessed October 29, 2009.

28. Qualis Health. The patient centered medical home program and the safety net medical home initiatives. A collaboration of the Commonwealth Fund, Qualis Health, and the MacColl Institute for Healthcare Innovation. July 2009. Available at: http://www.qhmedicalhome.org. Accessed July 31, 2009.

29. Smith M. Disruptive innovation: can health care learn from other countries? A conversation with Clayton M. Christensen. Health Aff (Millwood). 2007;26(3):w288-95.

30. United States Congress. American Recovery and Reinvestment Act of 2009, P.L. 111-5, Feb 17, 2009.

31. O'Malley AS, Peikes D, Ginsburg PB. Qualifying a physician practice as a medical home. In Making medical homes work: moving from concept to practice. Washington, DC: Center for Studying Health System Change and Mathematica Policy Research; December 2008. Policy Perspective. Insights into Health Policy Issues, no. 1.

32. Rittenhouse DR, Casalino LP, Gillies RR, et al. Measuring the medical home infrastructure in large medical groups. Health Aff (Millwood) 2008;27(5):1246-58.

33. Chaudhry BI, Wang J, Wu S, et al. Systematic review: impact of health information technology on quality, efficiency, and costs of medical care. Ann Intern Med 2006;144(10):742-52.

34. Rittenhouse DR, Shortell SM, Fisher E. Primary care and accountable care—two essential elements of delivery-system reform. N Engl J Med 2009;361(24):2301-3.

35. Blumenthal D, Glaser JP. Information technology comes to medicine. N Engl J Med 2007;356(24):2527-34.

36. Congressional Budget Office. Evidence on the costs and benefits of health information technology. Publication no. 2976. Washington, DC: CBO; 2008.

37. Shekelle PM, Morton SC, Keeler EB, et al. Costs and benefits of health information technology. Evidence Report/Technology Assessment 132. Rockville, MD: Agency for Healthcare Research and Quality; 2006. AHRQ Publication No. 06-E006.

38. Diamond CC, Shirky C. Health information technology: a few years of magical thinking. Health Aff (Millwood) 2008;27(5):w383-90.

39. Frisse ME. Health information technology: one step at a time. Health Aff (Millwood) 2009;28(2):w379-84.

40. Patient-Centered Primary Care Collaborative. Meaningful connections: a resource guide for using health IT to support the patient centered medical home. Washington, DC: PCPCC; 2009.

41. DesRoches CM, Jha AK. Health information technology in the United States: on the cusp of change, 2009. Princeton, NJ: Robert Wood Johnson Foundation; 2009.

42. Blumenthal D. Launching HITECH. N Engl J Med 2010;362(5);382-5.

43. Blumenthal D. Health information technology: what is the federal government's role? Commission on a High Performance Health System. Publication no. 907. Washington, DC: Commonwealth Fund; 2006.

44. Weimar C. Going all-digital is easier said than done. Physician Exec 2009;35(2):20-2.

45. Hing E, Burt CW. Office-based medical practices: methods and estimates from the national ambulatory medical care survey. Adv Data 2007;12(383):1-15.

46. Sidorov J. It ain't necessarily so: the electronic health record and the unlikely prospect of reducing health care costs. Health Aff (Millwood) 2006;25(4):1079-85.

47. Mostrous A. Electronic medical records not seen as a cure-all. Washington Post; Oct 25, 2009. Available at: http://www.washingtonpost.com/wp-dyn/content/article/2009/10/24/AR2009102400967.html. Accessed October 29, 2009.

48. Scott T, Rundall TG, Vogt TM, et al. Kaiser Permanente's experience of implementing an electronic medical record: a qualitative study. BMJ 2005;331(7528):1313-6.

49. Wears RL, Berg M. Computer technology and clinical work. Still waiting for Godot. JAMA 2005;293(10):1261-3.

50. Baron RJ, Fabens EL, Schiffman M, et al. Electronic health records: just around the corner? Or over the cliff? Ann Intern Med 2005;143(3):222-6.

51. Miller RH, West CE. The value of electronic health records in community health centers: policy implications. Health Aff (Millwood) 2007;26(1):206-14.

52. Miller RH, Sim I. Physicians' use of electronic medical records: barriers and solutions. Health Aff (Millwood) 2004;23(2):116-26.

53. Ventres W, Kooienga S, Vuckovic N, et al. Physicians, patients, and the electronic health record: an ethnographic analysis. Ann Fam Med 2006;4(2):124-31.

54. Irani JS, Middleton JL, Marfatia R, et al. The use of electronic health records in the exam room and patient satisfaction: a systematic review. J Am Board Fam Med 2009;22(5):553-62.

55. Johnson KB, Serwint JR, Fagan LM, et al. Computer-based documentation: effect on parent and physician satisfaction during a pediatric health maintenance encounter. Arch Pediatr Adolesc Med 2005;159(3):250-4.

56. Earnest MA, Ross SE, Wittevrongel L, et al. Use of a patient-accessible electronic medical record in a practice for congestive heart failure: patient and physician experiences. J Am Med Inform Assoc 2004;11(5):410-17.

57. Miller RH, West CE. The value of electronic health records in community health centers: policy implications. Health Aff (Millwood) 2007;26(1):206-14.

58. Baron RJ. Quality improvement with an electronic health record: achievable, but not automatic. Ann Intern Med 2007;147(8):549-52.

59. Fiscella K, Geiger HJ. Health information technology and quality improvement for community health centers. Health Aff (Millwood) 2006;25(2):405-12.

60. Linder JA, Ma J, Bates D, et al. Electronic health record use and the quality of ambulatory care in the United States. Arch Intern Med 2007;167(13):1400-5.

61. Wachter RM. Expected and unanticipated consequences of the quality and information technology revolutions. JAMA 2006;295(23):2780-3.

62. Miller RH, Sim I. Physicians' use of electronic medical records: barriers and solutions. Health Aff (Millwood) 2004;23(2):116-26.

63. Simborg DW. Promoting electronic health record adoption. Is it the correct focus? J Am Med Inform Assoc 2008;15(2):127-9.

64. Baron RJ. Quality improvement with an electronic health record: achievable, but not automatic. Ann Intern Med 2007;147(8):549-52.

65. Scott T, Rundall TG, Vogt TM, et al. Kaiser Permanente's experience of implementing an electronic medical record: a qualitative study. BMJ 2005;331(7528):1313-6.

66. Baron RJ. Quality improvement with an electronic health record: achievable, but not automatic. Ann Intern Med 2007;147(8):549-52.

67. Miller RH, West CE. The value of electronic health records in community health centers: policy implications. Health Aff (Millwood) 2007;26(1):206-14.

68. Davis K, Doty MM, Shea K, et al. Health information technology and physician perceptions of quality of care and satisfaction. Health Policy 2009;90(2-3):239-46.

69. DesRoches CM, Campbell EG, Rao SR, et al. Electronic health records in ambulatory care—a national survey of physicians. N Engl J Med 2008;359(1):50-60.

70. Christensen MC, Remler D. Information and communications technology in U.S. health care: why is adoption so slow and is slower better? J Health Polit Policy Law 2009;34(6):1011-34.

71. Blumenthal D. Stimulating the adoption of health information technology. N Engl J Med 2009;360(15):1477-9.

72. Steinbrook R. Health care and the American Recovery and Reinvestment Act. N Engl J Med 2009;360(11):1057-60.

73. Fuller S. A statement by the American Health Information Management Association on determining the definition of 'meaningful use' to the National Committee on Vital and Health Statistics, April 2009. Available at: http://www.ahima.org/dc/documents/AHIMAFullStatementonMeaningfulUse4-29-2009-final.pdf. Accessed November 13, 2009.

74. Health Information and Management Systems Society. Definition of meaningful users of certified EHR technology. Apr 2009. Available at: http://www.himss.org/content/files/2009HIMSS_DefUseEHRUsers.pdf. Accessed November 13, 2009.

75. Markle Foundation. Achieving the health IT objectives of the American Recovery and Reinvestment Act: a framework for 'meaningful use' and 'certified or qualified' EHR. Apr 2009. Available at: http://www.markle.org/publications/403-achieving-health-it-objectives-american-recovery-and-reinvestment-act. Accessed October 28, 2010.

76. National Committee for Quality Assurance. Demonstrating 'meaningful use' of electronic health record technology. Washington, DC: NCQA; 2009.

77. Office of the National Coordinator. Health IT Policy Council recommendations to National Coordinator for defining meaningful use. Aug 2009. Available at: http://healthit.hhs.gov/portal/server.pt/gateway/PTARGS_0_10741_888532_0_0_18/FINAL%20MU%20RECOMMENDATIONS%20TABLE.pdf. Accessed October 28, 2009.

78. Kibbe DC. Should doctors reject the government's EHR incentive plan? Feb 2010. Available at: http://www.aafp.org/online/en/home/publications

/journals/fpm/preprint/ehrincentive.html. Accessed February 12, 2010.

79. Redhead CS. The Health Information Technology for Economic and Clinical Health (HITECH) Act. Congressional Research Service Report for Congress 7-5700, 2009.

80. Office of the National Coordinator. HITECH funding opportunities. Dec 2009. Available at: http://healthit.hhs.gov/portal/server.pt?open=512&objID=1310&parentname=CommunityPage&parentid=8&mode=2&in_hi_userid=11113&cached=true. Accessed December 29, 2009.

81. Dobrow Stone RE, Briskin AE, Hinkley G, et al. Carrots and sticks: the stimulus package promotes health information technology. Health Law Advisory Bulletin. Davis Wright Tremaine LLP. Feb 2009. Available at: http://www.dwt.com/LearningCenter/Advisories?find=65361. Accessed October 28, 2009.

82. O'Malley AS, Grossman JM, Cohen GR, et al. Are electronic medical records helpful for care coordination? Experiences of physician practices. J Gen Intern Med 2010;25(3):177-85.

83. Adler-Milstein J, McAfee AP, Bates DW, et al. The state of regional health information organizations: current activities and financing. Health Aff (Millwood) 2009;27(1):w60-9.

84. Office of the National Coordinator. State Health Information Exchange Cooperative Agreement Program. Dec 2009. Available at: http://healthit.hhs.gov/portal/server.pt?open=512&objID=1336&parentname=CommunityPage&parentid=13&mode=2&in_hi_userid=10741&cached=true. Accessed December 29, 2009.

85. Office of the National Coordinator. Beacon Community Program. Dec 2009. Available at: http://healthit.hhs.gov/portal/server.pt?open=512&objID=1422&parentname=CommunityPage&parentid=102&mode=2&in_hi_userid=11113&cached=true. Accessed December 29, 2009.

86. Goodell S, Bodenheimer T, Berry-Miller R. Care management of patients with complex health care needs. Policy brief no. 19. Princeton, NJ: Robert Wood Johnson Foundation; Dec 2009.

87. Office of the National Coordinator. HITECH priority grants program: health information technology extension program. Facts-at-a-glance. Sep 2009. Available at: http://healthit.hhs.gov/portal/server.pt?open=512&objID=1331&parentname=CommunityPage&parentid=47&mode=2&in_hi_userid=11113&cached=true. Accessed December 29, 2009.

88. U.S. Department of Health and Human Services, Office of Inspector General. Medicare and state health programs: fraud and abuse; safe harbors for certain electronic prescribing and electronic health records arrangements under the anti-kickback statute. Final rule. Fed Regist 2006;71(152):45109-37.

89. U.S. Department of Health and Human Services, Centers for Medicare & Medicaid Services. Medicare program: physicians' referrals to health care entities with which they have financial relationship; exceptions for certain electronic prescribing and electronic health records arrangements. Final rule. Fed Regist 2006;71(152):45139-71.

90. Schoen C, Osborn R, Huynh PT, et al. On the front lines of care: primary care doctors' office systems, experiences, and views in seven countries. Health Aff (Millwood) 2006;25(6):w555-71.

91. Centers for Medicare & Medicaid Services. Medicare Care Management Performance (MCMP) Demonstration. Dec 2009. Available at: http://www.cms.hhs.gov/DemoProjectsEvalRpts/MD/itemdetail.asp?filterType=none&filterByDID=99&sortByDID=3&sortOrder=descending&itemID=CMS1204776&intNumPerPage=10. Accessed December 29, 2009.

92. Centers for Medicare & Medicaid Services. Electronic health records demonstration. Dec 2009. Available at: http://www.cms.hhs.gov/DemoProjectsEvalRpts/MD/itemdetail.asp?filterType=none&filterByDID=99&sortByDID=3&sortOrder=descending&itemID=CMS1204776&intNumPerPage=10. Accessed December 29, 2009.

93. Hussey PS, Eibner C, Ridgely MS, et al. Controlling U.S. health care spending—separating promising from unpromising approaches. N Engl J Med 2009;361(22):2109-11.

94. Primary Care Information Project. Jan 2010. Available at: http://www.nyc.gov/html/doh/html/pcip/pcip.shtml. Accessed January 6, 2010.