Evaluation of the Regional Extension Center Program

Final Report

Prepared for:
Office of the National Coordinator for Health Information Technology
200 Independence Avenue, SW
Washington, DC 20201

Contract No.:
HHSPS23320095626WC

Prepared by:
American Institutes for Research
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1 Executive Summary

Electronic health record (EHR) systems have positive effects on many dimensions of care process and outcomes. However, EHR adoption has been slow because of financial, organizational, and technological barriers. The 2009 Health Information Technology for Economic and Clinical Health (HITECH) Act was designed to help health care providers overcome barriers, adopt EHRs, and meaningfully use EHRs (that is, use EHRs to improve care).

The HITECH Act was designed to help health care providers adopt EHRs and achieve meaningful use through technical assistance and financial incentives. The Office of the National Coordinator for Health Information Technology (ONC) established the Regional Extension Center (REC) program, which set goals to support 100,000 providers with priority on providers working in:

- small primary care practices,
- practices with a large proportion of patients with Medicaid or without insurance,
- community health centers,
- rural health clinics, and
- critical access hospitals.

ONC awarded 62 cooperative agreements to 60 local organizations to provide technical assistance to providers in areas such as EHR implementation and project management, training, vendor selection and financial consultation, workflow redesign, and privacy and security. In addition, the Medicare and Medicaid Electronic Health Record Incentive Programs (EHR Incentive Programs) offered financial incentives to eligible professionals for achieving meaningful use of certified EHR systems.

In 2010 ONC contracted with the American Institutes for Research (AIR) to conduct a mixed method evaluation of the REC program's implementation and impact. Although all the local RECs shared the common goal of helping providers adopt EHRs and achieve meaningful use, local RECs operationalized their programs in different ways. To evaluate the REC program as a whole, it was necessary to characterize and explain this variation in implementation. Further, RECs exceeded program targets, but the extent to which RECs helped providers adopt and use EHRs above and beyond existing trends was unclear. Therefore, we sought to estimate REC program impact by comparing outcomes for REC participants to nonparticipants.

The following is an overview of methods and findings about REC implementation and impact, by research question. Detailed results may be found in the specified section number.

REC Program Implementation

The implementation study included data collected through interviews and focus groups with REC representatives, an electronic survey of RECs, and surveys of Health Information Technology Research Center (HITRC) online portal users.

How did RECs structure and organize their programs? (Section 4.1)

- RECs with other health care transformation grants structured their programs to create synergy among the grants they administered. The initiative that most commonly overlapped with other programs was the Quality Improvement Organization (QIO) Program. RECs aligned program operations to increase the chances of program success and communicated the benefits of integration to providers.
- RECs in areas with a well-established infrastructure for the diffusion of health care transformation initiatives built their program models around large-scale collaborations. Several RECs brought together organizations with existing provider relationships and expertise in supporting providers' health IT goals. In competitive areas, RECs partnered because other organizations were better positioned to recruit and support providers.
- RECs drew on resources available through the HITRC online portal. Many RECs shared resources, contributed to discussion threads or blogs, or added training tools to the HITRC to support fellow RECs.
- REC business models depended on the perception of providers' willingness or ability to pay. Most RECs thought that eligible professionals would be unwilling or unable to pay and thus provided services free of charge. Some RECs charged a fee because it demonstrated providers' commitment to reach their health IT goals.
- REC program models can be characterized as consultant, convener, or constituency based. In the common consultant model, RECs were businesses designed to provide much-needed services to providers. In a convener model, RECs engaged local organizations and stakeholders to meet providers' health IT needs. Conveners spent time building and maintaining relationships with local organizations, rather than working directly with providers. RECs that created a constituency model viewed the REC program as an opportunity to help their preexisting client base. The REC was an extension of a set of services the organization already provided to its constituency.

What contextual conditions influenced the implementation and operation of the REC programs? (Section 4.2)

- RECs operating in rural areas structured their programs to maximize the impact of limited human and financial capital. Field staff became knowledgeable about EHRs that could be used effectively, given limited infrastructure in rural areas. RECs hired insiders who lived in the communities where they provided technical assistance and who had community connections.
- Some Medicaid EHR Incentive Program time lines, delays, and administrative challenges prompted some RECs to devise specialized strategies for Medicaid-eligible professionals. Some RECs convinced Medicaid-eligible professionals to begin the process in anticipation of program availability. RECs also partnered with Medicaid by creating a structured process for receiving timely information about the status and requirements of the Medicaid EHR Incentive Program so REC staff could communicate new information to providers in real time.
- RECs in areas with high health system penetration adjusted their goals after award because these RECs had a small pool of eligible professionals to recruit from.

- RECs in areas where state and local financial incentives were available leveraged these programs when recruiting providers.

How did RECs identify and recruit eligible professionals? (Section 4.3)

- RECs tapped their existing client base and contacted new providers via mail, fax, telephone, and through conferences to reach providers. REC staff often emphasized improvements in care quality or the monetary gains from the EHR Incentive Programs.

What services did RECs provide to eligible professionals? How did they provide these services? (Section 4.4)

- RECs provided a full array of services, including help with: meaningful use preparation and attestation, privacy and security-related, needs assessment, workflow redesign, EHR product selection, liaison with vendor, software, and hardware recommendations.
- Technical assistance was frequent and tailored to meet provider needs. Technical assistance was offered frequently (e.g., biweekly) for as long as was needed and often face-to-face. Many RECs created provider peer learning groups to share strategies for success. Technical assistance included only services needed or requested by providers.
- Technical assistance staff used "hand holding" or "education." Hand holders showed providers step-by-step what they needed to do to adopt an EHR system and to achieve meaningful use. In contrast, educators gave providers resources to proceed through the steps on their own.

What challenges did RECs face in enrolling providers in the REC program, helping providers adopt EHRs, and helping providers achieve meaningful use? (Section 4.5)

- Subpar EHR technology and unsavory vendor business practices impeded progress toward milestones. These business practices lowered morale and stalled progress. Many vendors were unresponsive to RECs' attempts to build formal relationships. While some RECs and individual technical assistance staff were successful in mitigating the challenges associated with subpar EHR technology and unsavory vendor business practices, no clear best practice emerged to counteract these challenges.
- Working with subcontractors had advantages and disadvantages. Advantages were: reduced competition, ability to tap into existing networks, and ability to provide niche services for certain clients. Disadvantages were: difficulty managing multiple organizations, variable performance among subcontractors, and diminished REC branding. Strategies to manage subcontractor relationships included centralized communication processes, clear expectations, close monitoring, and tools and resources to support technical activities.
- Newly incorporated organizations faced startup challenges. The REC program payment structure forced new REC organizations to develop strategies to fund outreach and recruitment activities. Some RECs engaged in small-scale recruitment efforts early on, scaling up once they received revenue for achieving milestones. Others pursued loans.

- QIOs faced challenges to charging providers fees. Centers for Medicaid & Medicare Services (CMS) rules for QIOs complicated efforts to collect user fees to support REC activities. RECs that were also QIOs did not charge providers for REC services and documented financial and technical assistance relationships with practices extensively to minimize the perception of conflict of interest.

What factors facilitated REC achievement of enrolling providers in the REC program, helping providers to adopt EHRs, and helping providers to achieve meaningful use? (Section 4.6)

- Subcontracting with or employing trusted advisors helped RECs gain access to and credibility with providers. Using insiders was the best strategy for reaching providers and marketing REC services. Key informants also frequently reported using a physician champion.
- Skilled staff who worked well as a team were best able to meet providers' needs. An important driver to REC success was the ability to assemble staff who had a diverse skill set and could work together cohesively. Several RECs hired IT experts, as well as individuals with clinical backgrounds. Strong leadership was also an asset to RECs.
- Designating a meaningful use expert liaison helped RECs communicate to providers accurate and timely information about meaningful use. Meaningful use experts translated and disseminated information about the complex EHR Incentive Programs. RECs also built relationships with state Medicaid offices to have a direct line of communication with the Medicaid EHR Incentive Program.
- Frequent communication with providers kept them on track. Most staff contacted clients at least biweekly to check in on progress, identify next steps, and troubleshoot.
- Strong interpersonal skills helped technical assistance staff build relationship with providers. Staff visited providers, offered emotional support during times of frustration, and acted dependably.
- Peer learning opportunities for providers created economies of scale for RECs and facilitated expert knowledge transfer. Many RECs created both structured and informal opportunities for providers to learn from one another. Peer learning helped reach more providers with fewer resources and spread providers' EHR product-specific knowledge.

To what extent and in what ways did RECs plan to sustain their services after the REC program ended? (Section 4.7)

- Most RECs intended to pursue sustainability; however, they anticipated numerous challenges. The first challenge was generating the revenue needed to support the RECs. RECs that downsized were concerned about having the human capital to sustain services. Several RECs anticipated competition after the REC program ended. Many RECs had little name recognition among providers. Finally, key informants worried that providers would stall at Stage 1 meaningful use.

- Many RECs intended to sustain their programs by offering the same services provided under the REC for a fee. These RECs intended to support existing REC participants through subsequent stages of meaningful use as well as target a wide

variety of new provider-types and settings, including specialists, nurse practitioners, and nursing homes. Another option was to create cooperatives where providers pooled resources to receive the services they needed.

REC Program Impact

While controlling for practice and county characteristics, the impact study analyzed administrative data collected by ONC and new data from a cross-sectional screening questionnaire and survey of primary care physicians.

Was REC participation associated with adoption of EHRs? (Section 5.1)

- REC participation was positively associated with EHR adoption among primary care physicians working in small practices or practices with a large underserved patient base. Further, RECs appeared to serve a wide range of early and late EHR adopters.

Was REC participation associated with receiving incentives through the Medicare and Medicaid EHR Incentive Programs? (Section 5.2)

- REC participation was positively associated with receiving incentives. Whereas 68 percent of REC participants received incentives for achieving Stage 1 meaningful use, only 12 percent of nonparticipants did. The current rate of receiving incentives among REC participants compared with nonparticipants is notable given some EHR systems' limited capacity to achieve meaningful use as of only 3 years ago.

Was REC participation associated with experiencing difficulty in adoption of EHRs? (Section 5.3)

- A similar proportion of REC participants and nonparticipants experienced difficulties in adopting EHRs. Many survey respondents reported challenges with workflow and staff trainings. Because of data limitations, it was unclear whether the REC program helped to decrease adoption barriers.

Was REC participation associated with use of EHR-focused assistance? (Section 5.4)

- When comparing REC participants to nonparticipants, survey data showed that fewer REC participants got help from their local hospital or health system or a payer. RECs filled a technical assistance gap for some physicians who were unable or ineligible to receive assistance from payers or health systems in their local markets.

Was REC participation associated with routine use of EHRs' meaningful use features? (Section 5.5)

- According to survey data, significantly more REC participants used six EHR features routinely compared with nonparticipants. Five out of the six features were core objectives for Stage 1 meaningful use, and one was a menu objective.

Was REC participation associated with being part of a care transformation program? (Section 5.6)

- Among three programs (i.e., pay-for-performance programs, Patient-Centered Medical Home, and accountable care organizations), REC participation was

positively associated with only pay-for-performance programs. However, it is unclear whether physicians took part in care transformation programs before REC program enrollment.

Was REC participation associated with positive opinions about EHRs? (Section 5.7)

- Similar proportions of REC participants and nonparticipants agreed or strongly agreed with the survey statements that EHRs provided financial benefits and that practices function more efficiently with EHRs. In contrast, significantly more nonparticipants than REC participants agreed or strongly agreed that EHRs helped practices deliver better patient care. Physicians who adopted EHRs on their own might have valued their EHRs more than REC participants who felt compelled to adopt them. The REC program likely helped many physicians who were more skeptical about EHRs and added these physicians to the pool of physicians with EHRs.

An important consideration for interpreting impact study results is who enrolled and who did not enroll in the REC program. For example, nonparticipants may (a) already have adopted EHRs and therefore not needed REC help or (b) have been fundamentally uninterested in health IT and, therefore, unwilling to participate in the REC program at all. We used propensity score matching methods and observable characteristics to identify the best possible nonparticipant comparison group against which to compare the outcomes of REC participants. However, we did not ask in the survey and were unable to determine using other data sources why nonparticipants chose not to enroll in the REC program.

Availability of technical assistance and federal meaningful use incentives were key motivators in helping primary care providers adopt EHRs and achieve meaningful use. Modeling the REC program on the diffusion of innovation extension center model was fitting as this model allowed RECs the flexibility to address local challenges.

2 Introduction

The 2009 Health Information Technology for Economic and Clinical Health (HITECH) Act was designed to help health care providers adopt and meaningfully use electronic health record systems (EHRs), which have positive effects on care processes and outcomes (Exhibit 1).[1-9]

Exhibit 1. Examples of Reported Benefits of EHRs

Quality of Care
- Increased adherence to clinical guidelines and protocols
- Increased rates of screening (e.g., breast cancer, chlamydia) and vaccinations
- Reduced prescribing errors

Efficiency of Care
- Timely receipt of medications
- Reduced staffing levels
- Enhanced capacity to perform surveillance and monitoring

Outcomes of Care
- Increased medication adherence
- Increased patient satisfaction
- Improved health outcomes (e.g., blood pressure control, asthma control)

Sources: [2, 10-16]

Historically, adoption has been low, despite the benefits of EHRs. Fewer than 4 percent of office-based physicians in 2007 had fully functional EHRs that could send prescriptions to the pharmacy or order lab or radiology tests, for example; that rate rose to only 24 percent by 2012.[7] Numerous financial, organizational, and technological factors act as barriers to adopting and meaningfully using EHRs (Exhibit 2).

Exhibit 2. Typical Challenges to EHR Adoption, Implementation, or Modification

Financial
- Lack of capital or financial resources and uncertainty about the return on investment
- Costs of hardware, software, Internet access, technical support
- Productivity losses during implementation

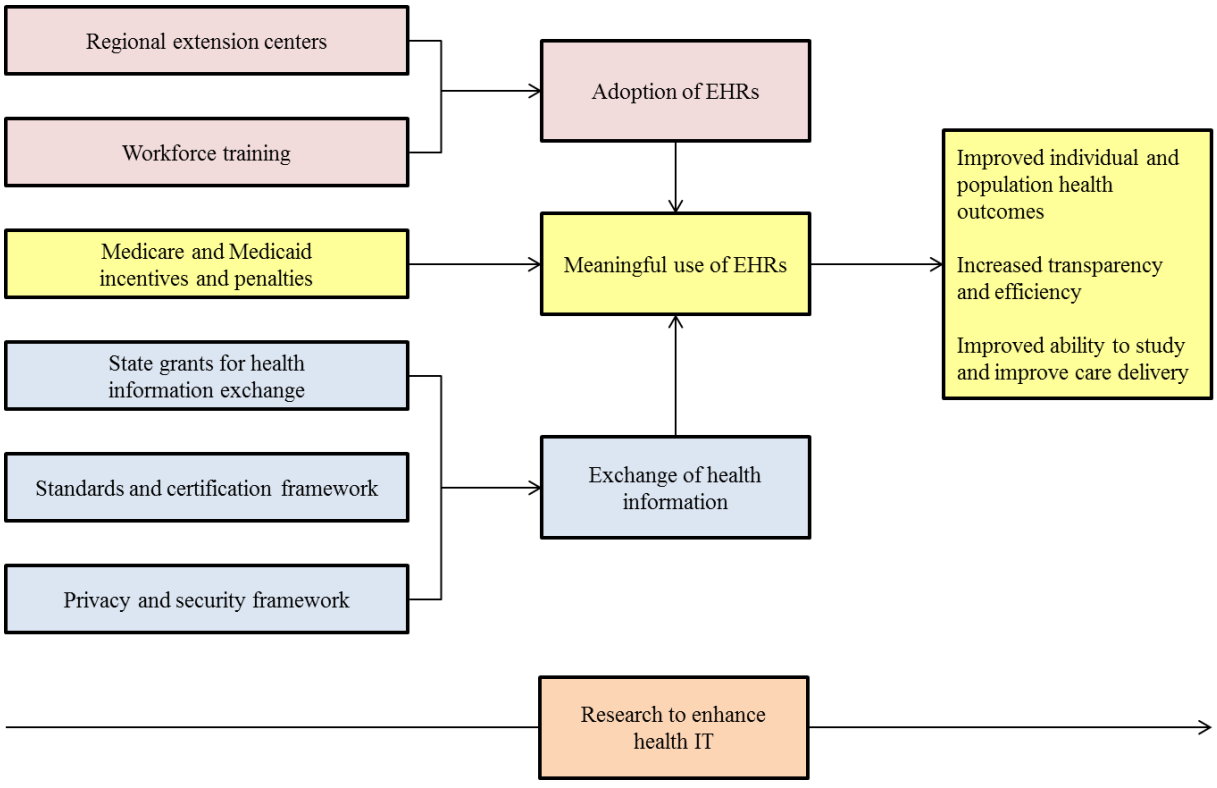
Organizational
- Culture of resistance
- Insufficient human capital with information technology skills
- Integrating EHR technology into complex clinical workflows

Technological
- Limited information technology infrastructure and evolving EHR technology

Sources: [5, 9, 11, 14, 16-20]

To help providers overcome barriers and adopt EHRs, the HITECH Act supported several initiatives (Exhibit 3). The Regional Extension Center (REC) program provided technical assistance, and the Medicare and Medicaid Electronic Health Record Incentive Programs (EHR Incentive Programs) offered financial incentives. HITECH supported the State Health Information Exchange (HIE) Cooperative Agreement Program, which helped states build capacity to exchange information. The 56 funded HIEs build on existing efforts to advance regional- and state-level health information exchange, with the goal of moving toward nationwide interoperability. The Health IT Workforce Development Program addressed a shortage of health IT professionals through education, curriculum development, funds for community college programs, and competency examinations. The 17 Beacon Community Program supported communities with combined health and IT goals to improve health and care. The program funds communities that have demonstrated the ability to integrate EHR adoption, meaningful use, and HIE to achieve the triple aims of better health, better care, and lower cost.[21]

Exhibit 3. The HITECH Act's Framework for Meaningful Use of Electronic Health Records



Source: [1]

2.1 The Regional Extension Center program

The Office of the National Coordinator for Health Information Technology (ONC) established the REC program to provide technical "assistance and information on best practices to accelerate efforts to adopt and optimize the use of EHR technology to improve the quality and value of the health care delivery system."[22]

2.1.1 Model

ONC modeled the REC program after a successful, centralized diffusion of innovation (DOI) and technology transfer model originally authorized by Congress and implemented by the U.S. Department of Agriculture more than a century ago.[23] DOI models combine a central administration and coordination function with decentralized expertise and engagement. In practice, RECs bring expertise and innovations to areas and constituencies that otherwise would not have access to them. The DOI approach was successful not only in agriculture but, most recently, in health care innovations in Massachusetts and New York City, for example.[24, 25] ONC applied this model to the REC program to encourage consistency of results across different geographic areas and to permit RECs to respond to local needs and to innovate accordingly.

2.1.2 Funding

ONC awarded 62 cooperative agreements to 60 local organizations to establish and operate RECs over three rounds of Funding Opportunity Announcements. ONC also awarded supplemental funding to select RECs to work with critical access and rural hospitals (Exhibit 4). This competitive process involved knowledgeable reviewers, who selected the most capable and committed organizations.[26] The period of performance for each cooperative agreement was 4 years, with options for no-cost extensions.

Each REC grantee received between $500,000 and $750,000 annually for the first 2 years. The remaining funds for direct technical assistance were based on the number of providers who reached milestones, for a maximum of $5,000 per provider. The milestones were REC program enrollment, EHR adoption, and Stage 1 meaningful use achievement. In total, more than $700 million was invested in the REC program.[22, 27]

Exhibit 4. Rounds of Funding for the REC Program

Round 1

- February 2010, 32 awards totaling $375 million

Round 2

- April 2010, 28 awards totaling $267 million

Round 3

- September 2010, two awards and two service area expansions totaling $14 million

Supplemental funding for critical access hospitals and rural hospitals

- March 2010 and December 2010, $32 million dollars

Source: [22]

2.1.3 Intersection with the Medicare and Medicaid Electronic Health Record Incentive Programs

In concert with the REC program, the Centers for Medicare & Medicaid Services administered the EHR Incentive Programs. Eligible professionals chose the Medicare EHR Incentive Program or the Medicaid EHR Incentive Program. Under the Medicare EHR Incentive Program, individual physicians received up to $44,000 over 5 years for achieving Stage 1 meaningful use. Under the Medicaid EHR Incentive Program, eligible professionals (i.e., physicians, nurse practitioners, physician assistants, certified nurse

midwives, and dentists) received up to $63,750 over 6 years for adopting, implementing, or upgrading EHRs and achieving Stage 1 meaningful use.

Meaningful use is defined as use of EHRs to "achieve significant improvements in care."[28] Stage 1 meaningful use involves capturing and sharing data. Stage 2 meaningful use and Stage 3 meaningful use focus on advanced clinical processes and improved outcomes, respectively. In 2012, Stage 1 meaningful use required that eligible professionals meet 15 core objectives and five out of 10 menu objectives (Exhibit 5). In addition, all eligible professionals had to report on three core clinical quality measures and three out of 38 menu clinical quality measures (Appendix A). Meaningful use requirements changed over time; for example, providers must now meet thirteen of fifteen core objectives.

Exhibit 5. Core and Menu Objectives for Stage 1 Meaningful Use, 2012

Core objectives

1. Computerized provider order entry (CPOE)
2. Drug-drug and drug-allergy checks
3. Maintain an up-to-date problem list of current and active diagnoses
4. E-Prescribing (eRx)
5. Maintain active medication list
6. Maintain active medication allergy list
7. Record demographics
8. Record and chart changes in vital signs
9. Record smoking status for patients 13 years or older
10. Report ambulatory clinical quality measures to states (a)
11. Implement clinical decision support
12. Provide patients with an electronic copy of their health information, upon request (a)
13. Provide clinical summaries for patients for each office visit
14. Capability to exchange key clinical information
15. Protect electronic health information

Menu objectives

1. Submit electronic data to immunization registries
2. Submit electronic syndromic surveillance data to public health agencies
3. Drug formulary checks
4. Incorporate clinical lab-test results
5. Generate lists of patients by specific conditions
6. Send reminders to patients for preventive/follow-up care
7. Patient-specific education resources
8. Electronic access to health information for patients (b)
9. Medication reconciliation
10. Summary of care record for transitions of care

NOTE: (a) This objective was removed for all providers in 2014. (b) Patient electronic access was a menu objective in 2012 and was required in 2014.
Sources: [29, 30]

To receive incentives, eligible professionals must use certified EHRs. The ONC Certification Program tested and certified that certain EHRs met standards and certification criteria.[1] These criteria aligned with meaningful use criteria and ensured that EHRs could meet meaningful use core and menu objectives.

2.1.4 Target audience and activities

The REC program was intended to help 100,000 providers. The REC program focused attention on providers in small primary care practices with fewer than 10 clinicians, practices with a large proportion of patients with Medicaid or without insurance, community health centers, rural health clinics, and critical access hospitals.[22] These providers were selected to receive technical assistance because they often had lower rates of EHR adoption than larger organizations and they generally lacked resources to investigate, adopt, and maintain EHRs.[24]

To serve these providers, RECs offered technical assistance in areas such as EHR implementation and project management, health IT education and training, vendor selection and financial consultation, practice and workflow redesign, privacy and security, and partnering with health information exchanges.[26]

2.1.5 Tools to support the REC program

ONC offered four tools to support RECs in outreach and technical assistance activities[22]:

1. The Health Information Technology Research Center (HITRC) online portal provided central access to knowledge resources for REC staff.[31]
2. A Learning Management System trained REC staff on vendor selection, workflow, and project management.
3. The Customer Relationship Management tool tracked clients, their challenges, and milestone achievement at each REC.
4. A National Learning Consortium built Communities of Practice (CoPs) to share strategies for encouraging EHR adoption and health information optimization.

In addition, ONC program officers closely supervised the individual cooperative agreements and provided RECs with support and advice, as needed.

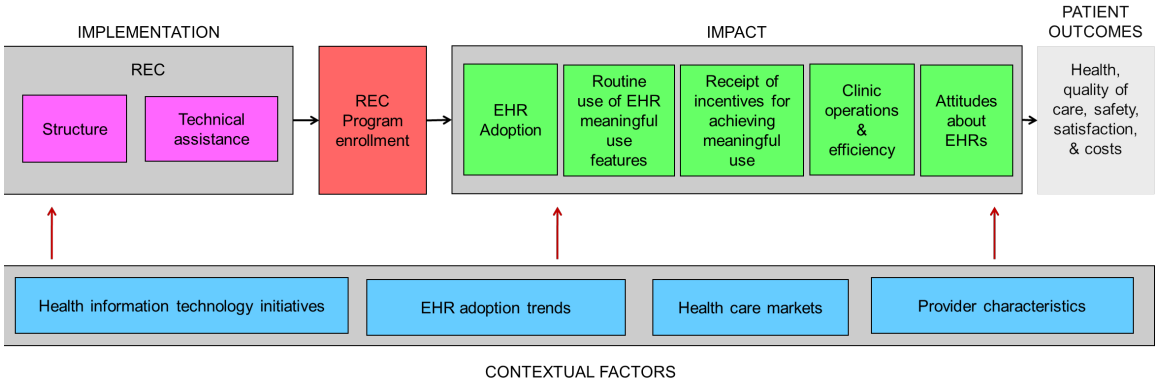
2.2 Regional Extension Center program evaluation

In 2010 ONC contracted with the American Institutes for Research (AIR) to conduct an evaluation of the REC program. To help design the evaluation, AIR developed a conceptual model (Exhibit 6). The model illustrates that the REC program was established and operated within a context of evolving health information technology (health IT) initiatives (i.e., State Health Information Exchange Cooperative Agreement Program, Health IT Workforce Development Program, Beacon Community Program), EHR adoption trends, and health care markets.[6, 7, 32, 33] REC program implementation (i.e., REC program structure and technical assistance) responded to these contextual factors. These contextual factors also influenced who received help from and

[1] The Certified Health IT Product List shows EHRs and EHR Modules that have been tested and certified under the ONC Health IT Certification Program (http://oncchpl.force.com/ehrcert).

enrolled in the REC program. For example, late-adopting providers who had not responded to previous health IT initiatives may have been attracted to the REC program.

Exhibit 6. Conceptual Model



The model links REC program implementation to impact on provider outcomes. The REC program's technical assistance was intended to support EHR adoption, meaningful use of EHRs, and receipt of incentives for achieving meaningful use. The meaningful use of EHRs would affect clinic operations and efficiency. Although meaningful use of EHRs was designed to improve patient outcomes, the exhibit shows "Patient Outcomes" as grey because patient outcomes are outside the scope of this evaluation.

The purpose of the evaluation was to study program implementation and impact on providers. Although all the local RECs shared the common goal of helping providers adopt EHRs and reach meaningful use, local RECs operationalized their programs in different ways. To evaluate the REC program as a whole, it was necessary to characterize and explain this variation in implementation. To study implementation, we addressed the following research questions:

1. How did RECs structure and organize their programs?
2. What contextual conditions influenced the implementation and operation of the REC programs?
3. How did RECs identify and recruit eligible professionals?
4. What services did RECs provide to eligible professionals? How did they provide these services?
5. What challenges did RECs face in enrolling providers in the REC program, helping providers adopt EHRs, and helping providers achieve meaningful use?
6. What factors facilitated REC achievement of enrolling providers in the REC program, helping providers to adopt EHRs, and helping providers to achieve meaningful use?
7. To what extent and in what ways did RECs plan to sustain their services after the REC program ended?

As of December 2014, ONC reported that more than 130,000 REC participants adopted EHRs, and more than 100,000 REC participants achieved meaningful use of their EHRs.[7, 34] Although the REC program thus exceeded its program targets, these figures

do not show the extent to which the REC program helped providers adopt EHRs above and beyond existing trends (i.e., the impact of the REC program). For example, EHR system adoption rates quadrupled between 2001 and 2013.[35, 36] With EHR adoption on the rise over the last decade, REC participants and nonparticipants likely made progress on EHR adoption. Therefore, we sought to estimate the REC program impact by addressing the following research questions.

1. Was REC participation associated with adoption of EHRs?
2. Was REC participation associated with receiving incentives through the Medicare and Medicaid EHR Incentive Programs?
3. Was REC participation associated with experiencing difficulty in adoption of EHRs?
4. Was REC participation associated with use of EHR-focused assistance?
5. Was REC participation associated with routine use of EHRs' meaningful use features?
6. Was REC participation associated with being part of a care transformation program?
7. Was REC participation associated with positive opinions about EHRs?

EHR adoption and receipt of incentives were of greatest interest because the REC program used these outcomes to determine program success. We studied additional outcomes because the REC program's technical assistance may have influenced a broader EHR adoption process—from overcoming difficulties to care transformation. Our approach to estimate impact sought to control for contextual factors that may have also influenced outcomes.

The purpose of this report is to present findings from this evaluation. In the next chapters, we describe our methods for studying implementation and impact. We report on the variation in implementation, as detected through qualitative case studies, and we report on the association between REC participation and key provider outcomes, as studied through quantitative data analyses. Finally, we discuss the implications of findings for policy as providers transition to Stage 2 meaningful use and as the REC program ends.

3 Study Design

We combined qualitative and quantitative research methods to document the implementation of the REC program and measure its impact. The evaluation included four distinct but interrelated components: a typology study, a HITRC User Experience Survey, REC case studies and focus groups, and an REC impact study. Our organization's institutional review board reviewed all procedures and approved the study. This chapter summarizes data collection procedures and analytical methods.

3.1 Typology study

The purpose of the typology study was to gather standardized information on all RECs, to characterize RECs, and to categorize the RECs into distinct "types" across which we could compare program implementation and outcomes.

Data collection and analysis. We developed an electronic survey with 21 items about RECs' organizational characteristics, collaborations, pricing, and services (Appendix B). We worked with ONC to administer the survey to all RECs (100 percent response). We conducted a cluster analyses in the four concepts described above. We found that the RECs clustered into three to four "types" within these concepts and that these clusters aligned well with the case study. Much of the reporting on REC implementation in Chapter 3 reflects these underlying REC clusters.

Limitations. Typology data do not reflect changes over time. There is little variation in some typology variables. This is likely because RECs were accessing the same ONC resources to strengthen their programs.

3.2 Health Information Technology Research Center User Experience Surveys

The HITRC survey's purpose was to provide ONC with an understanding of how well the HITRC products and services met REC needs and to identify areas in which the HITRC products and services could be improved.

Data collection and analysis. There were two HITRC User Experience Survey waves administered online and analyzed descriptively. The first wave assessed early use and perceptions of the portal's resources. After reviewing survey results, ONC improved the HITRC Portal. The second survey wave assessed use and perceptions of the updated portal. Both surveys asked questions about REC respondents' use of and satisfaction with various resource topic areas in the portal (Appendix C).

The survey sampling frame was registered HITRC Web Portal users and REC employees or subcontractors with email addresses and documented REC affiliation. In the first survey wave (December 2011–February 2012), 424 individuals were invited to participate; of these, 190 individuals responded (45%). In the second survey wave (August–September 2012), 648 individuals were invited to participate; of these, 265 individuals (41%) responded, covering 59 RECs.

Limitations. Potential nonresponse bias is a limitation of the HITRC survey data. Survey responders may have been heavy HITRC users, for example. In contrast, nonresponders might have been less frequent HITRC users or held neutral views of its helpfulness.

3.3 REC case studies and focus groups

The purpose of the case studies and focus groups was to gather qualitative data about the RECs' structure and activities, contextual conditions that could explain variation in program implementation and operation, and facilitators and challenges associated with achieving program goals. The case studies and focus groups also assessed RECs' plans for long-term sustainability.

Data collection. We sampled RECs and individual respondents for the case studies in a two-stage process. First, we drew a purposive sample of 18 RECs from the population of 60. RECs were chosen so that those with above average, average, and below average percentages of enrolled providers who had demonstrated meaningful use were represented. Within these three strata, RECs were chosen to represent all regions and to include a diversity of prime organization types. One REC declined to participate in a case study, leaving a final sample of 17. In the second stage of case study sampling, we identified individual REC staff and stakeholders to interview. Within each REC, we interviewed individuals in the following roles: REC leadership, staff and subcontractors; clients of REC services, EHR vendors; and REC partners. A total of 204 interviews including 259 people were conducted across the 17 participating case study RECs.

Interview protocols elicited information about the RECs' structure and activities, contextual conditions that could explain variation in program implementation and operation, facilitators and challenges associated with achieving program goals, and plans for long-term sustainability. We visited 11 RECs in person and conducted interviews with staff and stakeholders at the remaining six RECs by telephone. All interviewees signed a consent form before participating. Interviews varied in length from 30 minutes to 1 hour. Interviews were audio-recorded and transcribed verbatim.

In addition to the 17 case studies, we recruited REC staff to participate in 1-hour focus groups during three ONC regional meetings. A total of 27 individuals participated in the three focus groups, representing 22 RECs not included in the case studies and five RECs that were included in the case studies. All focus group participants signed a consent form before participating. Each focus group lasted for 1 hour and was held in the same hotel as the meeting. Focus group participants received a $5 Starbucks card as a thank you for participating. All focus groups were audio-recorded and transcribed verbatim.

Data analysis. The initial coding scheme for the qualitative analysis was developed based on the Diffusion of Innovation theory (DOI) and literature on technical assistance to primary care practices. As data collection and analysis proceeded, this initial coding scheme was expanded and refined to capture the totality and complexity of the data. Data were coded on the basis of the refined coding scheme, and descriptive and analytic memos were drafted to facilitate the identification of themes. Six analysts worked collaboratively to analyze the data, with checks for consensus and consistency in coding and memos. Themes were identified first within the cases, then across cases based on prevalence of discussion and relevance to research question. Patterns based on the

selection criteria described above were also assessed. The quotes included throughout the paper illustrate key themes identified in these analyses.

Limitations. Neither the 17 case study RECs nor the individual interviewees and focus group participants were selected randomly. In addition, the qualitative data include information from 39 out of the 60 RECs. Thus, it is possible that we were unable to capture the REC programs' full scope and complexity.

3.4 REC impact study

The impact study's purpose was to compare outcomes for REC participants to nonparticipants. We conducted a cross-sectional analysis using ONC administrative data and responses from the screening questionnaire and telephone survey. We focused on primary care physicians because the AMA Physician Masterfile (our sampling frame) excludes nonphysicians, and the REC program prioritized serving primary care providers over specialists.

Sampling frame data. We used National Provider Identifier (NPI) and county to link data from: the American Medical Association (AMA) Physician Masterfile (extracted June 2013), ONC's customer relation management (CRM) system (extracted December 2013), and the Area Health Resources File (2010 and 2011)[22]. We excluded physician assistants, nurse practitioners, nonprimary care physicians, doctors not working in the United States, full-time hospital staff, residents, locum tenens, those who requested not to be contacted, persons without an NPI, and providers who left a practice, retired, or worked in practices that were sold or closed.

Sampling procedures. We matched REC participants to nonparticipants on propensity score using nearest neighbor with replacement procedures [37, 38]. Appendix D provides details about the propensity-score model and how the two groups became more similar on observable characteristics after matching. Then, we randomly sampled matched pairs of physicians, stratified by REC to include providers in all REC catchment areas. The number of pairs selected from a REC catchment area was based on RECs' estimates of the number of primary care providers in the area. We sampled 2,352 REC participants and 2,286 nonparticipants (total n=4,638) to invite to take part in the study.

Data collection. We sent a screening questionnaire to the 4,638 sampled physicians to capture EHR adoption and practice characteristics and then contacted nonrespondents by phone. Ultimately, 2,306 physicians responded to the screening questionnaire between April and September 2014, for a 50 percent response rate (56% among REC participants and 44% among nonparticipants).

Based on information from the screening questionnaire, we identified 1,440 physicians with EHR systems in small practices or in large practices with 30 percent or more patients with Medicaid or without insurance. Only these physicians were invited to the follow-up telephone survey. Telephone survey data were collected from 1,079 physicians between May and October 2014. Appendix E shows both the screening questionnaire and the telephone survey instruments.

Outcome measures. We used screening questionnaire, survey, and administrative data to measure: (1) EHR adoption, (2) receipt of meaningful use incentive, (3) difficulty with EHR adoption, (4) use of EHR-focused assistance, (5) use of EHR meaningful use features, (6) participation in care transformation programs, and (7) opinions about EHRs (Appendix F).

Explanatory measure. REC participation was defined as REC program enrollment. REC participants were physicians in the CRM data who had enrolled. Nonparticipants were physicians in the AMA Physician Masterfile who were not listed in the CRM data as enrollees.

Control measures. For EHR adoption and meaningful use incentive outcomes, control variables were whether the physician was in obstetrics/gynecology (no, yes), whether the physician works in a federally qualified health care center (FQHC) (no, yes), percent of practice's patients with Medicare (continuous), percent of practice's patients with Medicaid (continuous), number of hospitals in the county with 6–49 beds (continuous), 100–199 beds (continuous), and 300 or more beds (continuous).

For all other outcomes, control variables were physician age, whether respondent worked in a private practice, whether respondent worked in an FQHC, percent of practice's patients with Medicare, and percent of practice's patients with Medicaid.

We selected these control variables because REC participants and nonparticipants significantly differed in bivariate analyses on these variables, and we wanted to develop parsimonious outcomes models [39].

Analysis. Based on screening questionnaire data, we further refined the analysis population to include only primary care physicians with EHR status reported and working in small practices or in large practices with 30 percent or more patients with Medicaid or without insurance. Appendix G shows sample sizes at each study step.

To compare REC participants and nonparticipants on individual, practice, and county characteristics, we conducted descriptive analyses and assessed differences between groups using t-tests (Appendix H). To compare REC participants and nonparticipants on outcomes, we conducted logistic regression controlling for measures described previously and clustering by REC. Model quality was assessed with the Pearson-Windmeijer goodness-of-fit test [40, 41]. We calculated predicted probabilities to report results as adjusted proportions of REC participants and nonparticipants achieving each outcome.

We explored whether physician characteristics and other variables moderated the relationship between REC participation and outcomes. We used interaction terms among these variables and the REC participation indicator to assess whether and how these moderators affected results.

Limitations. We cannot account for positive or negative selection of individual physicians into the REC program. Findings may not be generalizable to all primary care physicians. Our study may have experienced response bias (e.g., REC participants with positive or negative experiences were more eager to respond to the survey). Multiple sensitivity analyses addressing these limitations showed results consistent with those reported in Chapter 5. Details may be found in Appendix I.

4 REC Program Implementation

Although RECs shared the common goal of helping providers adopt EHRs and reach meaningful use, RECs operationalized their programs in different ways. This variation in program operationalization reflected the advantage of the diffusion of innovation extension model: RECs had the flexibility to respond to local community needs. To evaluate the efficacy of the REC program as a whole, it is necessary to characterize and explain this variation. Thus, the purpose of this section is to describe the structure and activities of the RECs, to assess the contextual conditions that explained variation in program implementation and operation, and to identify the challenges and facilitators associated with achieving program goals.

4.1 How did RECs structure and organize their programs?

4.1.1 RECs with other health care transformation grants structured their programs to create synergy.

Some RECs were funded by multiple federal programs. The initiative that most commonly overlapped with other programs was the CMS QIO Program.[2] Twenty-three percent (n=14) of RECs were also QIOs. Eighteen percent (n=11) of RECs also held State Health Information Exchange (HIE) Cooperative Agreement Program grants and three RECs held a Beacon grant. One additional REC operated in a Beacon community. Fifty-six percent (n=34) were not funded by any other federal health care transformation program.

RECs with funding for multiple initiatives sought to align the operations of these programs to enhance the chances of success for each program. These RECs also communicated this integration to providers so that they would understand how the programs worked together to achieve health care transformation and how providers could benefit from synergistic support and pooled resources. Services from multiple programs were delivered in an intuitively logical sequence. For example, HIE awardees would enroll a provider in an REC and provide adoption, implementation, and meaningful use assistance, and then connect the provider to the state HIE. QIO or Beacon awardees would provide REC technical assistance and then proceed to the quality improvement programs offered by the QIO or a Beacon collaborative. In some instances, providers received services from multiple programs at the same time.

[2] QIOs are charged by CMS to improve the effectiveness, efficiency, economy, and quality of services delivered to Medicare beneficiaries. QIOs meet this objective by analyzing claims data, investigating complaints about quality of care, and working with clinical organizations to improve the quality of care.

I think that's an excellent model, because I have seen many, many examples where the programs cross over and you don't have to worry about, OK, now who do I have to find in the REC community, because it's a REC issue? Or who do I have to find in the Beacon community? . . . And even if you think about it from a practical relationship, what are we doing here? We're building models for delivery of electronic information around patient care. It has nothing to do [with] whether it's being delivered by a Regional Extension Center, [which] is promoting adoption, or a Beacon, which is creating connectivity, or a state HIE, which is gathering patient information. From the community, from the customer's standpoint . . . it really doesn't matter where it's coming, or it shouldn't matter to us who it's coming from (—REC staff person)

Grantees with funding for multiple initiatives were careful to use and account for their grant funds appropriately—for example, using funds solely for the purpose of administering or operating a specific grant. However, they leveraged the activities of related programs to maximize resources in other ways. For example, several RECs reported having staff that worked on multiple initiatives, conducting meetings with multiple programs' staff to discuss individual progress and collaborative strategies, and making providers aware of all the organizations' program offerings at one time.

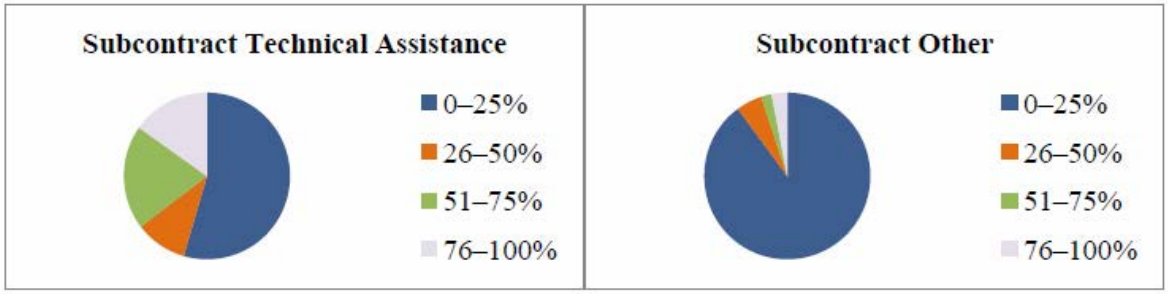
4.1.2 RECs in areas with a well-established infrastructure for the diffusion of health care transformation initiatives built their program models around large-scale collaborations.

Several RECs operated in places where organizations had longstanding relationships with providers and/or specific experience and expertise to support providers' health IT goals effectively. In some cases, such as Chesapeake Regional Information System for Our Patients (CRISP, a MD REC), these local organizations were designated and certified by the state government to perform support activities. In such situations, RECs opted to collaborate with the organizations rather than compete with them.

We decided that we didn't want to compete in the marketplace. We'd rather just utilize the marketplace. (—REC staff person)

Informants from many RECs noted that local competition drove their decisions about partnership. RECs often sought partners and subcontractors because they recognized that other organizations were better positioned to recruit and work with providers. Twenty-seven RECs (46%) reported that more than a quarter of their grant funds went to technical assistance contractors. Six RECs (11%) reported that more than a quarter of their grant funds went to subcontractors performing other activities, such as outreach, education, and grant administration (Exhibit 7).

Exhibit 7. Percentage of Grant Funding Passed Through to Subcontractors



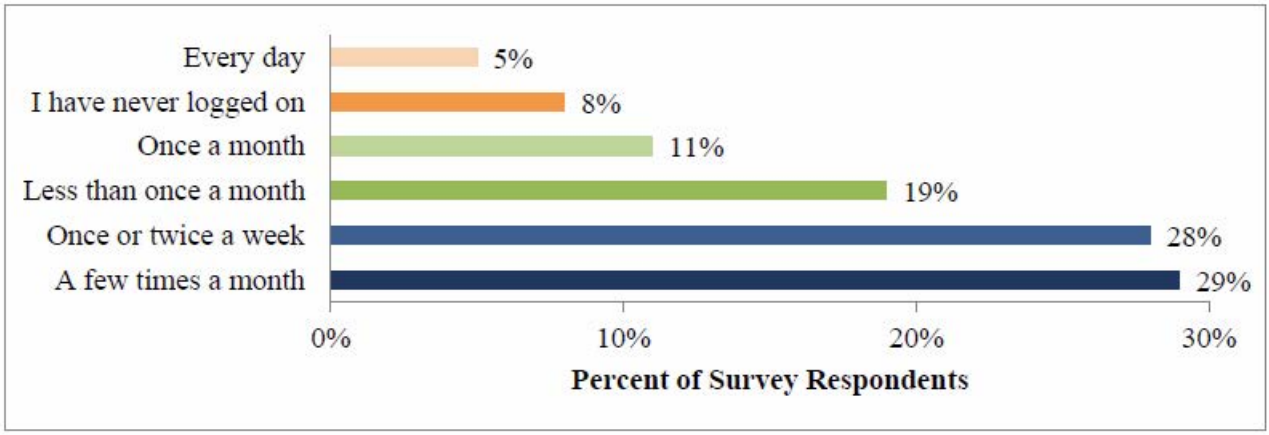
A variety of organizations served as subcontractors; these organizations included private for-profit consulting firms, hospitals and health systems, provider associations, accountable care organizations, billing management companies, colleges and universities, and EHR resellers.[3] Two case study RECs contracted with neighboring RECs. Louisiana Health Information Technology Resource Center, for example, worked with the Arkansas REC, and the Tri-State REC worked with the REC for Kentucky.

The California Health Information Partnership & Services Organization was unique in its subcontracting model, since it contracted with 10 Local Extension Centers across the state, which then contracted with local implementation partners to supply technical assistance for providers.

4.1.3 RECs drew on the resources made available by the HITRC to develop implementation strategies.

Results of the HITRC surveys demonstrated that REC personnel used the HITRC frequently and were satisfied with the support the online community provided. Six in 10 (62%) of those surveyed logged on to the portal more than once a month (Exhibit 8).

Exhibit 8. Frequency of Logging On to the HITRC Portal

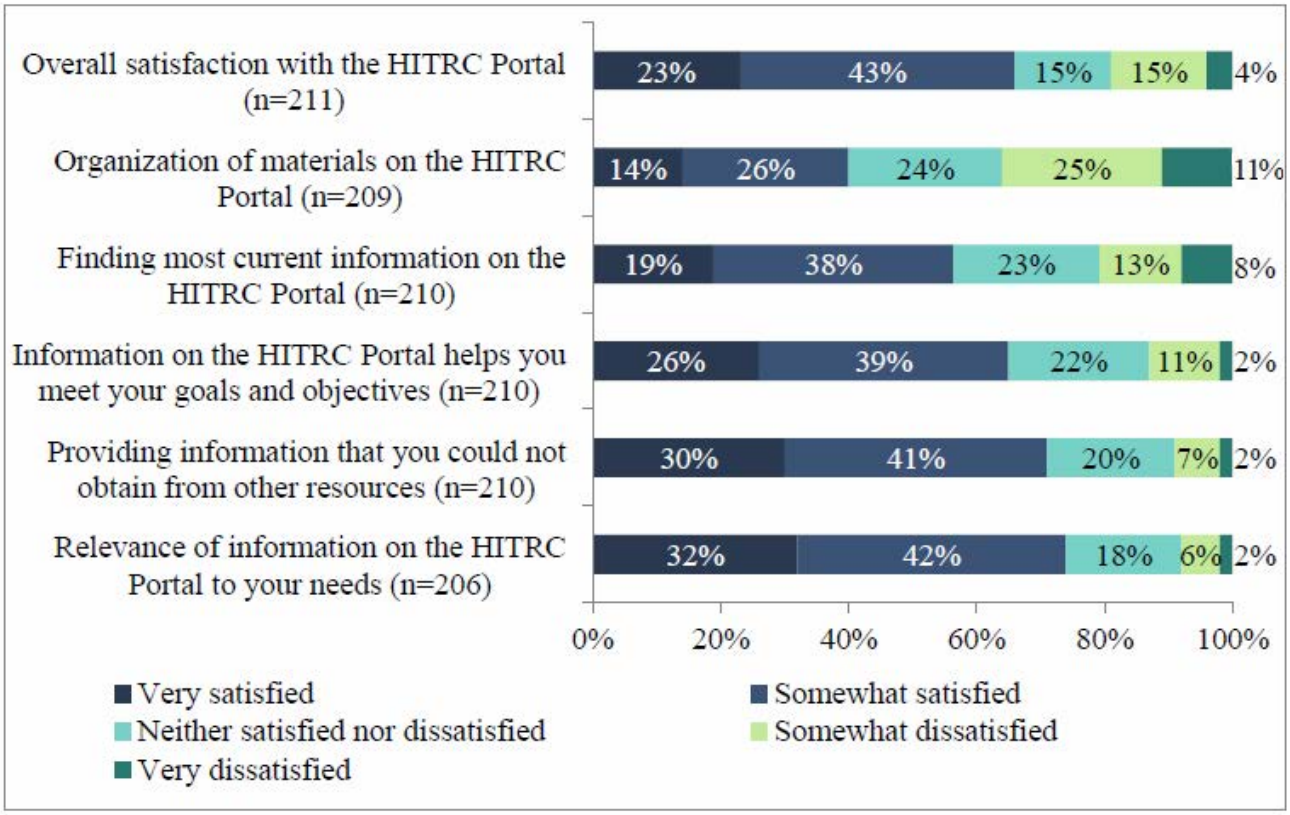


[3] EHR resellers are organizations that are authorized to sell a specific EHR product but are not a part of the vendor organization.

Nearly half (46%) posted materials on the HITRC Portal by sharing content or resources, contributing to a discussion thread or blog, or adding a training tool or comments. The majority of respondents (66%) were generally satisfied with the HITRC Portal and the relevance of information and unique resources it offered (Exhibit 9).

> *I think they have the right amount of online community portals where we can draw from each other's experience, and barriers and issues and resources. . . . I'd give it praise for the organization and kind of the spirit behind it and the people behind it, and I think it's been pretty successful given the scope. (—REC staff person)*

Exhibit 9. Satisfaction With the HITRC

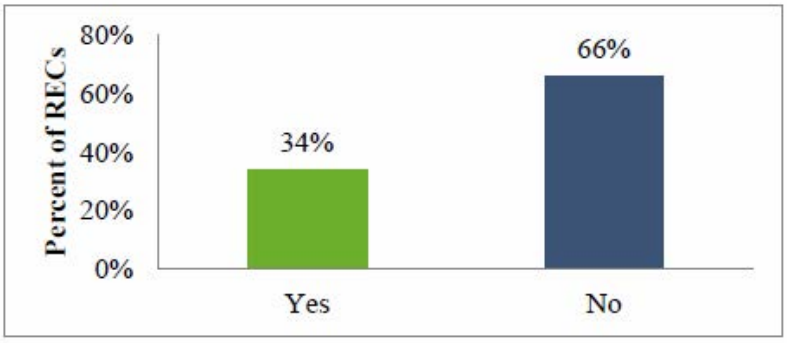


4.1.4 REC business models depended on the perception of providers' willingness or ability to pay.

The REC program required a cost share component: 90 percent federal share and 10 percent client share. Many RECs (66%; n=40) thought that eligible professionals would simply be unwilling or unable to pay for REC services and thus provided services free of charge (Exhibit 10). To meet the requirement of the in-kind match, some of these RECs instructed providers to document the number of hours spent pursuing meaningful use and to tally the dollar figure associated with those hours on the basis of the hourly salary rate of staff (including physicians) engaged in the process. In these cases, the labor time expended by practices on pursuing meaningful use was sufficient to meet the 10 percent client match requirement.

The remaining 34 percent of RECs chose to fulfill the matching requirement by charging providers a fee. These RECs thought that it was important to charge providers even in the face of reluctance to pay because it demonstrated the providers' commitment to the work necessary to reach their health IT goals. The Louisiana Health IT Resource Center, for example, charged practices on the basis of the number of providers in the clinic and whether the practice already had an EHR system. A one-provider practice enrolled with that center would pay $500 if he or she already had an EHR system or $1,250 if he or she was still practicing with paper records. A 10-provider practice enrolled with the Louisiana Health IT Resource Center would pay $1,800 if it already had an EHR system and $3,500 if not. The variation in price was associated with a certain number of hours the Louisiana Health IT Resource Center expected to spend with providers. The payments were distributed over the course of the providers' enrollment in the REC.

Exhibit 10. Percentage of RECs That Charged Primary Care Providers a Fee



Several RECs used different fee strategies over the course of their grant periods. Four of the case study RECs charged providers a fee early on in their programs, but they moved to the in-kind labor hours match after these fees created difficulty in getting providers to enroll.

4.1.5 REC program models can be characterized as consultant, convener, or constituency based.

Key informants characterized their program models in three distinct ways: (1) consultant, (2) convener, or (3) constituency (Exhibit 11). In the consultant model, which was most common among case study participants, RECs described their programs as businesses designed to provide much-needed services to providers. Often, the executive and management team had experience running start-ups; Master of Business Administration credentials; or work history in sales, marketing, or promotions. These RECs focused on providing a high-quality product—technical assistance with the adoption, implementation, and meaningful use of EHRs—in ways that were consistent with for-profit small-business models.

In a convener model, key informants described their REC's role as primarily to engage and dispatch local, state, and federal organizations and stakeholders to meet the health IT needs of the providers in their catchment areas. These RECs' implementation strategies differed from the consulting model's provision of direct assistance. A large part of the RECs' work was spent building, maintaining, and leveraging informal and contractual relationships with local organizations, rather than working directly with providers.

Finally, key informants in RECs that created a constituency model viewed the REC as an opportunity to help their preexisting client base. The REC was an extension of a set of services the organization already provided to its constituency. Constituency models were especially prevalent among longstanding organizations with trusted advisor status in the provider community. Subcontractors also often focused on their constituents; these constituents were typically unique subpopulations, such as rural health centers, FQHCs, and physician groups (e.g., accountable care organizations, independent practice associations).

These three models were not mutually exclusive; however, most case study RECs had one model that was dominant in program structure and operations. Eight case study RECs can be categorized as consultant models. Four case study RECs can be categorized as convener models. Three case study RECs can be categorized as constituency models. The remaining two REC case studies can be categorized as a blend of models.

Exhibit 11. REC Program Models[4]

Model	REC role	Illustrative quotes
Consultant	Offer top-quality technical assistance in a way that makes good business sense.	*"We weren't just technical assistance. I had a legal person. I had a finance person. I had a sales and marketing person. I had an education and outreach person and then I had program managers. So, we treated this thing as a little business."* *"My own bias—more business, like MBAs . . . bringing in that mindset would've probably helped more."*
Convener	Bring all stakeholders to the table and capitalize on the unique expertise and community position of these stakeholders.	*"We always really work towards collaboratives. So when we do something, all stakeholders are at the table planning with us, and that's just the way that we've moved the ball in our state. And so I think we have a real trusted, strong relationship with stakeholders in the state [that] affords us quite a bit of funding through different contracts, and [where] we're seen as a real neutral convener, facilitator; so that's been a strong role for us."* *"Part of what has made our efforts very successful is . . . the model that we have where we believe in bringing all the stakeholders to the table. In applying for the grants, we got stakeholder input; . . . when the grants were awarded, it was a matter of focusing on implementing what the stakeholders had said they wanted to see."*

[4] All quotes in the table are from REC staff persons.

Model	REC role	Illustrative quotes
Constituency	Support its preexisting constituencies (e.g., members, clients) in achieving their care delivery goals.	*"Our agreement with the other partners in the state was that [for] anyone that's a member of one of our IPAs, we will do the REC services."* *"We're not going to charge you anything. Basically, we're going to help fund this as a member services type of arrangement . . . That's going to help me get my providers there and ultimately the most important thing for me is to satisfy my member[s]."*

4.2 What contextual conditions influenced the implementation and operation of the REC programs?

4.2.1 RECs operating in rural areas structured their programs to maximize the impact of limited human and financial capital.

Rural location affected the way RECs structured their programs. First, rural providers were often located in places where the community infrastructure was insufficient to support EHR products. For example, the availability of consistent and high-quality Internet service was limited in rural areas. Second, key informants across several RECs noted that many rural providers were especially skeptical of government programs and mistrustful of community outsiders, as well as nonphysicians. Third, rural providers were geographically hard to reach.

> *The first thing that I did was look at the state and familiarize myself with just exactly how rural we are in the central and the west side. And I determined that the people who needed to focus on those areas lived in those areas. Also, to support them for the IT side of things, we needed people who were familiar with those challenges, such as the idea of remote connectivity and the idea of telehealth. We tried to pair up our strengths and I think we did a really good job of doing that. (—REC staff person)*

RECs located in rural areas structured and organized their provision of technical assistance to accommodate these issues. Field staff became knowledgeable about EHR products that could be used effectively, given infrastructure deficiencies. For example, technical assistance staff helped rural providers identify potential vendors that were local, rather than national, and that understood the needs of rural health care providers. To address the challenge of skepticism and mistrust, RECs hired field staff who were community insiders. These staff had previously worked in area clinics or had personal relationships and community connections. Finally, to address travel challenges, RECs hired field staff who lived in the communities where they were providing technical assistance to rural providers. The field staff could travel to rural providers more frequently, using fewer resources. Together, these strategies helped to align the rural REC programs with the realities of their geographic context.

4.2.2 Some Medicaid EHR Incentive Program time lines, delays, and administrative challenges prompted some RECs to devise specialized strategies for Medicaid-eligible professionals.

The Medicaid EHR Incentive Programs became active in the states at different times over the course of the RECs' grant periods. In several states, RECs were prepared to support Medicaid-eligible professionals well before the Medicaid program opened the provider attestation function. For example, at the time of the first round of the case study site visits (approximately 2 years after the REC funds were awarded), three of the nine state Medicaid EHR Incentive Programs were not yet operational.

> *And then with Medicaid not having started until just this summer, those were big hurdles. All of our sites were basically saying, "We'd love to do it. But if we don't have this incentive, then we have no . . . other motive to do it besides just wanting to do it." (—REC staff person)*

RECs in states where the Medicaid EHR Incentive Program was delayed or experiencing administrative problems had to develop strategies to recruit and enroll providers, even though the financial incentive was not yet available. Some RECs also had to mitigate the skepticism toward the Medicaid EHR Incentive Program that arose from delayed payments. One strategy that RECs used was to convince Medicaid-eligible professionals to begin the process in anticipation of EHR Incentive Program availability. Another strategy was to partner closely with Medicaid to stay abreast of developments so REC staff could communicate new information to providers in real time. RECs built relationships with Medicaid-eligible professionals while the Medicaid EHR Incentive Programs were established. These strategies were especially important for allowing the RECs to reach milestone goals if the REC had a high proportion of clients intending to attest for the Medicaid rather than Medicare EHR Incentive Program.

4.2.3 RECs in areas with high health system penetration adjusted their goals after award.

The REC program targeted physicians in small practices not owned or affiliated with hospitals or health systems. However, the trend in many areas of the country was for hospitals and health systems to acquire ambulatory practices. Estimates of the proportion of physicians who worked in large practices or practices that were affiliated or owned by hospitals or health systems ranged from 10 to 90 percent. In the case of high health system or large practice penetration—which some RECs did not have detailed data on until after submitting their grant proposals—RECs had a small pool of eligible professionals to recruit from.

It was a lot of [effort] to make this thing . . . work. I mean, in [state] are two of the most heavily integrated systems you have in the country and when you move half of your providers under one tax ID number, yet you're required to keep the same goal, it makes it a challenge. So I can't believe how much effort we put into trying to make the numbers still work for us. (—REC staff person)

Some RECs operating in areas dominated by large health systems worked with ONC to make their goals more realistic. Pennsylvania Regional Extension and Assistance Center for Health Information Technology, for example, initially set a target of 8,700 providers (5,700 in the east and 3,000 in the west). After the funding was awarded, this REC determined that 57 percent of the potentially eligible professionals in Pennsylvania were owned by the University of Pittsburgh, West Penn Allegheny, and Geisinger Health Systems. This trend was expected to continue. This drastically reduced the number of providers the REC could work with; so they adjusted their goals to 5,000 providers.

4.2.4 RECs in areas where state and local financial incentives were available leveraged these programs when recruiting providers.

Some RECs benefited from state and local financial support for providers to adopt and achieve meaningful use of EHRs. One state-level financial incentive program sponsored by a payer offered providers in Maryland financial support for EHR adoption. In North Dakota, some providers received low-interest (1%) loans with long repayment periods (10 years) to purchase EHR systems. A local program from LA Care Health Plan offered its contracted providers financial incentives for achieving each of the milestones. These incentive programs and loan funds enabled providers to install EHR systems with little out-of-pocket cash investment or use of commercial loans. RECs in these states leveraged these financial support programs when discussing the benefits of EHR adoption with providers.

4.3 How did RECs identify and recruit eligible professionals?

RECs tapped into their own existing client base to reach providers they had worked with in the past on other initiatives, such as QIO work. In addition, RECs executed an outreach strategy that involved contacting new providers via mail, fax, or telephone. Distributing information about the REC program to providers attending conferences and local medical associations' events was another common method for reaching providers.

When communicating the value proposition of EHRs and meaningful use, REC staff often emphasized improvements in care quality or the monetary gains from the EHR Incentive Programs, as well as avoiding future meaningful use penalties. Less often, REC staff would explain to providers the potential of increased revenue or cost savings from using the EHR (e.g., savings on paper and printers or turning medical record rooms into lab space).

4.4 What services did RECs provide to eligible professionals? How did they provide these services?

4.4.1 RECs provided a full array of services.

Exhibit 12 lists the nine types of services provided by RECs. Except for support in choosing and installing software and hardware solutions, these services were provided by almost all RECs. Only 51 percent of RECs provided assistance with EHR software installation, implementation, or training, and only 46 percent of RECs provided assistance with hardware recommendation, selection, purchasing, or installation. Software and hardware solutions were almost always provided by the EHR vendors, often with the participation of the RECs.

Exhibit 12. Technical Assistance Services Provided by RECs

Type of service	Description and example of services	% RECs offering the service
Meaningful use preparation and attestation	Helping clients move through all steps of the meaningful use process, including registering with CMS, "pulling reports" to assess clients' progress toward meaningful use and readiness to attest, working on specific meaningful use objectives with the client, attesting (e.g., entering the necessary information into the CMS website), and following up on problems (e.g., delays in payment, errors, failure to meet guidelines)	98
Privacy and security-related matters	Advising clients on privacy, and security definitions and requirements (e.g., Health Insurance Portability and Accountability Act [HIPAA] guidelines, protected health information), and on how to develop policies and procedures that accommodate these issues	97
Practice of needs assessment	Conducting baseline evaluations to assess clients' readiness, capability, or baseline status with regard to selecting, implementing, or using EHRs (e.g., what hardware they have, if they currently are using EHRs, and how they currently deliver care)	95
Workflow redesign	Helping clients reorganize their care delivery, office procedures, or general workflow to facilitate EHR use (e.g., how to allocate tasks to specific types of staff to maximize efficiency, suggesting that staff go to the patient rather than have the patient moving through various rooms within the practice)	93
EHR product selection	Helping clients choose vendors for their EHRs (e.g., setting up EHR demos, helping clients find the money to purchase their EHR systems, and providing advice on what to look for in an EHR system)	92
Liaison with vendor	Acting as a liaison between clients and their vendors (e.g., helping clients resolve conflicts and negotiate contracts with their vendors)	92*

Type of service	Description and example of services	% RECs offering the service
Software installation, implementation, or training	Helping to install EHR software or training practice staff to use it	51
Hardware recommendation, selection, purchasing, or installation	Providing advice or services related to clients' hardware needs (e.g., computers, laptops, and Internet service)	46

* RECs could indicate the nature of their advocacy with vendors as formal (38%), informal (49%), on an individual provider case basis (5%), or not at all. Percentage here reflects RECs that replied in the affirmative (formal, informal, or individual provider case basis).

4.4.2 Technical assistance involved frequent communication and was tailored to meet provider needs.

Implementation data do not include quantitative estimates of how much time technical assistance staff spent with clients. However, most key informants reported that technical assistance was offered at frequent intervals (e.g., biweekly) for as long as was needed for a provider to achieve meaningful use. The majority of technical assistance was provided face-to-face in practices. Appointments, emails, and phone calls supplemented face-to-face interactions. In addition to one-on-one technical assistance, many RECs created provider peer learning groups in which providers with the same EHR product or client base (FQHCs, for example) could work together to share effective strategies for success. In these "user groups," providers worked together to identify practical solutions to common problems and to facilitate meaningful use achievement.

RECs tailored their strategies to offer providers services based on their needs. In such instances, technical assistance staff customized their assistance to include only services that providers needed or requested. For example, some providers had an EHR system installed when they enrolled in the REC program. In these situations, assistance with vendor selection was unnecessary. Instead, technical assistance staff could assist with EHR workflow redesign, proper electronic documentation and reporting, and successful attestation to meaningful use.

4.4.3 Technical assistance staff used "hand holding" or "education" approaches to working with providers.

Although most RECs provided high-touch technical assistance, there was some variation in which technical assistance strategies they used when working with providers (Exhibit 13). Some technical assistance staff described themselves as "hand holders." These key informants described typical interactions with providers as showing them step-by-step what they needed to do to move through the milestones. This step-by-step in-person guidance was also often accompanied by emotional support to keep the providers engaged and moving forward when they became frustrated or disillusioned.

Other technical assistance consultants described themselves as educators. These key informants gave providers the necessary resources to proceed through the steps on their own. Examples of these resources included webinars, FAQs, toolkits, decision aids, and worksheets to help providers work through the process. These educators often gave providers assignments to complete between in-person visits.

Exhibit 13. Approach to Technical Assistance[5]

Approach to technical assistance	Description	Illustrative quotes
Hand holding	Step-by-step instruction and demonstration, accompanied by emotional support; in-person visits spent on instruction and demonstration	*"Our philosophy here at this regional extension center is hand holding, boots on the ground."* *"I've had doctors cry on me many times, out of frustration or anger, not because they're angry with me or frustrated with me but with the program. I've had them swear at me, not at me but again at the program. . . . And so we've learned as a team to just allow them to go through it, knowing that it will get better, and we often say to them, you know, what you're going through right now is normal; we see it all the time; it's OK, you're going to go through this for a few weeks but you will get through it."*
Education	Provision of resources and tools to support providers as they proceeded through the process themselves; in-person visits spent going over resources and tools, and checking on the progress	*"So we put together, and I'm happy to send it to you, a really, I think it's an excellent piece; it's a toolkit for physicians on the implementation of electronic health records. So it takes them sort of step-by-step. You can start at the very beginning where, if you, you know, you turn on your computer in the morning but that's kind of all you know about any of this, or you can go to chapter 4, for example, and learn more about what exactly the meaningful use requirements are."* *"We don't have time to hand-hold, and . . . the other thing I had to change in the team was, you don't have time to hand-hold; you have time to explain all the tools, teach them how to use the tools, and then tell them they have to go do it."*

[5] All quotes in the table are from REC staff persons.

4.5 What challenges did RECs face in enrolling providers in the REC program, helping providers adopt EHRs, and helping providers achieve meaningful use?

4.5.1 Subpar EHR technology and unsavory vendor business practices impeded progress toward milestones.

The EHR product market was a key challenge for RECs. A large number of new vendors emerged, hoping to capitalize on the increased demand for EHRs. Bringing certified products to market as quickly as possible was vital to remaining competitive, given the time-limited nature of the EHR Incentive Programs. Key informants believed, however, that vendors struggled to develop problem-free products because of this shortened production cycle.

Interviewees indicated that the usability of many vendor products was poor and that this made it more difficult for providers to achieve meaningful use. For example, interviewees noted that some certified vendor products seemed unable to perform even the most basic functions necessary to achieve meaningful use, such as producing reports. Key informants reported other technological issues, including the inability to interface with immunization registries in the state and general technological glitches that stalled providers' ability to use the software effectively. Providers hoping to use their EHRs to exchange patient data with other collaborating practices or hospitals were especially frustrated by the lack of interoperability among EHRs.

> *The biggest challenge I think is that there's no clear market signal about the value of any one certified EHR. There's kind of this idea that if I get a certified system, I should be able to do meaningful use relatively easily. And that's not necessarily the case. (— REC staff person)*

A second common challenge regarding vendors was unsavory business practices. For example, key informants reported that some vendors had inaccurate advertising, inadequate training, extra fees for add-on services that were essential to product functionality, and long wait times for customer support. Vendor business practices interfered with RECs' ability to support providers in achieving meaningful use because these practices lowered providers' morale, stalled progress (particularly the long wait times for customer support), and in some rare and extreme cases, meant that providers had to replace their EHRs and start over. As more and more providers progressed past EHR implementation and proceeded toward meaningful use, the challenges associated with EHR technology and vendor business practices may have become more pronounced.

When you get the electronic medical record systems, it's . . . as if you got a car in various boxes. So here's your car, but that part's over there. That's the brakes. And if you want the seats, you know, the seats are in that other box. And if you want seatbelts, well they'll be coming in a couple of weeks. In the sense that just endless end user customization is required. (—REC staff person)

Third, many RECs attempted to build formal relationships with vendors and act on behalf of clients, in part as a way of preempting some of the challenges identified above. Brokering relationships with vendors, however, was difficult. According to key informants, many vendors were unresponsive to REC attempts to build these relationships, and several RECs that pursued a group purchasing option for their enrollees noted that it was difficult to convince large vendors to apply. One REC chose preferred vendors but could not get past contract negotiations.

I think it's different with every vendor. We have some vendors who understand, you know, from a marketing perspective how important it is to keep the RECs happy. And if for no other reason, they go above and beyond to do that. And then you have some vendors who I think are so completely overwhelmed at this point that their customer service, whether it be with the REC or their clients, is just awful. So sometimes I think we can really be a useful resource to these practices, to kind of be the go-between when they're having problems with their vendors. But that doesn't even work all the time. (—REC staff person)

Providers seemed indifferent to these group purchasing relationships with vendors. Key informants attributed this lack of enthusiasm to the fact that providers often made decisions based on word-of-mouth referral and that some vendors were providing better pricing in the open market than through the group purchasing options. Vendors noted that, depending on the REC, the value proposition for partnering with the REC was not strong, given the many concessions being requested.

No clear best practice or success story emerged with regard to counteracting the challenges associated with vendor technology and business practices. Successes were few and far between, and often situation specific. From the vendors' perspectives, the best vendor–REC relationships occurred when RECs brokered relationships with a few vendors that had the top market share in a specific locale, developed business arrangements that did not involve unreasonable burden to enter, and trained technical assistance staff in the products that their preferred vendors offered.

Those Regional Extension Centers that have made preferred vendor selections of about five vendors. . . . [That] is the smartest way to go, in my opinion. . . . I think for a Regional Extension Center to be totally vendor agnostic doesn't make sense because as you know there are 700 vendors and 1,300 certified products. It's impossible for anybody to become familiar with all of those products. . . . So I think that for Regional Extension Centers to work with a small group of vendors, predominantly, makes the most sense. And I think the market results have borne that out. . . . What you need to do is say, Here are the ones we are working more closely with based on the tool sets they're providing us to help providers get to meaningful use. (—EHR vendor staff person)

4.5.2 Working with subcontractors had advantages and disadvantages.

Although RECs that used the subcontracting models often excelled in recruiting providers quickly, several challenges were associated with this operational model. The advantages of subcontracting were

1. Reduced competition
2. The ability to tap into existing networks
3. The ability to provide niche services for certain types of clients, such as members of accountable care organizations, critical access hospitals, and FQHCs

The subcontracting model, however, had several disadvantages as well, including

1. The difficulty of managing multiple organizations
2. Variable performance among subcontractors
3. Diminished opportunities for REC branding

Managing the activities of multiple organizations proved to be challenging. Keeping track of subcontractors' progress toward goals and ensuring consistent, high-quality services across all subcontractors were difficult. Without a clear understanding of when subcontractors were faltering, RECs did not know when to provide additional support. In addition, several key informants reported variable performance among subcontractors. This variation, along with difficulty projecting milestone achievement, threatened the success of the REC as a whole, given that the REC was ultimately accountable for its overall performance and milestone achievement.

We're all one team. If we're the leadership, they report up to us. We have our staff meetings together. We're all focused on the same goals; so it's never felt like managing a subrecipient. We're just managing a team to reach our shared goals. . . . Any of our independent consultants or our partners . . . follow the same program and methodology. They come from different organizations, but it's a pretty cohesive . . . team moving the ball forward. (—REC staff person)

Mitigation strategies: Key informants from several RECs reported a few strategies that facilitated the management of large and diverse subcontractor relationships. Strategies included centralized communication processes, clear expectations combined with close monitoring of progress, and tools and resources to support technical activities. These strategies helped to create consistency and high quality across subcontractors. Three of

the case study RECs addressed these challenges by consolidating and terminating several subcontracts. In one instance, this consolidation occurred in tandem with a major reorganization of the REC's strategic planning and operations team.

4.5.3 Newly incorporated organizations faced startup challenges.

Some RECs (14) were newly formed organizations, whereas others had been in business before the REC program. This distinction was important because of the funding structure of the REC program. After the initial administrative startup payment, RECs were paid by ONC only as each provider enrolled with the REC program, adopted an EHR system, and achieved meaningful use. Although this provided a strong incentive for success, this payment structure forced new REC organizations to develop strategies to fund outreach and recruitment activities, despite having little working capital for these activities. Well-established organizations that had been in business before the REC program often had the resources to begin outreach and recruitment activities during the startup period and thus were less affected by the REC program's funding structure.

Mitigation strategies: Some RECs that were newly incorporated organizations engaged in small-scale recruitment efforts early on, scaling up once they began receiving grant revenue for achieving milestones. Others that were not in the position to support these activities with internal funds pursued and received business startup loans through a bank. These funds were then repaid once the REC received funding for milestone achievement.

> *Now, I think for entities that have to stand alone, the cash flow's been a big problem. . . . You can be in big trouble because those core operational budgets are not significant enough. (—REC staff person)*

4.5.4 Quality Improvement Organizations faced challenges to charging providers fees.

In addition to helping health care organizations improve quality of care, QIOs review medical care for inappropriate utilization and investigate complaints from Medicare beneficiaries about providers. Under the QIO contract, receipt of monies from providers presented a perceived potential conflict of interest. Currently, CMS requires QIOs that accept payments from providers to implement mitigation strategies to remove any perceived conflict of interest. These rules complicated efforts to generate and collect user fees as a source of revenue to support REC activities during and after the grant period.

Mitigation strategies: RECs that were also QIOs did not charge providers for REC services and engaged in extensive documentation efforts to minimize the perception of conflict of interest. In addition, some of these QIO-based RECs decided that once their REC grants come to a close, they will no longer be offering technical assistance to providers to support provider adoption, implementation and meaningful use of EHRs because of this challenge.

There's a weakness of having been a QIO and a REC. . . . The whole conflict of interest issue has created horrific—what word should I even use?— it creates quite a lot of problems and a lot of impact on our QIO side because those clients we now have, those providers, are all conflicted so we have to mitigate and it's just a nightmare. (—REC staff person)

4.6 What factors facilitated REC achievement of enrolling providers in the REC program, helping providers to adopt EHRs, and helping providers to achieve meaningful use?

4.6.1 Subcontracting with or employing trusted advisors helped RECs gain access to and credibility with providers.

To gain providers' trust, all key informants agreed that using organizations or individuals who were insiders was the best strategy for reaching providers and marketing REC services. This finding was consistent with theory on DOI.[42] However, key informants thought this approach was especially important in the REC context because some providers were resistant to government regulation of the way they practiced care. Using trusted insiders signaled to providers that the REC was the organization best suited to provide assistance with adopting and meaningfully using EHRs. Both organizations and individuals were seen as trusted advisors. The kinds of organizations that were seen as trusted advisors in the provider community included professional associations, universities, and organizations that had supported providers with quality improvement efforts in the past. Sometimes the trusted organization was the REC; other times it was a subcontractor. Key informants also frequently reported that clinicians who were prominent in the provider community were trusted insiders. Many RECs employed these clinicians to validate the legitimacy and utility of the REC program and to champion REC efforts.

I think the medical society was very helpful because they already had a trusted group of physicians. So if they said something, their membership followed it and agreed and trusted it. So that was a good partnership. (—REC staff person)

4.6.2 Skilled staff who worked well as a team were best able to meet providers' needs.

Many key informants commented that an important driver to their RECs' success was the ability to assemble staff who had a diverse skill set and could work together cohesively. The expanding role of information technology in health care has increased the demand for professionals who are knowledgeable in health care and information technology. The goal of the Workforce Development Program, another HITECH program, was to build a health IT workforce to meet this demand. At the beginning of the REC program, however, few individuals possessed both skill sets. Thus, RECs assembled technical assistance teams of individuals with a wide variety of skill sets. Several RECs hired IT experts as well as individuals with clinical backgrounds. Key informants believed that IT experts were valuable because they were well equipped to help providers make the most educated decisions regarding the selection of EHR technology, head off challenges to health IT implementation, and optimize vendor software.

According to key informants, persons with clinical backgrounds, such as nurses and practice managers, were valuable because they understood the unique challenges associated with installing health IT in a clinical practice and could more easily build rapport and credibility with providers. In particular, respondents noted that a nuanced understanding of clinical workflows and physician culture was a valuable skill that consultants with clinical backgrounds possessed.

> *You have to show up with both resources [IT and clinical practice expertise] at the same time. Otherwise you're kind of wasting their time if you can't answer the question that they have at the time that they have it. (—REC staff person)*

In addition to technical skills, key informants noted that it was helpful to have staff who were flexible and worked well as a team because the scale, pace, and complexity of the REC program could be challenging at times. Finally, strong leadership was as an asset to RECs. Key informants from several RECs praised individuals in strategic planning and operational roles within their RECs. The key leadership traits that these informants believed facilitated REC success were innovative vision, persistence in the face of complex and difficult obstacles, and visibility and respect in the community.

4.6.3 Designating a meaningful use expert liaison helped RECs communicate to providers accurate and timely information about meaningful use.

A wealth of information about the Medicare and Medicaid EHR Incentive Programs was available to the RECs and providers. However, the policies and procedures—particularly with respect to Medicaid—were quite complex and evolving, so condensing, translating, and communicating this information to providers in an accurate, systematic, and timely way became a major challenge for the RECs. Providers' ability to achieve meaningful use depended on their accurate understanding and implementation of the guidelines. Thus, misinterpretation, confusion, and conflicting information stalled providers' progress toward and achievement of meaningful use.

> *The final rule wasn't even out when we were going out to try and educate providers and do our recruitment. We didn't want to be out there and misspeaking; so from the beginning, we had CMS out with us. We started out with the regional medical director and the regional director and we had someone from Medicaid there at every session. . . . We wanted the experts to* [say]*,"This is what AIU [Adopt Implement Upgrade] is. This is how you calculate it." We wanted that. (—REC staff person)*

RECs used two approaches to tackle the challenges associated with the abundance, complexity, and conflicting and evolutionary nature of meaningful use information. The first approach was to designate a meaningful use expert who was responsible for gathering, translating, and disseminating this information. The second approach was to build close working relationships with state Medicaid offices. These relationships allowed a REC to have a direct line of communication for issues related to the Medicaid EHR Incentive Program, which often presented more challenges than the Medicare EHR Incentive Program. For example, definitions for eligible professional differed between the two programs. RECs cherished their roles as the "points of truth" about all things meaningful use. Interviews with providers confirmed that RECs served as a source of

credible and up-to-date information regarding meaningful use, and providers appreciated this feature of RECs.

> *They see us as that neutral party who's current on the regulations, current on what information is out there. (—REC staff person)*

4.6.4 Frequent communication with providers kept them on track.

Key informants noted that it was important to communicate frequently with providers. The strategy of frequent communication came from the REC as a whole, as well as from individual technical assistance staff who were working with providers. For example, RECs would regularly mass-mail all clients to keep them up-to-date on information that they needed to achieve their goals, such as clarification on meaningful use measures or availability of new resources. Communications between individual technical assistance staff and the practices they were supporting was also frequent. Most technical assistance staff interviewed through the case studies reported that they contacted their clients at least biweekly to check in on their progress, identify next steps, and troubleshoot challenges. According to key informants, frequent communication helped to keep the progression toward milestone ever present in the priorities of the providers' practices, to move providers through the process in a systematic and timely way, and to keep providers abreast of information that they needed to achieve their goals.

> *Communicating regularly [was successful]. I like to call it general pressure relentlessly applied with our practices. (—REC staff person)*

4.6.5 Strong interpersonal skills helped technical assistance staff build relationship with providers.

Many technical assistance staff said that it was vitally important to build relationships with the providers they were working with so that providers would trust and follow their guidance. To build relationships, technical assistance staff visited providers face-to-face as often as possible to be sympathetic, patient, and emotionally supportive in times of challenges and frustration. Technical assistance staff also believed that demonstrating dependability, for example by being widely available and keeping all scheduled appointments, also helped to build providers' trust.

4.6.6 Peer learning opportunities for providers created economies of scale for RECs and facilitated expert knowledge transfer.

Many RECs created opportunities for providers to learn from one another. Sometimes opportunities were structured. For example, several RECs created user groups and provided a platform (e.g., workshop or conference call) for participants to meet and discuss challenges and successes related to program milestones. Typically user groups were based on the EHR product the providers were using or their clinical organization type (e.g., critical access hospital, FQHC). Other times, opportunities were more ad hoc and informal, as when technical assistance staff introduced providers to one another so providers could learn more about specific EHR features. Creating peer learning opportunities helped reach more providers with fewer resources. It also facilitated the translation of providers' EHR product-specific knowledge that was difficult for technical

assistance staff to amass because of the large number of EHR products their clients were using.

> *Also we do a bimonthly [vendor] meeting with the clients that we have. We all get together and we just, you know, sit at a round table with no agenda and just shoot problems off of each other and kind of network that way and work out issues. So that's been really helpful to us and our clients. (—REC staff person)*

4.7 To what extent and in what ways did RECs plan to sustain their services after the REC program ended?

4.7.1 Many RECs intended to pursue fee-for-service models targeting a wide variety of providers and settings.

Thirty-six percent (n=22) of RECs secured funding to support REC services beyond the grant period. Of those hoping to sustain their REC status, fee-for-service models targeting specialty providers and subsequent stages of meaningful use were the most commonly reported strategies. Rather than solicit fees from all providers that enrolled in the REC, these plans involved marketing REC services to those better positioned to afford them. Examples included specialists, accountable care organizations, and payers already invested in quality improvement. In the last case, packaging REC-like services with quality improvement was seen as a potentially viable strategy to communicate the value proposition of RECs. Another sustainability option, according to key informants, was to create cooperatives where similar providers pooled resources to receive the services and support they needed to sustain health IT development. A few RECs considered seeking other sources of grant funding. A few RECs had already secured grant funding to pursue continued delivery of REC-like services; typically this was from state Medicaid agencies that contracted with RECs to provide continued support to providers eligible for the Medicaid EHR Incentive Program.

4.7.2 RECs anticipated numerous challenges to sustainability.

All RECs' grant periods will end by January 2016. Key informants anticipated numerous challenges to sustaining their REC programs after the grant periods end. The first challenge will be to generate the revenue needed to support the RECs. The consensus among the key informants and providers interviewed was that most providers would not be willing or able to pay for these services. Recognizing this sentiment, RECs acknowledged that creating a fee-for-service sustainability model would be challenging. RECs that charged providers a fee to participate in the REC program believed that they had an advantage in pursuing this sustainability plan because it would be easier to convince providers to pay for REC services when funding ended if providers were already accustomed to paying for these services. However, even the RECs that charged providers acknowledged that providers expected to receive incentives via the EHR Incentive Programs. Absent incentives, key informants believed the value proposition of the REC dwindles. If the key informants' assessments indicated the sentiment of the general provider population, RECs face challenges in generating the revenue necessary to sustain programs.

Second, as the RECs are winding down their grant programs, they have also downsized and scaled back. Technical assistance staff have left RECs to work for large hospitals, health systems, and vendors. Thus, key informants were concerned that they would not have the human capital necessary for sustaining their technical assistance services.

Third, several RECs, particularly those that contracted with organizations to provide technical assistance to providers, anticipated competition once the REC program ends. Subcontractors were obligated to work for and through the REC during the grant period but could independently offer services to providers once contracts end.

> *I haven't done a count but there's probably, I don't know, 200+ health IT consulting companies in [state], and they're basically our competition. And we're their competition. (—REC staff person)*

Fourth, RECs that had subcontractors conduct most of the outreach, recruitment, and technical assistance with providers have little name recognition among providers. As one key informant noted, "The REC isn't the name that everyone remembers; it's the subcontractor that they remember, and so there's no loyalty there." Building sustainability, then, is an anticipated challenge for RECs with subcontracting models because, once funding ends and the subcontracts expire, these RECs have few ties to the provider community. It seems, then, that subcontracting program models both facilitated and impeded program success and sustainability.

Finally, key informants worried that providers would stall at Stage 1 meaningful use. According to key informants, this was likely to occur in two ways. First, key informants across all sampled RECs indicated that there would be a group of providers who simply would not make it to Milestone 3 during the grant periods (including the no-cost extension period). The most common reasons given were that some organizations simply moved on a slower time line because of continued resistance to EHRs and that other organizations were managing other structural changes that created delays, such as a change in ownership. Without continued pressure and support from the REC, key informants said, these providers would simply be left behind. Second, key informants indicated that many providers were not capable of pursuing Stages 2 and 3 meaningful use on their own, without technical assistance, but would be unwilling or unable to afford paying for this assistance. Many key informants worried that providers would choose not to pursue subsequent stages of meaningful use or would struggle to attest to subsequent stages accurately without subsidized technical assistance to help.

> *My biggest fear is that funding will dry up before additional funding comes out and before Stage 2 is released. And that these providers who really have said that they are committed to this—and we believe them—who can't afford full-time fee-for-service work, they'll just turn their back on the [meaningful use] program. (—REC staff person)*

5 REC Program Impact

With EHR adoption on the rise over the last decade, REC participants and nonparticipants likely made progress on EHR adoption. Therefore, the purpose of the impact study was to estimate the marginal impact of the REC program by determining the difference between REC participants and nonparticipants on several outcomes. EHR adoption and receipt of incentives were of greatest interest because the REC program used these outcomes to determine program success. We studied additional outcomes because the REC program's technical assistance may have influenced a broader EHR process—from overcoming difficulties to care transformation.

An important consideration for interpreting impact study results is who did and did not enroll in the REC program. For example, nonparticipants may (a) already have adopted EHRs and therefore not needed REC help or (b) have been fundamentally uninterested in health IT and, therefore, unwilling to participate in the REC program at all. We used propensity score matching methods to identify the best possible nonparticipant comparison group against which to compare the outcomes of REC participants. However, we were unable to determine why nonparticipants chose not to enroll in the REC program. To study the potential effect of observable and unobservable characteristics, we conducted sensitivity analyses for the EHR adoption and incentive outcomes. Details may be found in Appendix I.

5.1 Was REC participation associated with adoption of EHRs?

Eighty-four percent of screening questionnaire respondents used an EHR system at the time of data collection in 2014. This EHR adoption rate was consistent with national trends.[35] It was also similar to Congressional Budget Office predictions but higher than experts' predictions.[43, 44]

More important, REC participation was positively associated with EHR adoption (Exhibit 14, Appendix J). Eighty-nine percent of REC participants, compared with only 58 percent of nonparticipants, adopted EHRs after 2010 or after enrolling in the REC program after controlling for confounding variables, according to screening questionnaire data.

We also studied physicians who had their EHR systems longer (acquired in 2009 or earlier, Appendix J). Among physicians who had their EHR systems longer, 35% of REC participants acquired their EHRs in 2009 or earlier compared to 21% of nonparticipants.

These findings suggest three conclusions. First, the REC program influenced EHR adoption among primary care physicians working in small practices or practices with a large underserved patient base. Second, RECs served a wide range of early and late EHR adopters. More REC participants than nonparticipants adopted their EHR systems in 2009 or earlier; RECs likely attracted early adopters with older EHRs who needed help with meaningful use. Third, more REC participants than nonparticipants acquired EHRs in 2010 or later. The difference in adoption rates between REC participants and nonparticipants suggested that RECs were especially helpful in accelerating EHR use among late adopters, which was the intent of RECs.

I think the meaningful use, the EHR adoption process, I think would have not moved as quickly as it had, had there not been RECs out there in the space. (—REC staff person)

Exhibit 14. Adoption of EHRs, Among Screening Questionnaire Respondents Working in Small Practices or Large Practices With >30 percent Medicaid or Uninsured Patients

Outcome *	n	REC participants with all or part EHR	Non-participants with all or part EHR	Odds ratio (reference is non-participants)	p-value	95% confidence interval—low	95% confidence interval—high
Physician adopted EHR in 2010 or later, or after signing up with REC	950	89%	58%	6.52	<0.01	4.86	8.74

NOTE. Adjusted figures control for whether respondent was in obstetrics/gynecology, worked in a private practice, worked in an FQHC, percentage of patients with Medicare, percentage of patients with Medicaid, number of hospitals in the county with six to 49 beds, number with 100 to 199 beds, number with 300 or more beds. Source: Screening questionnaire (April to September 2014).
* Outcome is binary (0=no; 1=all or part EHR). The outcome excludes those missing adoption year, those who adopted EHRs in 2009 or earlier, and those who adopted EHRs before enrolling in the REC program.

5.2 Was REC participation associated with receiving incentives through the Medicare and Medicaid EHR Incentive Programs?

On the basis of an analysis of administrative data, 44 percent of primary care physicians in our study received incentives as of May 2014. This rate increased over 2012 rates and suggested that qualifying for incentives occurred sooner than projected by experts in industry, academia, and government.[43, 45]

REC participation was positively associated with receiving incentives. Whereas 68 percent of REC participants received incentives for achieving Stage 1 meaningful use, only 12 percent of nonparticipants did (Exhibit 15). The rate of receiving incentives among REC participants compared with nonparticipants is notable. The odds of receiving incentives among REC participants, compared with nonparticipants, are higher now than in 2012.[46] Also, previous research reported that relatively few physicians had EHRs in 2012 that could achieve meaningful use. Three years ago, only 27 percent of office-based physicians who planned to apply or already had applied for incentives had EHRs that could support 13 of the 15 Stage 1 meaningful use core objectives.[35]

Exhibit 15. Received Incentives, Among Screening Questionnaire Respondents Working in Small Practices or Large Practices With >30 percent Medicaid or Uninsured Patients

Outcome *	n	REC participants achieving outcome	Non-participants achieving outcome	Odds ratio (reference is non-participants)	p-value	95% confidence interval—low	95% confidence interval—high
Received incentive for achieving meaningful use as of May 2014	1,587	68%	12%	18.33	<0.01	12.85	26.14

NOTE. Adjusted figures control for whether respondent was in obstetrics/gynecology, worked in a private practice, worked in an FQHC, percentage of patients with Medicare, percentage of patients with Medicaid, number of hospitals in the county with six to 49 beds, number with 100 to 199 beds, number with 300 or more beds. Source: Administrative data.
* Outcome is binary (0=no; 1=yes).

Further, the obstetrics and gynecology field and percentage of Medicare patients in the practice moderated the association between REC participation and receiving incentives after controlling for other confounding factors. First, REC participation increased the odds of obstetricians and gynecologists' receiving incentives (odds ratio: 12.5, 95% CI: 6.7, 23.1, n=245), but the association was even stronger for all other physicians (odds ratio: 21.6; 95% CI: 14.0, 33.3, n=1342). Second, REC participation increased odds of receiving incentives among practices with less than 25 percent Medicare patients (odds ratio: 12.8, 95% CI: 8.4, 19.6, n=807), but the association was stronger among practices with 25% or more Medicare patients (odds ratio: 31.3; 95% CI: 18.4, 53.3, n=780). No other factors were found to be significant moderators.[6]

Quantitative findings and REC client interview findings were consistent. Clients appreciated REC services, insisted that they could not have reached meaningful use on their own, and found it daunting to tackle future stages of meaningful use without the REC program. Clients shared:

- *It took a lot of pressure off of me with the first stage of meaningful use because that in itself was a lot of pressure.*
- *I can tell you that, had we not had their expertise, then we wouldn't be where we are today in terms of success.*
- *Would we have been as far as we were? I would say absolutely not.*
- *I mean, it would have been impossible for us to do this without the REC.*

[6] We did not detect a significant moderating effect for provider subspecialty (e.g., family practice, internal medicine, pediatrics), age, gender, private practice type, FQHC status, percentage of Medicaid patients in the practice, EHR adoption year, number of small or large hospitals in the region, rural location, number of FQHCs in the region, Beacon community status, or number of rural health clinics in the region.

5.3 Was REC participation associated with experiencing difficulty in adoption of EHRs?

On the basis of survey responses, we found that REC participants and nonparticipants with EHRs experienced barriers to adopting EHRs (Exhibit 16). The most frequently reported barriers for REC participants and nonparticipants with EHRs related to workflow and staffing. Survey respondents experienced barriers to adopting EHRs that were similar to those reported in the literature.[11, 17, 47-49]

We were unable to make conclusions about the effect of RECs on managing difficulties. For example, REC participation was not associated with experiencing difficulties in most areas. The proportion of REC participants and nonparticipants experiencing difficulties may be similar because RECs did not mitigate difficulties. Alternatively, the proportion of REC participants and nonparticipants experiencing difficulties may be similar because RECs mitigated difficulties for REC participants who started with more challenges. Neither interpretation prevails because we do not have baseline data on difficulties from before REC program implementation.

Exhibit 16. Prevalence of Physicians Reporting Difficulty With EHR Adoption Process, by REC Participation

Outcome *	n	REC participants responding somewhat or extremely difficult	Non-participants responding somewhat or extremely difficult	Odds ratio (reference is non-participants)	p-value	95% confidence interval—low	95% confidence interval—high
Assessing hardware requirements	976	31%	26%	1.32	0.09	0.96	1.81
Assessing software requirements	977	27%	21%	1.43	0.03	1.03	2.00
Selecting EHR system	957	33%	29%	1.19	0.32	0.85	1.66
Negotiating a contract with an EHR vendor	922	22%	22%	1.00	0.99	0.69	1.45
Designing or redesigning workflow	987	54%	51%	1.12	0.37	0.88	1.42

Outcome *	n	REC participants responding somewhat or extremely difficult	Non-participants responding somewhat or extremely difficult	Odds ratio (reference is non-participants)	p-value	95% confidence interval—low	95% confidence interval—high
Implement-ing workflow that accom-modated the EHRs	989	53%	50%	1.16	0.19	0.93	1.45
Training staff to use EHRs	993	50%	46%	1.19	0.18	0.92	1.53
Protecting data privacy and security	992	16%	9%	1.82	<0.01	1.26	2.63

NOTE. Adjusted figures control for physician age, whether respondent worked in a private practice, whether respondent worked in an FQHC, percentage of patients with Medicare, percentage of patients with Medicaid, number of hospitals in the county with six to 49 beds, number with 100 to 199 beds, number with 300 or more beds. Each row shows a separate analysis and excludes observations with missing data on outcomes or confounding variables. Source: Survey of physicians with EHRs (May to October 2014).
* Outcomes are binary (0=somewhat or extremely easy, neither difficult nor easy; 1=somewhat or extremely difficult).

We also examined these outcomes stratified by age of EHR system. According to survey data, the relationship between REC participation and experiencing difficulties may have differed for those with older EHR systems (i.e., acquired in 2009 or earlier, or before signing on with an REC) compared to newer EHR systems (i.e., acquired in 2010 or later, or after signing on with an REC). Compared with nonparticipants with older EHRs, significantly more REC participants with older EHRs experienced difficulty with assessing software requirements and protecting data. We also detect nonsignificant trends for assessing hardware, designing or redesigning work flow and training staff (Exhibit 17a). In contrast, for those with newer EHRs, we found that similar proportions of REC participants and nonparticipants experienced barriers (Exhibit 17b).

Exhibit 17. Prevalence of Physicians Reporting Difficulty With EHR Adoption Process, by REC Participation and Time

a. Among Physicians Who Adopted Current EHR Systems in 2009 or Earlier, or Before REC Program Enrollment

Outcome *	n	REC participants responding somewhat or extremely difficult	Non-participants responding somewhat or extremely difficult	Odds ratio (reference is non-participants)	p-value	95% confidence interval—low	95% confidence interval—high
Assessing hardware requirements	500	34%	25%	1.50	0.07	0.97	2.34
Assessing software requirements	503	31%	20%	1.82	0.02	1.12	2.97
Selecting EHR system	494	37%	30%	1.35	0.15	0.90	2.03
Negotiating a contract with an EHR vendor	474	24%	25%	0.94	0.77	0.62	1.42
Designing or redesigning workflow	510	57%	50%	1.35	0.06	0.99	1.85
Implementing workflow that accommodated the EHRs	510	57%	52%	1.21	0.21	0.90	1.62
Training staff to use EHRs	512	51%	43%	1.38	0.07	0.98	1.96
Protecting data privacy and security	511	17%	10%	1.89	0.01	1.14	3.13

NOTE. Adjusted figures control for physician age, whether respondent worked in a private practice, whether respondent worked in an FQHC, percentage of patients with Medicare, percentage of patients with Medicaid, number of hospitals in the county with six to 49 beds, number with 100 to 199 beds, number with 300 or more beds. Each row shows a separate analysis and excludes observations with missing data on outcomes or confounding variables. Source: Survey of physicians with EHRs (May to October 2014).
* Outcomes are binary (0=somewhat or extremely easy, neither difficult nor easy; 1=somewhat or extremely difficult).

b. Among Physicians Who Adopted Current EHR Systems in 2010 or Later, or After REC Program Enrollment

Outcome *	n	REC participants responding somewhat or extremely difficult	Non-participants responding somewhat or extremely difficult	Odds ratio (reference is non-participants)	p-value	95% confidence interval—low	95% confidence interval—high
Assessing hardware requirements	476	29%	25%	1.20	0.42	0.78	1.84
Assessing software requirements	474	24%	23%	1.09	0.72	0.67	1.78
Selecting EHR system	463	30%	29%	1.05	0.85	0.63	1.75
Negotiating a contract with an EHR vendor	448	20%	18%	1.17	0.61	0.65	2.09
Designing or redesigning work flow	477	51%	54%	0.89	0.63	0.55	1.43
Implementing work flow that accommodated the EHRs	479	50%	45%	1.21	0.40	0.78	1.88
Training staff to use EHRs	481	49%	51%	0.91	0.66	0.59	1.40
Protecting data privacy and security	481	16%	10%	1.76	0.10	0.91	3.42

NOTE. All outcomes are binary. Adjusted figures control for physician age, whether respondent worked in a private practice, whether respondent worked in an FQHC, percentage of patients with Medicare, percentage of patients with Medicaid, number of hospitals in the county with six to 49 beds, number with 100 to 199 beds, number with 300 or more beds. Each row shows a separate analysis and excludes observations with missing data on outcomes or confounding variables. Source: Survey of physicians with EHRs (May to October 2014).
* Outcomes are binary (0=somewhat or extremely easy, neither difficult nor easy; 1=somewhat or extremely difficult).

These results may reflect a profile of clients that RECs attracted. The RECs served some clients who adopted their EHRs early. Among early adopters, RECs may have enrolled physicians who struggled with EHR adoption early on and knew they now needed support in achieving meaningful use. Conversely, nonparticipants with older EHRs may have decided not to enroll in the REC program because they did not need the help.

Among later adopters, the REC participants reported difficulties that were typical of nonparticipants. These complex profiles suggested that RECs served a range of clients, not just those who easily adopted EHRs and achieved meaningful use.

5.4 Was REC participation associated with use of EHR-focused assistance?

Among physicians experiencing a range of EHR adoption difficulties, one REC staff member shared, *"So for them to have somebody help them with it has been, you know, I don't think [they] could really have done it by themselves, put it that way. It would be very difficult for them to do it by themselves."*

Indeed, most survey respondents did not try to tackle EHR adoption by themselves. REC participants and nonparticipants got help from a range of sources (Exhibit 18). The most frequently reported source for REC participants and nonparticipants was EHR vendors. The majority of survey respondents who got help from EHR vendors felt that their needs were met (data not shown).

When comparing REC participants to nonparticipants, we found that fewer REC participants got help from their local hospital or health system or a payer. This finding suggests that RECs filled a technical assistance gap for some physicians who were unable or ineligible to receive assistance from payers or health systems in their local markets. Among survey respondents who reported getting no help from their local hospital or health system or a payer, 74 percent were REC participants. One REC client in a small practice stated, *"Being a small practice I think was what made [the REC] the most beneficial to us, because we don't have the resources of some larger organizations to have somebody who can really spend 100 percent of their time focused on something like this. So that was really a time saver and money saver for us."*

Notably, the survey showed that 46 percent of REC participants and 25 percent of nonparticipants reported receiving help from RECs or affiliates.[7] We suggest four possible explanations. First, REC participants and nonparticipants may have misattributed who actually provided services. For example, nonparticipants who received help from a private consultant may have mistakenly believed the consultant worked for the REC program.

Second, REC participants may not have recognized the phrase "Regional Extension Center." The survey asked respondents whether they received help from "a local Regional Extension Center or affiliate?" However, many local RECs went by names that did not include the phrase "Regional Extension Center." For example, one REC was called Health Information Technology Extension Center for Los Angeles County and went by its acronym HITEC-LA. Similarly, subcontractors providing technical assistance often identified themselves through their company name rather than the REC program.

[7] We used REC's client records to determine REC participation.

As a result, participants may not have recognized that the help they received was through a federal program.

Third, nonparticipants may have accessed REC-sponsored resources like workshops, seminars, or materials posted to websites without formally enrolling as clients. As a result, there was a potential spillover effect of REC activities on nonparticipants and an underestimate of the effect of the REC program on outcomes.

Finally, some REC participants may not have received a lot of hands-on assistance from the REC program. Even though they were listed as clients in REC program records, it was possible that some did not receive enough help to report RECs as an assistance source.

Exhibit 18. Prevalence of Type of Physician-Reported Assistance With EHR Implementation, by REC Participation

Physician received help from: *	n	REC participants responding yes	Non-participants responding yes	Odds ratio (reference is non-participants)	p-value	95% confidence interval—low	95% confidence interval—high
EHR vendor	821	85%	89%	0.69	0.16	0.41	1.16
Local REC or affiliate	819	46%	25%	2.61	<0.01	1.94	3.50
Professional association	818	7%	5%	1.42	0.30	0.74	2.75
Local hospital or health system	821	20%	32%	0.53	<0.01	0.39	0.71
Payer/insur-ance company	818	4%	8%	0.51	0.04	0.27	0.96

NOTE. Adjusted figures control for physician age, whether respondent worked in a private practice, whether respondent worked in an FQHC, percentage of patients with Medicare, and percentage of patients with Medicaid. Each row shows a separate analysis and excludes observations with missing data on outcomes or confounding variables. Source: Survey of physicians with EHRs (May to October 2014).
* Outcomes are binary (0=no or uncertain; 1=yes).

5.5 Was REC participation associated with routine use of EHRs' meaningful use features?

According to survey data, REC participants and nonparticipants routinely used many EHR features (Exhibit 19). Routine use of these features rose, compared with previous studies.[50] More than 90 percent of survey respondents used their EHRs to record patient demographic information, problem lists, vital signs, smoking status, clinical notes, and prescriptions.

We found evidence that the REC program supported physician achievement of Stage 1 meaningful use. Significantly more REC participants used six EHR features routinely compared with nonparticipants. Five out of the six features were core objectives for Stage

1 meaningful use, and one (generated patients lists) was a menu objective. RECs played an important role in providing detailed and individualized help to clients regarding EHR features. According to a REC staff person, RECs were *"providing assistance with actually achieving those meaningful use statements, which are actually quite difficult when you start breaking it down. . . . People are confused about what these objectives and measures actually mean and the FAQ for CMS doesn't help."*

Areas with lowest routine use continued to be electronic reporting to immunization registries and exchanging secure messages with patients. Some physicians may have been unable to report to immunization registries because their states were without operational registries.[51] A recent study noted that "the electronic public health reporting infrastructure as a whole may be lagging behind the goals set forth by the incentive programs."[52] Reporting to immunization registries was a menu objective for Stage 1 meaningful use, and some physicians may not have chosen this menu objective.

Routine use of secure message exchange was likely low because this objective was not required for Stage 1 meaningful use or incentives. Further, many patients may opt out of electronic communications with their providers. Although a recent study reported that patient demand for secure messaging was on the rise, 13% of adults in 2014 also reported not using the internet at all.[53, 54] Some subpopulations (e.g., older adults, persons with lower educational attainment, persons with lower literacy) are less likely to communicate electronically with physicians, and some patients simply prefer face-to-face visits or calls with physicians.[55-58]

Exhibit 19. Prevalence of Physicians' Reporting Routine Use of EHR Features, by REC Participation

Physician routinely used the EHR to: *	n	REC participants responding yes	Non-participants responding yes	Odds ratio (reference is non-participants)	p-value	95% confidence interval—low	95% confidence interval—high
Record demographic information	938	97%	96%	1.16	0.67	0.59	2.26
Record a patient problem list	939	99%	97%	4.34	0.01	1.39	13.56
Record and charting vital signs	941	99%	99%	1.78	0.46	0.38	8.25
Record patient smoking status	940	99%	94%	6.90	<0.01	2.20	21.62
Record clinical notes that included active medications	941	100%	99%	2.34	0.27	0.52	10.55

Physician routinely used the EHR to: *	n	REC participants responding yes	Non-participants responding yes	Odds ratio (reference is non-participants)	p-value	95% confidence interval—low	95% confidence interval—high
Record clinical notes that included active medication allergies	941	100%	99%	2.29	0.42	0.31	17.00
Order prescriptions	941	99%	96%	6.89	<0.01	2.45	19.36
Provide reminders for guideline-based interventions or screenings	920	86%	83%	1.26	0.19	0.89	1.78
Report clinical quality measures to federal or state agencies	914	83%	73%	1.91	0.00	1.37	2.66
Generate lists of patients with particular health conditions	923	90%	85%	1.61	0.02	1.06	2.45
Electronic report to immunization registries	927	66%	59%	1.32	0.09	0.96	1.83
Provide patients with clinical summaries for each visit	938	94%	89%	1.82	0.02	1.10	2.99
Exchange secure messages with patients	937	65%	60%	1.21	0.19	0.91	1.62
Provide patients with an electronic copy of their health information	938	80%	80%	0.94	0.70	0.70	1.27

NOTE. Adjusted figures control for physician age, whether respondent worked in a private practice, whether respondent worked in an FQHC, percentage of patients with Medicare, and percentage of patients with Medicaid. Each row shows a separate analysis and excludes observations with missing data on outcomes or confounding variables. Source: Survey of physicians with EHRs (May to October 2014).
* Outcomes are binary (0=no; 1=yes).

Approximately 30 percent of survey respondents took part in care transformation programs, including pay-for-performance programs, Patient-Centered Medical Home, and accountable care organizations.

Among those three programs, REC participation was positively associated with only pay-for-performance programs (Exhibit 20). Technical assistance from RECs to help physicians achieve meaningful use with certified EHRs and to submit data using their EHRs may have helped physicians with qualifying for pay-for-performance programs. However, it is unclear whether physicians took part in this and other care transformation programs prior to enrolling in the REC program.

Similar proportions of REC participants and nonparticipants were in Patient-Centered Medical Homes and accountable care organizations. Because meaningful use is often only one part of care transformation programs, the RECs' technical assistance may not have been sufficient to help meet all rules or to help establish the partnerships needed for these care transformation programs.[59] For example, eligible professionals, hospitals, and suppliers must come together in an accountable care organization to participate in the Medicare Shared Savings Program. Of the 33 quality standards in the Medicare Shared Savings Program, only one is calculated from EHR Incentive Program data.[60]

Exhibit 20. Participation in Care Transformation Programs, Among Physicians Who Adopted EHRs, by REC Participation

Physician participates in: *	n	REC participants responding yes	Non-participants responding yes	Odds ratio (reference is non-participants)	p-value	95% confidence interval—low	95% confidence interval—high
Pay for performance	1,004	38%	29%	1.54	0.01	1.13	2.11
Accountable care organization	1,003	33%	28%	1.24	0.13	0.94	1.62
Patient-Centered Medical Home	950	29%	27%	1.13	0.56	0.75	1.71

NOTE. Adjusted figures control for physician age, whether respondent worked in a private practice, whether respondent worked in an FQHC, percentage of patients with Medicare, and percentage of patients with Medicaid. Each row shows a separate analysis and excludes observations with missing data on outcomes or confounding variables. Source: Survey of physicians with EHRs (May to October 2014).
* Outcomes are binary (0=no or uncertain; 1=yes).

5.6 Was REC participation associated with positive opinions about EHRs?

More than 65 percent of survey respondents reported that EHRs offered financial, efficiency, and patient care benefits, a rate similar to that found by other studies.[61]

Although REC participation was positively associated with EHR adoption and receiving incentives, its effect on perceptions of EHRs' benefits appeared muted according to survey data. One possible explanation was that the effect of REC's technical assistance services extended through receiving incentives, but not to more distal outcomes related to longer-term EHR use.

Similar proportions of REC participants and nonparticipants agreed or strongly agreed with the survey statement that EHRs provided financial benefits (Exhibit 21). Similar proportions of REC participants and nonparticipants reported via the survey that they experienced decreased productivity during EHR implementation, and both groups required approximately 5 months to return to previous productivity levels (data not shown). Further, our case study data indicated that the financial benefits mainly accrued from improved documentation of services, which supported more complete and accurate billing. These findings were consistent with a recent study that reported only 27 percent of practices would achieve a positive return on investment following EHR adoption.[16]

We detected no statistically significant differences between REC participants and nonparticipants on opinions that practices function more efficiently with EHRs (Exhibit 21). Despite mixed evidence from a recent review of efficiency related to EHRs, more than 70 percent of our study's survey respondents held positive opinions about EHRs' effect on practice efficiency.[2] One REC participant shared during an interview the numerous ways, he believed, EHRs increased efficiency, including legible records, complete documentation, searchable lab data, identification of common illness and procedures, and interoffice communications. In contrast, we found that significantly more nonparticipants than REC participants agreed or strongly agreed that EHRs helped practices deliver better patient care (Exhibit 21).

Physicians who adopted EHRs on their own might have valued their EHRs more than REC participants who felt compelled to adopt them. Further, the REC program likely helped many physicians who were more skeptical about EHRs and added these physicians to the pool of physicians with EHRs.

Exhibit 21. Positive Opinions About EHRs, by REC Participation

Outcome *	n	REC participants that agree or strongly agree	Non-participants that agree or strongly agree	Odds ratio (reference is non-participants)	p-value	95% confidence interval—low	95% confidence interval—high
EHRs provide financial benefits	1,006	66%	70%	0.82	0.17	0.63	1.09
Practice functions more efficiently with EHRs	1,006	73%	77%	0.83	0.19	0.63	1.10

Outcome *	n	REC participants that agree or strongly agree	Non-participants that agree or strongly agree	Odds ratio (reference is non-participants)	p-value	95% confidence interval—low	95% confidence interval—high
EHRs help practice deliver better patient care	1,006	74%	80%	0.73	0.04	0.54	0.98

NOTE. All outcomes are binary. Adjusted figures control for physician age, whether respondent worked in a private practice, whether respondent worked in an FQHC, percentage of patients with Medicare, and percentage of patients with Medicaid. Each row shows a separate analysis and excludes observations with missing data on outcomes or confounding variables. Source: Survey of physicians with EHRs (May to October 2014).

* Outcomes are binary (0= strongly disagree, disagree, or neither disagree nor agree; 1= agree or strongly agree).

6 Policy Implications/Considerations of REC Program

While we find that RECs have had an impact across a range of key outcomes related to EHR adoption and that EHR adoption among physicians has grown substantially since the passage of HITECH, more remains to be done to fully achieve adoption of interoperable health IT systems, essential for supporting the delivery of the right care to the right people at the right time, improving population health, and reducing the costs of care. As the REC program funding concludes and as the federal government, states, and other organizations develop new programs and services to support EHR adoption, our evaluation points to several important considerations.

Federal meaningful use incentives and availability of technical assistance to eligible professionals are motivators. Availability of incentive payments to eligible professionals was a significant factor for many participating providers' decisions to adopt EHRs and enroll with RECs to receive technical assistance support with that process. In addition, our evaluation found that achievement of federal incentives for adoption and routine meaningful use of certified EHRs was significantly associated with REC participation. However, qualification for the federal incentives through CMS was many providers' primary objective for their EHR adoption and REC program participation. It remains to be seen whether these providers are able to continue up the meaningful use "elevator" without additional incentives and ongoing technical assistance from local resource(s). To the greatest extent possible, future programs at the federal, state, and local level should consider the combination of financial incentives and technical assistance through achievement of Stage 3 meaningful use to maintain provider motivation and resources to support their efforts.

The extension center model is effective for working with program enrollees to achieve program objectives. The extension center model helped eligible professionals working with RECs to adopt EHRs and achieve meaningful use incentives. Wisely, the financial incentives were aligned among REC participants (eligible professionals) and technical assistance providers (REC grantees). Since the extension center model was effective for its designed purpose, future programs at the federal, state, and local level should apply this model when supporting technology-based quality improvement initiatives for small- to medium-sized primary care providers, critical access hospitals, and FQHCs.

Local relationships and leveraging existing infrastructure are important to grantees' effectiveness. To gain trust, RECs found that working through organizations or individuals who were known in the community was the best strategy for reaching providers and advancing program objectives. This approach was especially important in the REC context because some providers were resistant to perceptions of government intrusion into the way they practiced. Future programs at the federal, state, and local level should consider technical assistance models that use resources well known and respected within the target community and that have existing relevant technical assistance infrastructure.

EHR vendor engagement and relationships at the REC level, in general, were not important to RECs. During early program implementation, many REC programs dedicated significant resources to establishing relationships with vendors and negotiating

preferred pricing agreements. Our evaluation found that, while significant time was invested in forming relationships with EHR vendors, RECs did not believe those relationships had a positive impact on their achievement of program objectives. Many RECs felt as if they did not have enough influence or market potential with vendors to merit special consideration. Future programs should carefully consider the merits of a delegated approach to EHR vendor engagement.

Program supports should be in place in advance of program startup. Initial REC program implementation could have benefited from many of the tools and resources developed and disseminated by the HITRC, especially those focused on enrolling and engaging eligible professionals and community stakeholders. In the early phase of the program, while many of the HITRC resources were under development, many RECs developed their own marketing and outreach tools and resources to meet early program objectives, rather than wait for those made available later through the HITRC. Future programs could benefit from initiating technical assistance support in advance of program kickoff so that comprehensive technical assistance could be available at the very start of the program's implementation.

Awards to preexisting organizations had strengths. ONC awarded cooperative agreements to a heterogeneous group of not-for-profit organizations. Some of these were established organizations and some newly formed. They included health IT research and consulting organizations, universities, QIOs, and health center controlled networks. Our research found that many of the established organizations were better equipped to operationalize the REC programs more quickly in their service areas by drawing on their pre-REC cooperative agreement staff, capital, and infrastructure. Many newly established RECs reported that they struggled during early implementation with obtaining adequate resources and funding to meet early program objectives. Future programs should carefully consider the need for a flexible funding model to accommodate the varying needs of a heterogeneous set of grantees, especially newly established grantees during early implementation.

Recipients of multiple awards leveraged activities of related programs to maximize resources. RECs with funding for multiple related initiatives (REC, HIE, Beacon, QIO) sought to align and leverage activities of related programs to maximize operations because they believed that alignment enhanced the chances of success for each program. Future programs should carefully consider the merits and potential advantages of multiple awards to the same grantee.

7 References

1. Blumenthal, D., *Launching HITECH.* N Engl J Med, 2010. **362**(5): p. 382-5.
2. Southern California Evidence-based Practice Center. *Health information technology: an updated systematic review with a focus on meaningful use functionalities* 2015 [cited 2015 July 22]; Available from: http://www.healthit.gov/sites/default/files/systematic_review_final_report_508_compliant.pdf.
3. Chaudhry, B., et al., *Systematic review: impact of health information technology on quality, efficiency, and costs of medical care.* Ann Intern Med, 2006. **144**(10): p. 742-52.
4. Buntin, M.B., et al., *The benefits of health information technology: a review of the recent literature shows predominantly positive results.* Health Aff (Millwood), 2011. **30**(3): p. 464-71.
5. Bowman, S., *Impact of electronic health record systems on information integrity: quality and safety implications.* Perspect Health Inf Manag, 2013. **10**: p. 1c.
6. DesRoches, C.M., et al., *Meeting meaningful use criteria and managing patient populations: a national survey of practicing physicians.* Ann Intern Med, 2013. **158**(11): p. 791-9.
7. Hsiao, C.J., E. Hing, and J. Ashman, *Trends in electronic health record system use among office-based physicians: United States, 2007-2012.* Natl Health Stat Report, 2014(75): p. 1-18.
8. *Health Information Technology for Economic and Clinical Health Act. Pub. L. No. 111-5, div. A, tit. XIII, 123 Stat. 115, 226–279 and div. B, tit. IV, 123 Stat. 115, 467–496.* 2009.
9. Gold, M.R., et al., *Obtaining providers' 'buy-in' and establishing effective means of information exchange will be critical to HITECH's success.* Health Aff (Millwood), 2012. **31**(3): p. 514-26.
10. Jamoom, E., et al., *Physician experience with electronic health record systems that meet meaningful use criteria: NAMCS physician workflow survey, 2011.* NCHS Data Brief, 2013(129): p. 1-8.
11. Goetz Goldberg, D., et al., *EHRs in primary care practices: benefits, challenges, and successful strategies.* Am J Manag Care, 2012. **18**(2): p. e48-54.
12. Grabenbauer, L., A. Skinner, and J. Windle, *Electronic health record adoption - maybe it's not about the money: physician super-users, electronic health records and patient care.* Appl Clin Inform, 2011. **2**(4): p. 460-71.
13. Boris, J.R., *Commentary on the adoption of the electronic health record.* Cardiol Young, 2010. **20 Suppl 3**: p. 140-2.
14. Blavin, F.E., et al. *Lessons from the literature on electronic health record implementation*. 2013 August 1 [cited 2015 July 22]; Available from: http://www.healthit.gov/sites/default/files/hit_lessons_learned_lit_review_final_08-01-2013.pdf.
15. De Leon, S., et al., *The business end of health information technology. Can a fully integrated electronic health record increase provider productivity in a large community practice?* J Med Pract Manage, 2010. **25**(6): p. 342-9.

16. Adler-Milstein, J., C.E. Green, and D.W. Bates, *A survey analysis suggests that electronic health records will yield revenue gains for some practices and losses for many.* Health Aff (Millwood), 2013. **32**(3): p. 562-70.
17. Ancker, J.S., et al., *Predictors of success for electronic health record implementation in small physician practices.* Appl Clin Inform, 2013. **4**(1): p. 12-24.
18. Moreno, L., D. Peikes, and A. Krilla. *Necessary but not sufficient: the HITECH act and health information technology's potential to build medical homes*. (Prepared by Mathematica Policy Research under Contract No. HHSA290200900019I TO2.) AHRQ Publication No. 10-0080-EF. 2010 June [cited 2015 July 22]; Available from: https://pcmh.ahrq.gov/sites/default/files/attachments/Necessary%20But%20Not%20Sufficient_The%20HITECH%20Act.pdf.
19. Office of the National Coordinator for Health Information Technology. *Update on the adoption of health information technology and related efforts to facilitate the electronic use and exchange of health information: a report to Congress*. 2013 June [cited 2015 July 22]; Available from: http://www.healthit.gov/sites/default/files/rtc_adoption_of_healthit_and_relatedefforts.pdf.
20. Dennehy, P., et al., *A partnership model for implementing electronic health records in resource-limited primary care settings: experiences from two nurse-managed health centers.* J Am Med Inform Assoc, 2011. **18**(6): p. 820-6.
21. Blumenthal, D. and D. Berwick. *Adoption and meaningful use of EHRs – the journey begins*. Health Affairs Blog 2010 August 5 [cited 2015 June 19]; Available from: http://healthaffairs.org/blog/2010/08/05/adoption-and-meaningful-use-of-ehrs-%E2%80%93-the-journey-begins/.
22. Lynch, K., et al., *The Health IT Regional Extension Center Program: evolution and lessons for health care transformation.* Health Serv Res, 2014. **49**(1 Pt 2): p. 421-37.
23. Grumbach, K. and J.W. Mold, *A health care cooperative extension service: transforming primary care and community health.* JAMA, 2009. **301**(24): p. 2589-91.
24. Mostashari, F., M. Tripathi, and M. Kendall, *A tale of two large community electronic health record extension projects.* Health Aff (Millwood), 2009. **28**(2): p. 345-56.
25. Maxson, E., et al., *The regional extension center program: helping physicians meaningfully use health information technology.* Ann Intern Med, 2010. **153**(10): p. 666-70.
26. Office of the National Coordinator for Health Information Technology. *REC history*. 2014 September 11 [cited 2015 March 5]; Available from: http://healthit.gov//providers-professionals/rec-history.
27. Office of the National Coordinator for Health Information Technology. *Fiscal year 2012 President's budget request to congressional appropriations committees: online performance appendix*. 2012 [cited 2015 July 22]; Available from: http://www.healthit.gov/sites/default/files/online-performance-appendix-021411.pdf.
28. Blumenthal, D. and M. Tavenner, *The "meaningful use" regulation for electronic health records.* N Engl J Med, 2010. **363**(6): p. 501-4.

29. Centers for Medicare & Medicaid Services. *Eligibility*. 2012 May 17 [cited 2015 July 22]; Available from: http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/eligibility.html#BOOKMARK1.
30. Centers for Medicare & Medicaid Services. *EHR Incentive Programs: what's new for Stage 1 in 2014*. 2014 March [cited 2015 April 8]; Available from: http://www.cms.gov/eHealth/downloads/eHealthU_Stage1Changes.pdf.
31. Prestigiacomo, J., *A tale of two RECs. Two New York regional extension centers lead the pack in EHR adoption, sharing best practices and strategies along the way.* Healthc Inform, 2010. **27**(11): p. 37, 39-41.
32. Decker, S.L., E.W. Jamoom, and J.E. Sisk, *Physicians in nonprimary care and small practices and those age 55 and older lag in adopting electronic health record systems.* Health Aff (Millwood), 2012. **31**(5): p. 1108-14.
33. Menachemi, N., et al., *Market factors and electronic medical record adoption in medical practices.* Health Care Manage Rev, 2012. **37**(1): p. 14-22.
34. Office of the National Coordinator for Health Information Technology. *Regional Extension Centers (REC) priority primary care providers meaningful use milestone*. 2015 June [cited 2015 July 22]; Available from: http://dashboard.healthit.gov/quickstats/pages/FIG-REC-Program-Priority-Primary-Care-Provider-Meaningful-Use-Milestone.php.
35. Hsiao, C.J. and E. Hing, *Use and characteristics of electronic health record systems among office-based physician practices: United States, 2001-2013.* NCHS Data Brief, 2014(143): p. 1-8.
36. Audet, A.M., D. Squires, and M.M. Doty, *Where are we on the diffusion curve? Trends and drivers of primary care physicians' use of health information technology.* Health Serv Res, 2014. **49**(1 Pt 2): p. 347-60.
37. Austin, P.C., *An introduction to propensity score methods for reducing the effects of confounding in observational studies.* Multivariate Behav Res, 2011. **46**(3): p. 399-424.
38. Li, F., A.M. Zaslavsky, and M.B. Landrum, *Propensity score weighting with multilevel data.* Stat Med, 2013. **32**(19): p. 3373-87.
39. Hosmer Jr, D.W. and S. Lemeshow, *Applied logistic regression, second edition*. 2000, Hoboken, NJ: John Wiley & Sons.
40. Weesie, J. *On Pearson's X^2 for categorical response variables*. 2002 May 23 [cited 2015 May 11]; Available from: http://www.stata.com/meeting/2dutch/pearsonx2.pdf.
41. Allison, P. *Alternatives to the Hosmer-Lemeshow Test*. 2014 April 9 [cited 2015 May 11]; Available from: http://statisticalhorizons.com/alternatives-to-the-hosmer-lemeshow-test.
42. Rogers, E.M., *Diffusion of innovations*. 1962, New York: Free Press of Glencoe. 612.
43. Blavin, F.E. and M.B. Buntin, *Forecasting the use of electronic health records: an expert opinion approach.* Medicare Medicaid Res Rev, 2013. **3**(2).
44. United States Congressional Budget Office (CBO). *Estimated effect on direct spending and revenues of Title IV of Division B of the American Recovery and Reinvestment Act: Health Information Technology*. 2009 [cited 2015 March 3]; Available from: http://www.cbo.gov/publication/20592.
45. Heisey-Grove, D., et al., *A national study of challenges to electronic health record adoption and meaningful use.* Med Care, 2014. **52**(2): p. 144-8.

46. United States Government Accountability Office (GAO). *GAO-12-778R, Electronic health records: number and characteristics of providers awarded Medicare incentive payments for 2011*. 2012 July 26 [cited 2015 July 22]; Available from: http://www.gao.gov/products/GAO-12-778R.
47. Howard, J., et al., *Electronic health record impact on work burden in small, unaffiliated, community-based primary care practices.* J Gen Intern Med, 2013. **28**(1): p. 107-13.
48. Fernald, D.H., R. Wearner, and W.P. Dickinson, *The journey of primary care practices to meaningful use: a Colorado Beacon Consortium study.* J Am Board Fam Med, 2013. **26**(5): p. 603-11.
49. Fleming, N.S., et al., *The financial and nonfinancial costs of implementing electronic health records in primary care practices.* Health Aff (Millwood), 2011. **30**(3): p. 481-9.
50. Jones, E.B. and M.F. Furukawa, *Adoption and use of electronic health records among federally qualified health centers grew substantially during 2010-12.* Health Aff (Millwood), 2014. **33**(7): p. 1254-61.
51. Lenert, L. and D.N. Sundwall, *Public health surveillance and meaningful use regulations: a crisis of opportunity.* Am J Public Health, 2012. **102**(3): p. e1-7.
52. Wright, A., et al., *The Medicare Electronic Health Record Incentive Program: provider performance on core and menu measures.* Health Serv Res, 2014. **49**(1 Pt 2): p. 325-46.
53. Crotty, B.H., et al., *Patient-to-physician messaging: volume nearly tripled as more patients joined system, but per capita rate plateaued.* Health Aff (Millwood), 2014. **33**(10): p. 1817-22.
54. Pew Research Center. *Three technology revolutions*. 2014 [cited 2015 February 19]; Available from: http://www.pewinternet.org/three-technology-revolutions/.
55. Kontos, E., et al., *Predictors of eHealth usage: insights on the digital divide from the Health Information National Trends Survey 2012.* J Med Internet Res, 2014. **16**: p. e172.
56. Bailey, S.C., et al., *Literacy disparities in patient access and health-related use of Internet and mobile technologies.* Health Expect, 2014.
57. Kruse, R.L., et al., *Internet use by primary care patients: where is the digital divide?* Fam Med, 2012. **44**(5): p. 342-7.
58. Varsi, C., et al., *Patients' reported reasons for non-use of an internet-based patient-provider communication service: qualitative interview study.* J Med Internet Res, 2013. **15**(11): p. e246.
59. Agency for Healthcare Research and Quality (AHRQ). *Strategies to ensure HITECH supports the patient-centered medical home*. Patient-Centered Medical Home Decisionmaker Brief 2011; Available from: http://www.pcmh.ahrq.gov/sites/default/files/attachments/Strategies%20to%20Ensure%20HITECH%20Supports%20the%20PCMH.pdf.
60. Centers for Medicare & Medicaid Services (CMS). *Quality measures and performance standards*. 2015 March 2 [cited 2015 July 22]; Available from: http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/sharedsavingsprogram/Quality_Measures_Standards.html.
61. King, J., et al., *Clinical benefits of electronic health record use: national findings.* Health Serv Res, 2014. **49**(1 Pt 2): p. 392-404.

62. Samuel, C.A., *Area-level factors associated with electronic health record adoption and meaningful use in the Regional Extension Center Program.* J Am Med Inform Assoc, 2014.
63. Xierali, I.M., et al., *Factors influencing family physician adoption of electronic health records (EHRs).* J Am Board Fam Med, 2013. **26**(4): p. 388-93.
64. Rubin, D.B., *The design versus the analysis of observational studies for causal effects: parallels with the design of randomized trials.* Stat Med, 2007. **26**(1): p. 20-36.

8 Appendixes

Appendix A. Core and Menu Clinical Quality Measures for Stage 1 Meaningful Use

Reported in CMS's "An Introduction to the Medicaid EHR Incentive Program for Eligible Professionals" in 2012 (http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Downloads/EHR_Medicaid_Guide_Remediated_2012.pdf)

Core Clinical Quality Measure

1. Hypertension: Blood Pressure Measurement
2. Preventive Care and Screening Measure Pair: (a) Tobacco Use Assessment (b) Tobacco Cessation
3. Adult Weight Screening and Follow-up

Menu Clinical Quality Measures

1. Diabetes: Hemoglobin A1c Poor Control
2. Diabetes: Low Density Lipoprotein (LDL) Management and Control
3. Diabetes: Blood Pressure Management
4. Heart Failure (HF): Angiotensin-Converting Enzyme (ACE) Inhibitor or Angiotensin Receptor Blocker (ARB) Therapy for Left Ventricular Systolic Dysfunction (LVSD)
5. Coronary Artery Disease (CAD): Beta-Blocker Therapy for CAD Patients with Prior Myocardial Infarction (MI)
6. Pneumonia Vaccination Status for Older Adults
7. Breast Cancer Screening
8. Colorectal Cancer Screening
9. Coronary Artery Disease (CAD): Oral Antiplatelet Therapy Prescribed for Patients with CAD
10. Heart Failure (HF): Beta-Blocker Therapy for Left Ventricular Systolic Dysfunction (LVSD)
11. Anti-depressant medication management: (a) Effective Acute Phase Treatment (b) Effective Continuation Phase Treatment
12. Primary Open Angle Glaucoma (POAG): Optic Nerve Evaluation
13. Diabetic Retinopathy: Documentation of Presence or Absence of Macular Edema and Level of Severity of Retinopathy
14. Diabetic Retinopathy: Communication with the Physician Managing Ongoing Diabetes Care
15. Asthma Pharmacologic Therapy

16. Asthma Assessment
17. Appropriate Testing for Children with Pharyngitis
18. Oncology Breast Cancer: Hormonal Therapy for Stage IC-IIIC Estrogen Receptor/Progesterone Receptor (ER/PR) Positive Breast Cancer
19. Oncology Colon Cancer: Chemotherapy for Stage III Colon Cancer Patients
20. Prostate Cancer: Avoidance of Overuse of Bone Scan for Staging Low Risk Prostate Cancer Patients
21. Smoking and Tobacco Use Cessation, Medical assistance: (a) Advising Smokers and Tobacco Users to Quit, (b) Discussing Smoking and Tobacco Use Cessation Medications, (c) Discussing Smoking and Tobacco Use Cessation Strategies
22. Diabetes: Eye Exam
23. Diabetes: Urine Screening
24. Diabetes: Foot Exam
25. Coronary Artery Disease (CAD): Drug Therapy for Lowering LDL Cholesterol
26. Heart Failure (HF): Warfarin Therapy Patients with Atrial Fibrillation
27. Ischemic Vascular Disease (IVD): Blood Pressure Management
28. Ischemic Vascular Disease (IVD): Use of Aspirin or Another Antithrombotic
29. Initiation and Engagement of Alcohol and Other Drug Dependence Treatment: (a) Initiation (b) Engagement
30. Prenatal Care: Screening for Human Immunodeficiency Virus (HIV)
31. Prenatal Care: Anti-D Immune Globulin
32. Controlling High Blood Pressure
33. Cervical Cancer Screening
34. Chlamydia Screening for Women
35. Use of Appropriate Medications for Asthma
36. Low Back Pain: Use of Imaging Studies
37. Ischemic Vascular Disease
38. Diabetes: Hemoglobin A1c Control (<8.0%)

Appendix B. Typology Instrument

Organization characteristics

1. Is the REC an organization that existed (on its own or as part of another organization) prior to receiving REC grantee funding, or was it newly created when the funding was awarded?
   a. Existing or spinoff of an existing organization
   b. New organization
2. What is the current target number of Priority Primary Care Providers (PPCPs)? (Enter exact number.)
3. Has the REC prime awardee secured funding to support REC services beyond the grant period? (Do not include anticipated fees from providers for services.)
   a. Yes
   b. No
4. How are providers matched with subcontractors that provide technical assistance? They are matched according to . . . (Check all that apply.)
   a. Type of provider (FQHC, critical access hospital, rural health clinic)
   b. Geographic location
   c. Technical assistance needs, such as implementation, training, workflow redesign, and security risk assessment
   d. Grant management activities
   e. None of the above
5. What percentage of the REC funding is passed through to subcontractors who provide technical assistance?
   a. 0–25%
   b. 26–50%
   c. 51–75%
   d. 75–100%
6. What percentage of the REC funding is passed through to subcontractors who provide assistance with recruiting, marketing, and/or grants administration?
   a. 0–25%
   b. 26–50%
   c. 51–75%
   d. 75–100%

REC collaboration/partnership

7. What relationship does the REC prime awardee have with academic institutions? (Check all that apply.)
   a. REC prime awardee is an academic entity (e.g., college or university).
   b. REC prime awardee has a formal affiliation, financial relationship, or shared board membership with an academic entity (e.g., Area Health Education Centers).
   c. REC prime awardee subcontracts technical assistance or other REC activities to an academic institution.
   d. REC prime awardee collaborates informally with an academic institution.
   e. None of the above.
8. What relationship does the REC prime awardee have with Quality Improvement Organizations (QIOs)? (Check all that apply.)
   a. REC prime awardee is a QIO.
   b. REC prime awardee has a formal affiliation, financial relationship, or shared board membership with a QIO.
   c. REC prime awardee subcontracts technical assistance or other REC activities to a QIO.
   d. REC prime awardee collaborates informally with a QIO.
   e. None of the above.
9. What relationship does the REC prime awardee have with the State Health Information Exchange Cooperative Agreement Program (state HIE)? (Check all that apply.)
   a. REC prime awardee is a state HIE grantee.
   b. REC prime awardee has a formal affiliation, financial relationship, or shared board membership with a state HIE grantee.
   c. REC prime awardee subcontracts technical assistance or other REC activities to a state HIE grantee.
   d. REC prime awardee collaborates informally with a state HIE grantee.
   e. None of the above.
10. What relationship does the REC prime awardee have with the Beacon program? (Check all that apply.)
   a. REC prime awardee is a Beacon grantee.
   b. REC prime awardee has a formal affiliation, financial relationship, or shared board membership with a Beacon grantee.
   c. REC prime awardee subcontracts technical assistance or other REC activities to a Beacon grantee.
   d. REC prime awardee collaborates informally with a Beacon grantee.
   e. REC prime awardee is located in a Beacon community but has no other formal or informal relationship with the Beacon grantee.
   f. None of the above.

11. What relationship does the REC prime awardee have with the state Medicaid agency?
    a. REC prime awardee has a financial or contractual relationship with the state Medicaid agency.
    b. REC prime awardee collaborates informally with the state Medicaid agency
    c. None of the above.
12. What relationship does the REC prime awardee have with professional associations or medical societies?
    a. REC prime awardee has a formal affiliation, financial relationship, or shared board membership with a professional association or medical society.
    b. REC prime awardee collaborates informally with a professional association or medical society.
        i. How many?
    c. None of the above.
13. What relationship does the REC prime awardee have with the workforce development program (the university-based training program, the community college consortia, curriculum development centers, competency exam program)?
    a. REC prime awardee has a formal affiliation or financial relationship with workforce program grantee(s).
    b. REC prime awardee collaborates informally with workforce program grantee(s).
    c. None of the above.
14. In general, how often does a staff member from the REC log into the HITRC Portal?
    a. Every day
    b. Once or twice a week
    c. A few times a month
    d. Once a month
    e. Less often than once a month
    f. Never

    14.1 Does this REC have a representative on one or more Communities of Practice?
        a. Yes
        b. No

    14.2 Does this REC have a representative on one or more workgroups?
        a. Yes
        b. No

    14.3 Has this REC had a representative attend a workshop or bootcamp?
        a. Yes
        b. No

Pricing and services

15. Does the REC currently charge priority primary care providers (PPCPs) a fee to receive REC services?
    a. Yes
    b. No
    c. Varies across subcontractors
16. Have non-PPCPs (e.g., specialists) paid the REC for REC services?
    a. Yes
    b. No
    c. Varies across subcontractors
17. Does the REC currently provide any of the following types of technical assistance? (Check all that apply.)
    a. Practice needs assessment
    b. Vendor selection
    c. Liaison with vendor
    d. Software installation, implementation or training
    e. Hardware recommendation, selection, purchasing, or installation
    f. Workflow redesign
    g. Meaningful use preparation and attestation
    h. Privacy and security related matters
18. Does or did your REC employ a physician on staff to champion the REC program?
    a. Yes
    b. No
19. Is the REC involved in any quality improvement projects (e.g., serving as a coach for PCMH or ACO formation)?
    a. Yes
        i. If yes, please indicate the number of active projects.
        ii. If yes, please indicate the number of projects in the planning phase.
    b. No
20. Does (or did) the REC advocate on behalf of providers with vendors during the selection and purchasing process?
    a. Yes, the REC has a formal (contractual) relationship with vendors (e.g., preferred vendors, group purchasing plans).
    b. Yes, the REC has an informal relationship with vendors (e.g., ongoing communication between vendors and the REC, but no contractual relationship)
    c. Yes, individual REC technical assistance staff negotiate with vendors on behalf of providers during the selection and purchasing process (e.g., contract and pricing negotiations).
    d. No
21. Does the REC work with vendors to support providers as they pursue meaningful use (e.g., working together to identify and solve technological issues)?
    a. Often

b. Sometimes
c. Rarely
d. Never

Please review the form to make sure you have responded to each question. We are also interested to know who provided the information to complete this document. Thank you!

Appendix C. Wave 1 HITRC Survey

Welcome to the HITRC User Experience Survey for REC Members. The goal of this survey is to help ONC better understand how effectively the HITRC resources (e.g., person meetings, Communities of Practice, the HITRC Portal, resources and trainings) meet your needs.

This survey will take approximately 10–15 minutes to complete. Your participation in this survey is voluntary, and there are no penalties if you choose not to participate. Your individual responses will be kept confidential. All results will be provided in aggregate form—at no time will your individual responses be attributed back to you.

We thank you for your participation!

Of the following REC services, how involved are you in each of the following service areas? (Note: This is not limited to your involvement in a Community of Practice, but to your job responsibilities overall.)

Service area	Very involved	Somewhat involved	Slightly involved	Not involved
Education and outreach activities	☐	☐	☐	☐
Vendor selection and management	☐	☐	☐	☐
Implementation and project management services (Milestone 2)	☐	☐	☐	☐
Practice and workflow redesign	☐	☐	☐	☐
Privacy and security	☐	☐	☐	☐
Workforce development	☐	☐	☐	☐
Interoperability and exchange	☐	☐	☐	☐
Helping practices achieve meaningful use (Milestone 3)	☐	☐	☐	☐
Helping practices with continuous Quality Improvement	☐	☐	☐	☐

1. You have indicated that you are [VERY/SOMEWHAT/SLIGHTLY] involved in the following service areas:

[LIST SERVICE AREAS WITH HIGHEST LEVEL OF INVOLVEMENT HERE.]

Of these [TWO/THREE/FOUR . . .] service areas, which would you say you are *most* involved in?

- ☐ AREA 1
- ☐ AREA 2
- ☐ AREA 3

[SKIP TO SECTION OF THE SURVEY FOR SELECTED SERVICE AREA.]

[Practice and workflow redesign]
We would like to ask you a number of questions that refer to your experience with the HITRC resources for the [practice and workflow redesign] service area.

First, we would like you to tell us about your experience with the HITRC Collaborative Portal. **The HITRC Portal includes the dashboard, global resources, information on in-person meetings, the CoP, and REC resources.** Specifically, we would like to know about your use of the HITRC Portal to obtain information and resources about [practice and workflow redesign].

2. In the last 3 months, how often have you logged on to the HITRC Portal to obtain information or resources regarding [practice and workflow redesign]?

   - ☐ Every day *[GO TO 4.]*
   - ☐ Once or twice a week *[GO TO 4.]*
   - ☐ A few times a month *[GO TO 4.]*
   - ☐ Once a month *[GO TO 3.]*
   - ☐ Less often than once a month *[GO TO 3.]*
   - ☐ I have never used the HITRC Portal to obtain materials regarding [practice and workflow redesign] *[GO TO 3.]*

3. [*FROM Q2, THOSE WHO USE PORTAL ONCE PER MONTH OR LESS]* Why don't you use the HITRC Portal on a regular basis to obtain materials regarding [practice and workflow redesign]?	**Strongly agree**	**Agree**	**Neither agree nor disagree**	**Disagree**	**Strongly disagree**
A. I am not interested in the [practice and workflow redesign] content on the HITRC Portal.	☐	☐	☐	☐	☐
B. I can get the [practice and workflow redesign] information on the HITRC Portal elsewhere.	☐	☐	☐	☐	☐
C. The [practice and workflow redesign] material on the HITRC Portal is poorly organized.	☐	☐	☐	☐	☐
D. I do not have time to look for the [practice and workflow redesign] resources on the HITRC Portal.	☐	☐	☐	☐	☐
E. The [practice and workflow redesign] materials on the HITRC Portal are not useful.	☐	☐	☐	☐	☐

[IF Q2 IS "NEVER," GO TO Q7.]

4. How much do you agree with the following statements about the HITRC Portal?	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
A. It is easy to find what I need about [practice and workflow redesign] on the HITRC Portal.	☐	☐	☐	☐	☐
B. The [practice and workflow redesign] information on the HITRC Portal is timely.	☐	☐	☐	☐	☐
C. The [practice and workflow redesign] information on the HITRC Portal is relevant to my needs.	☐	☐	☐	☐	☐
D. The information on the HITRC Portal helps us enhance our [practice and workflow redesign] services.	☐	☐	☐	☐	☐

[IF Q4A IS OTHER THAN "STRONGLY AGREE," GO TO Q5. IF Q4A IS "STRONGLY AGREE," GO TO Q6.]

5. What changes could be made to the [practice and workflow redesign] section of the HITRC Portal that would make it easier to find the information you need?

6. Have you ever posted anything to the [practice and workflow redesign] section of the HITRC Portal (this includes posting shared content or resources, adding to a discussion thread or blog, adding a training or tool need, adding a comment to a page)?

   ☐ Yes
   ☐ No

7. Do you use the HITRC Portal for information outside of the [practice and workflow redesign] service area?

   ☐ Yes *[GO TO 8.]*
   ☐ No *[GO TO 9.]*

8. Please rate your level of agreement with the following statements about the HITRC Portal *overall (not limited to [practice and workflow redesign])*?	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
A. It is easy to find what I need on the HITRC Portal.	☐	☐	☐	☐	☐
B. The HITRC Portal provides timely information.	☐	☐	☐	☐	☐
C. The HITRC Portal is easy to use.	☐	☐	☐	☐	☐

9. What changes could be made to the HITRC Portal *overall* that would make it more useful to you?

The following series of questions refers to any resources (best practices, lessons learned, tools, articles, reports, FAQs, etc.) that you may have obtained from the HITRC Portal regarding [practice and workflow redesign].

10. Have you downloaded *any* resources (best practices, lessons learned, tools, articles, reports, FAQs, etc.) regarding [practice and workflow redesign] from the HITRC Portal?

    - ☐ Yes
    - ☐ No *[SKIP TO 16.]*

11. Are you aware of [RESOURCE 1]?

    - ☐ Yes
    - ☐ No *[SKIP TO 12.]*

    11A. Have you used [RESOURCE 1]?
    - ☐ Yes
    - ☐ No *[SKIP TO 12.]*

    11B. Please rate the overall usefulness of [RESOURCE 1].
    - ☐ Very useful
    - ☐ Somewhat useful
    - ☐ Slightly useful
    - ☐ Not at all useful

12. Are you aware of [RESOURCE 2]?

    - ☐ Yes
    - ☐ No *[SKIP TO 13.]*

    12A. Have you used [RESOURCE 2]?
    - ☐ Yes
    - ☐ No *[SKIP TO 13.]*

    12B. Please rate the overall usefulness of [RESOURCE 2]:
    - ☐ Very useful
    - ☐ Somewhat useful
    - ☐ Slightly useful
    - ☐ Not at all useful

13. Are you aware of [RESOURCE 3]?

    - ☐ Yes
    - ☐ No *[SKIP TO 14.]*

13A. Have you used [RESOURCE 3]?

- □ Yes
- □ No *[SKIP TO 14.]*

13B. Please rate the overall usefulness of [RESOURCE 3].

- □ Very useful
- □ Somewhat useful
- □ Slightly useful
- □ Not at all useful

14. Are you aware of [RESOURCE 4]?

- □ Yes
- □ No *[SKIP TO 15.]*

14A. Have you used [RESOURCE 4]?

- □ Yes
- □ No *[SKIP TO 15.]*

14B. Please rate the overall usefulness of [RESOURCE 4].

- □ Very useful
- □ Somewhat useful
- □ Slightly useful
- □ Not at all useful

15. Are you aware of [RESOURCE 5]?

- □ Yes
- □ No *[SKIP TO 17.]*

15A. Have you used [RESOURCE 5]?

- □ Yes
- □ No *[SKIP TO 16.]*

15B. Please rate the overall usefulness of [RESOURCE 5].

- □ Very useful
- □ Somewhat useful
- □ Slightly useful
- □ Not at all useful

[IF Q10 IS "NO," GO TO Q16. IF Q10 IS "YES," GO TO Q17.]

16. Why haven't you downloaded any resources regarding [practice and workflow redesign]?	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
A. I am not interested in [practice and workflow redesign] resources.	☐	☐	☐	☐	☐
B. The [practice and workflow redesign] resources are not useful.	☐	☐	☐	☐	☐
C. I can easily get the resources I need regarding [practice and workflow redesign] elsewhere.	☐	☐	☐	☐	☐
D. I do not know where to get [practice and workflow redesign] resources.	☐	☐	☐	☐	☐
E. I do not have access to the [practice and workflow redesign] resources.	☐	☐	☐	☐	☐
F. I was not aware of the [practice and workflow redesign] resources.	☐	☐	☐	☐	☐

[IF Q10 IS "NO," GO TO Q18.]

17. What changes could be made to the [practice and workflow redesign] *resources* that would make them more useful to you?

Next, we would like to ask you about the training sessions you may have attended in person, at regional meetings, via phone or online via the HITRC Learning Center. These are topic-driven trainings, such as Implementation Basics, Workflow Redesign, Trusted Advisor, Dream Team, and Boot Camp training.

18. Have you attended *any* training sessions about [practice and workflow redesign]?

☐ Yes
☐ No *[SKIP TO 24.]*

19. Are you aware of [TRAINING 1]?

☐ Yes
☐ No *[SKIP TO 20.]*

19A. Have you participated in [TRAINING 1]?

☐ Yes
☐ No *[SKIP TO 20.]*

19B. Please rate the overall usefulness of [TRAINING 1].

- □ Very useful
- □ Somewhat useful
- □ Slightly useful
- □ Not at all useful

20. Are you aware of [TRAINING 2]?

- □ Yes
- □ No *[SKIP TO 21.]*

20A. Have you participated in [TRAINING 2]?

- □ Yes
- □ No *[SKIP TO 21.]*

20B. Please rate the overall usefulness of [TRAINING 2].

- □ Very useful
- □ Somewhat useful
- □ Slightly useful
- □ Not at all useful

21. Are you aware of [TRAINING 3]?

- □ Yes
- □ No *[SKIP TO 22.]*

21A. Have you participated in [TRAINING 3]?

- □ Yes
- □ No *[SKIP TO 22.]*

21B. Please rate the overall usefulness of [TRAINING 3].

- □ Very useful
- □ Somewhat useful
- □ Slightly useful
- □ Not at all useful

22. Are you aware of [TRAINING 4]?

- □ Yes
- □ No *[SKIP TO 23.]*

22A. Have you participated in [TRAINING 4]?

- □ Yes
- □ No *[SKIP TO 23.]*

22B. Please rate the overall usefulness of [TRAINING 4].

- □ Very useful

- ☐ Somewhat useful
- ☐ Slightly useful
- ☐ Not at all useful

23. Are you aware of [TRAINING 5]?

- ☐ Yes
- ☐ No *[SKIP TO 25.]*

23A. Have you participated in [TRAINING 5]?

- ☐ Yes
- ☐ No *[SKIP TO 25.]*

23B. Please rate the overall usefulness of [TRAINING 5].

- ☐ Very useful
- ☐ Somewhat useful
- ☐ Slightly useful
- ☐ Not at all useful

[IF Q18 IS "NO," GO TO Q24. IF Q18 IS "YES," GO TO Q25.]

24. Why have you not participated in trainings regarding [practice and workflow redesign]?	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
A. I am not interested in the [practice and workflow redesign] topic.	☐	☐	☐	☐	☐
B. I know all I need to know about [practice and workflow redesign].	☐	☐	☐	☐	☐
C. The [practice and workflow redesign] trainings put on by the HITRC are not useful.	☐	☐	☐	☐	☐
D. I do not have enough time available to participate in the [practice and workflow redesign] trainings.	☐	☐	☐	☐	☐
E. I was not aware of the [practice and workflow redesign] trainings.	☐	☐	☐	☐	☐

25. Please indicate your preferred format for the HITRC training sessions (choose only one).

- ☐ In-person workshops
- ☐ Virtual workshops (WebEx)

- ☐ Moderated conference calls
- ☐ Self-guided online e-learning
- ☐ Podcast
- ☐ Other (specify): _____

26. What changes could be made to the HITRC-sponsored [practice and workflow redesign] trainings that would make them more useful to you?

The next series of questions refers to your experience with the [practice and workflow redesign] Community of Practice (CoP).

27. Which of the following best describes how often you participate in the [practice and workflow redesign] CoP?

- ☐ Regularly participating in workgroups or discussion groups *[SKIP TO 29.]*
- ☐ Occasionally, to stay informed on behalf of my REC *[GO TO 28.]*
- ☐ Infrequently *[GO TO 28.]*
- ☐ Never *[GO TO 28.]*

28. Why don't you regularly participate in the [practice and workflow redesign] CoP?	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
A. I was not aware of the [practice and workflow redesign] CoP.	☐	☐	☐	☐	☐
B. I do not have time to participate in the [practice and workflow redesign] CoP.	☐	☐	☐	☐	☐
C. CoPs are not useful.	☐	☐	☐	☐	☐

[IF Q27 IS "NEVER," SKIP TO Q32. IF Q27 IS "REGULARLY," "OCCASIONALLY," OR "INFREQUENTLY," GO TO Q29.]

29. What changes could be made to the [practice and workflow redesign] CoP that would make it more useful to you?

30. How much do you agree with the following statements about the CoP?	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
A. The [practice and workflow redesign] CoP provides timely information.	☐	☐	☐	☐	☐
B. The [practice and workflow redesign] CoP provides relevant information.	☐	☐	☐	☐	☐
C. The CoP has identified important gaps in the understanding of [practice and workflow redesign].	☐	☐	☐	☐	☐
D. The [practice and workflow redesign] CoP has developed innovative resources.	☐	☐	☐	☐	☐

30. How much do you agree with the following statements about the CoP?	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
E. The [practice and workflow redesign] CoP has helped me become more effective at my job.	☐	☐	☐	☐	☐

31. Have you adopted new practices as a result of your participation in the [practice and workflow redesign] CoP?

    ☐ Yes, definitely
    ☐ Yes, somewhat
    ☐ No

32. Have you collaborated informally with other RECs on the topic of [practice and workflow redesign] *outside of* the CoP activities?

    ☐ Yes *[GO TO 33.]*
    ☐ No *[THANK AND GO TO 34.]*

33. As a result of these collaborations, have you gained information or resources that have helped you conduct your work related to [practice and workflow redesign]?

    ☐ Yes, definitely
    ☐ Yes, somewhat
    ☐ No

[THANK AND GO TO 34.]

Thank you. In addition to your experience with the HITRC, we would like to ask you a few questions about your experience hiring new employees.

34. The ONC-funded community college health IT program is a grant program that seeks to rapidly create health IT education and training programs at community colleges or expand existing programs. Community colleges funded under this initiative have established intensive nondegree training programs that can be completed in 6 months or less. Prior to participating in this survey, were you aware of the ONC-funded community college health IT program?

    a. Yes *[GO TO Q35.]*
    b. No *[SKIP TO Q37.]*

35. The HIT PRO competency exam is an exam developed as part of the ONC-funded program that is designed to assess the health IT competency level of program graduates and others. Prior to participating in this survey, were you aware of the HIT PRO competency exam?

    a. Yes *[GO TO Q36.]*
    b. No *[SKIP TO 37.]*

36. When reviewing the qualifications of potential staff members (for positions that do not require a graduate degree), how often do you check to see if the candidate has taken the competency (or HIT PRO) exam?

    a. Always
    b. Usually
    c. Sometimes
    d. Never

HITRC USER CHARACTERISTICS

For the remaining few questions, please tell us a little about yourself.

37. How long have you worked in an information technology-related field? (any industry) _____ years

38. How long have you worked in a *health* information technology-related field? _____ years

39. How long have you worked for the Regional Extension Center? _____ months

40. Prior to joining the Regional Extension Center, did you work for either a parent organization or one of the affiliates of the current Regional Extension Center?

    - Yes *[GO TO 41]*
    - No *[THANK AND TERMINATE]*

41. How long did you work with this parent organization or affiliate of the Regional Extension Center? _____years

Please provide any additional comments or suggestions related to the HITRC, the HITRC Portal, the HITRC trainings or resources that you would like to include in the space below.

Thank you very much for participating in this survey. These results will help ONC better understand your experience with the HITRC and guide the development of HITRC resources and services.

Appendix D. Propensity Score Matching Before Sampling

The following describes the methods for developing propensity scores and matching on propensity scores before sampling for the study.

Data sources. Data on individual characteristics were from a June 2013 extract of the American Medical Association Physician Master File, and data on county characteristics were from 2010 and 2011 Area Health Resource Files. We used 2010 and 2011 data to mimic counties' context before REC program implementation.

Outcome measure. The outcome measure was REC participation, defined as enrolling in the REC program. REC participants were individuals in the CRM data who had enrolled in the program. Nonparticipants were individuals from the AMA Physician Masterfile who were not listed in the CRM data as program enrollees.

Explanatory measures. The explanatory measures were individual and county characteristics described in the literature as being associated with EHR adoption [62, 63]. We also took the approach of including variables with any possible connection to the outcome into the model [64].

Individual characteristics were age, graduation year, female, practice type, and provider type.

We included county characteristics related to health care: county is a Health Professional Shortage Area; number of FQHCs and rural health clinics in county; number of primary care physicians per capita in county; percent of county population with Medicare, with Medicaid, and without health insurance; number of hospitals with six to 49 beds, 50 to 99 beds, 100 to 199 beds, 200 to 299 beds, 300 or more beds in county; number of general practice physicians aged less than 35 years, between 35 and 44 years, between 45 and 54 years, between 55 and 64 years, between 65 and 74 years, and 74 years or older in county. These county characteristics were included to represent the context in which a physician practiced medicine.

We included general county demographic variables. These included median age in the county; rural designation; number with less than a high school degree, that is foreign born, that lives in urban areas, that is unemployed; number of households with incomes between 0 and $10,000, $10,000 and $15,000, $15,000 and $25,000, $25,000 and $50,000, $50,000 and $100,000, and more than $100,000 in the county; number of people aged 18 to 39, 40 to 64, and 65 years or older in the county; total population size of county; and state. These county characteristics were also included to represent physician context.

State is a categorical variable for the 50 states and 2 protectorates.

Analysis. We conducted logistic regression to calculate propensity scores for participating in the REC program. All categorical variables were entered into the model as dummy variables.

Next, we matched REC participants to nonparticipants using nearest neighbor with replacement procedures [37, 38]. This resulted in 66,439 matched pairs of REC participants and nonparticipants.

Results of the matching procedure. The following exhibit shows characteristics for REC participants and nonparticipants before and after matching. REC participants and nonparticipants become more similar after matching procedures, as shown by the change in standardized difference before compared with after matching.

Exhibit D1. Comparability Between REC Participants and Nonparticipants Before and After Matching Procedures

	Unmatched				Matched			
Variable	REC participant	Non-participant	Standardized difference	p-value	REC participant	Non-participant	Standardized difference	p-value
Individual characteristics								
Physician age	50.71	52.55	–16.3	<.01	50.71	50.54	1.5	<.01
Female (1=male, 2=female)	1.43	1.41	4.1	<.01	1.43	1.43	–1.0	0.06
Practice type: Solo	67%	44%	47.3	<.01	67%	67%	–0.5	0.36
Practice type: Two-Physician	14%	22%	–20.7	<.01	14%	14%	0.2	0.65
Practice type: Group	4%	4%	0.4	0.46	4%	4%	1.9	<.01
Provider type: General Practice	2%	5%	–14.3	<.01	2%	2%	0.6	0.21
Provider type: Geriatrics	1%	1%	–2.3	<.01	1%	1%	–0.1	0.83
Provider type: Pediatrics/Adolescent	19%	20%	–2.1	<.01	19%	19%	1.1	0.05
Provider type: Obstetrics/Gynecology	13%	12%	3.0	<.01	13%	12%	2.9	<.01
Provider type: Family Practice	39%	28%	24.8	<.01	39%	40%	–2.1	<.01
Provider type: Internal Medicine	25%	34%	–19.1	<.01	25%	26%	–1.1	0.04
County characteristics related to health care								
Not a HPSA	14%	11%	8.3	<.01	14%	14%	–0.8	0.15
A HPSA	38%	44%	–13.1	<.01	38%	39%	–1.3	0.02
A partial HPSA	48%	44%	7.4	<.01	48%	47%	1.8	<.01
0 rural health clinics	77%	76%	0.9	0.08	77%	77%	0.6	0.27
1 rural health clinics	11%	13%	–6.5	<.01	11%	11%	–1.1	0.04
2 to 39 rural health clinics	12%	11%	5.5	<.01	12%	12%	0.3	0.56
0 to 1 FQHCs	33%	26%	15.9	<.01	33%	32%	1.5	0.01
2 to 3 FQHCs	18%	16%	5.7	<.01	18%	18%	0.1	0.87
4 to 6 FQHCs	14%	15%	–3.3	<.01	14%	14%	0.2	0.71
7 to 16 FQHCs	19%	21%	–3.1	<.01	19%	20%	–0.7	0.22
17 to 131 FQHCs	15%	22%	–18.0	<.01	15%	16%	–1.4	0.01
10.137% or less Medicare enrollees	18%	21%	–9.2	<.01	18%	18%	–0.5	0.39

County characteristics related to health care , continued

	Unmatched				Matched			
Variable	REC participant	Non-participant	Standardized difference	p-value	REC participant	Non-participant	Standardized difference	p-value
10.138 to 11.249% of Medicare enrollees	18%	23%	–12.8	<.01	18%	18%	–1.0	0.05
11.254 to 13.0127% Medicare enrollees	19%	19%	0.2	0.72	19%	20%	–0.1	0.82
13.019 to 14.671% Medicare enrollees	20%	19%	2.8	<.01	20%	20%	1.3	0.02
14.683 to 57.735% Medicare enrollees	25%	17%	18.7	<.01	25%	25%	0.3	0.58
12.317% or less with Medicaid	21%	19%	4.9	<.01	21%	21%	–0.2	0.78
12.232 to 17.119% with Medicaid	21%	19%	4.6	<.01	21%	21%	0.8	0.14
17.130 to 20.791% with Medicaid	20%	21%	–0.4	0.37	20%	20%	0.4	0.46
20.795 to 25.427% with Medicaid	20%	21%	–2.1	<.01	20%	20%	0.5	0.39
25.440 to 69.774% with Medicaid	17%	20%	–7.1	<.01	17%	18%	–1.6	<.01
11.6% or less uninsured	23%	18%	12.9	<.01	23%	23%	0.6	0.26
11.7 to 14.7% uninsured	20%	20%	–1.0	0.05	20%	20%	1.0	0.06
14.8 to 18.4% uninsured	21%	20%	3.6	<.01	21%	21%	0.7	0.20
18.5 to 22.3% uninsured	20%	20%	–1.0	0.05	20%	20%	–0.6	0.31
22.4 to 40.5% uninsured	16%	22%	–14.9	<.01	16%	17%	–1.9	<.01
59.84 or less primary care physicians per capita	22%	19%	7.4	<.01	22%	22%	–0.1	0.91
59.91 to 73.55 primary care physicians per capita	19%	21%	–6.0	<.01	19%	19%	–0.8	0.13
73.55 to 87.77 primary care physicians per capita	20%	20%	–1.9	<.01	20%	19%	0.7	0.19
87.83 to 107.06 primary care physicians per capita	20%	20%	0.9	<.01	20%	20%	0.8	0.13
107.08 to 459.85 primary care physicians per capita	20%	20%	–0.4	0.37	20%	20%	–0.7	0.23
0 hospitals with 6-49 beds	53%	45%	16.7	<.01	53%	53%	0.3	0.62
1 hospitals with 6-49 beds	21%	20%	2.0	<.01	21%	20%	0.9	0.10
2 hospitals with 6-49 beds	11%	14%	–6.8	<.01	11%	11%	–0.5	0.39
3 to 11 hospitals with 6-49 beds	15%	22%	–17.7	<.01	15%	16%	–0.9	0.08
0 hospitals with 50-99 beds	53%	42%	23.4	<.01	53%	53%	1.0	0.08
1 hospitals with 50-99 beds	22%	23%	–1.0	0.05	22%	22%	0.6	0.25
2 to 3 hospitals with 50-99 beds	14%	18%	–11.2	<.01	14%	14%	–0.5	0.36
4 to 13 hospitals with 50-99 beds	10%	17%	–20.6	<.01	10%	11%	–1.6	<.01
0 hospitals with 100-199 beds	63%	55%	17.1	<.01	63%	63%	0.6	0.29

County characteristics related to health care , continued

	Unmatched				Matched			
Variable	REC participant	Non-participant	Standardized difference	p-value	REC participant	Non-participant	Standardized difference	p-value
1 hospitals with 100-199 beds	19%	21%	–4.0	<.01	19%	19%	0.6	0.24
2 hospitals with 100-199 beds	8%	10%	–7.3	<.01	8%	7%	0.3	0.53
3 to 9 hospitals with 100-199 beds	10%	15%	–14.4	<.01	10%	11%	–1.9	<.01
0 hospitals with 200-299 beds	77%	72%	12.1	<.01	77%	77%	1.0	0.07
1 hospitals with 200-299 beds	14%	15%	–4.3	<.01	14%	13%	0.2	0.72
2 to 3 hospitals with 200-299 beds	9%	13%	–12.1	<.01	9%	9%	–1.6	<.01
0 hospitals with 300 or more beds	77%	71%	13.4	<.01	77%	77%	0.9	0.11
1 hospitals with 300 or more beds	14%	16%	–5.6	<.01	14%	14%	0.0	0.95
2 to 3 hospitals with 300 or more beds	8%	12%	–12.5	<.01	8%	9%	–1.2	0.02
0 general practice physicians less than 35 years of age	92%	89%	9.1	<.01	92%	91%	1.8	<.01
1 to 3 general practice physicians less than 35 years of age	8%	11%	–9.1	<.01	8%	9%	–1.8	<.01
0 general practice physicians age 35 to 44 years.	74%	66%	18.7	<.01	74%	73%	3.0	<.01
1 general practice physicians age 35 to 44 years.	11%	13%	–6.9	<.01	11%	11%	–0.8	0.15
2 to 18 general practice physicians age 35 to 44 years.	15%	21%	–16.4	<.01	15%	16%	–2.9	<.01
0 general practice physicians age 45 to 54 years	46%	37%	18.5	<.01	46%	45%	2.2	<.01
1 to 2 general practice physicians age 45 to 54 years	25%	25%	–1.6	<.01	25%	25%	0.6	0.31
3 to 4 general practice physicians age 45 to 54 years	14%	16%	–4.7	<.01	14%	14%	–1.1	0.05
5 to 63 general practice physicians age 45 to 54 years	15%	21%	–17.6	<.01	15%	16%	–2.4	<.01
0 general practice physicians age 55 to 64 years	26%	18%	19.3	<.01	26%	25%	0.8	0.16
1 to 2 general practice physicians age 55 to 64 years	26%	22%	8.1	<.01	26%	26%	1.0	0.09
3 to 5 general practice physicians age 55 to 64 years	18%	18%	–0.3	0.49	18%	17%	1.4	0.01
6 to 11 general practice physicians age 55 to 64 years	16%	19%	–7.7	<.01	16%	16%	–1.0	0.06
12 to 186 general practice physicians age 55 to 64 years	15%	23%	–21.5	<.01	15%	16%	–2.3	<.01
0 general practice physicians age 65 to 74 years	25%	17%	19.3	<.01	25%	25%	1.1	0.07
1 to 2 general practice physicians age 65 to 74 years	29%	25%	8.6	<.01	29%	29%	0.6	0.25
3 to 5 general practice physicians age 65 to 74 years	15%	16%	–2.4	<.01	15%	14%	1.0	0.05
6 to 13 general practice physicians age 65 to 74 years	17%	20%	–8.0	<.01	17%	17%	–1.1	0.03
14 to 157 general practice physicians age 65 to 74 years	15%	22%	–20.1	<.01	15%	15%	–1.7	<.01
0 general practice physicians age 75 years or older	33%	25%	17.9	<.01	33%	32%	1.5	0.01
1 general practice physicians age 75 years or older	18%	16%	5.9	<.01	18%	18%	1.2	0.03

County characteristics related to health care , continued

	Unmatched				Matched			
Variable	REC participant	Non-participant	Standardized difference	p-value	REC participant	Non-participant	Standardized difference	p-value
2 to 4 general practice physicians age 75 years or older	19%	18%	2.1	<.01	19%	19%	–0.3	0.63
5 to 9 general practice physicians age 75 years or older	15%	19%	–10.8	<.01	15%	15%	–0.7	0.19
10 to 104 general practice physicians age 75 years or older	15%	22%	–18.2	<.01	15%	16%	–2.0	<.01
General county demographic variables								
Median age of 34.3 year or less	18%	22%	–9.5	<.01	18%	18%	–0.2	0.67
Median age of 34.4 to 36.2 years	20%	24%	–10.1	<.01	20%	20%	–0.8	0.13
Median age of 36.3 to 38.2 years	20%	18%	3.3	<.01	20%	20%	–0.5	0.38
Median age of 38.3 to 40.2 years	20%	19%	0.2	0.66	20%	19%	0.8	0.16
Median age of 40.3 to 62.7 years	23%	17%	16.5	<.01	23%	23%	0.8	0.18
Rural urban continuum code 1	54%	64%	–20.0	<.01	54%	54%	–1.5	0.01
Rural urban continuum code 2	21%	20%	2.7	<.01	21%	21%	0.2	0.68
Rural urban continuum code 3	11%	7%	11.3	<.01	11%	10%	0.9	0.12
Rural urban continuum code 4	4%	3%	7.9	<.01	4%	4%	1.3	0.03
Rural urban continuum code 5	2%	1%	6.3	<.01	2%	2%	1.4	0.02
Rural urban continuum code 6	4%	2%	8.8	<.01	4%	4%	0.0	0.99
Rural urban continuum code 7	3%	2%	8.2	<.01	3%	3%	–0.5	0.43
Rural urban continuum code 8	0%	0%	3.3	<.01	0%	0%	0.9	0.15
Rural urban continuum code 9	1%	0%	4.2	<.01	1%	1%	0.1	0.89
9.3% or less with less than a high school degree	22%	19%	5.5	<.01	22%	21%	0.9	0.13
9.4 to 12.1% with less than a high school degree	21%	19%	5.1	<.01	21%	21%	1.6	0.01
12.2 to 14.4% with less than a high school degree	19%	20%	–1.8	<.01	19%	19%	0.1	0.82
14.5 to 18.8% with less than a high school degree	19%	21%	–5.5	<.01	19%	19%	–1.0	0.06
18.9 to 52.1% with less than a high school degree	19%	20%	–3.5	<.01	19%	19%	–1.6	<.01
4.2% or less foreign born	26%	17%	20.1	<.01	26%	25%	0.7	0.26
4.3 to 7.9% foreign born	22%	19%	7.4	<.01	22%	22%	1.2	0.04
8.0 to 13.2% foreign born	20%	19%	2.2	<.01	20%	20%	0.0	0.99
13.3 to 23.0% foreign born	17%	23%	–14.1	<.01	17%	17%	–0.2	0.71
23.1 to 54.5% foreign born	15%	22%	–16.6	<.01	15%	16%	–1.7	<.01

General county demographic variables, continued

	Unmatched				Matched			
Variable	REC participant	Non-participant	Standardized difference	p-value	REC participant	Non-participant	Standardized difference	p-value
74.6% or less living in an urban area	26%	17%	22.8	<.01	26%	26%	1.0	0.10
74.7 to 91.5% living in an urban area	20%	20%	1.3	0.01	20%	20%	1.0	0.06
91.6 to 97.0% living in an urban area	19%	21%	–4.4	<.01	19%	19%	0.6	0.24
97.1 to 99.4% living in an urban area	19%	25%	–12.7	<.01	19%	20%	–0.9	0.08
99.5 to 100% living in an urban area	15%	18%	–7.4	<.01	15%	16%	–1.8	<.01
7.5% or less unemployed	23%	22%	3.8	<.01	23%	23%	1.4	0.01
7.6 to 8.7% unemployed	19%	18%	1.1	0.02	19%	19%	–0.6	0.32
8.8 to 9.9% unemployed	19%	20%	–1.9	<.01	19%	19%	0.1	0.88
10 to 11.4% unemployed	19%	20%	–2.1	<.01	19%	19%	0.1	0.80
11.5 to 29.9% unemployed	19%	20%	–1.1	0.03	19%	20%	–1.1	0.04
0 to 3302 households with incomes under $10k	25%	17%	20.2	<.01	25%	25%	1.2	0.04
3303 to 8604 households with incomes under $10k	22%	19%	6.7	<.01	22%	22%	0.5	0.36
8630 to 16749 households with incomes under $10k	20%	20%	–1.0	0.05	20%	20%	0.4	0.49
17136 to 38752 households with incomes under $10k	18%	23%	–11.1	<.01	18%	18%	–0.4	0.46
38844 to 199280 households with incomes under $10k	15%	21%	–15.7	<.01	15%	16%	–1.8	<.01
0 to 2484 households with incomes between $10k to $15k	25%	17%	20.4	<.01	25%	25%	0.8	0.18
2489 to 6310 households with incomes between $10k to $15k	22%	19%	5.8	<.01	22%	21%	1.3	0.02
6342 to 12753 households with incomes between $10k to $15k	20%	20%	0.5	0.32	20%	20%	–0.1	0.87
12778 to 28145 households with incomes between $10k to $15k	18%	22%	–9.0	<.01	18%	19%	–0.2	0.67
28807 to 186531 households with incomes between $10k to $15k	15%	22%	–18.6	<.01	15%	16%	–1.8	<.01
0 to 5067 households with incomes between $15k to $25k	25%	17%	20.8	<.01	25%	25%	1.3	0.03
5089 to 13174 households with incomes between $15k to $25k	22%	19%	7.7	<.01	22%	22%	0.5	0.37
13275 to 25161 households with incomes between $15k to $25k	20%	20%	–1.2	0.01	20%	20%	0.0	0.93
25589 to 57052 households with incomes between $15k to $25k	18%	21%	–9.4	<.01	18%	18%	0.0	0.99

General county demographic variables, continued

	Unmatched				Matched			
Variable	REC participant	Non-participant	Standardized difference	p-value	REC participant	Non-participant	Standardized difference	p-value
58984 to 338792 households with incomes between $15k to $25k	15%	23%	–18.8	<.01	15%	16%	–1.8	<.01
0 to 12166 households with incomes between $25k to $50k	26%	17%	22.0	<.01	26%	25%	1.2	0.04
12185 to 32220 households with incomes between $25k to $50k	22%	19%	7.3	<.01	22%	22%	0.5	0.35
32281 to 61398 households with incomes between $25k to $50k	20%	20%	0.7	0.13	20%	20%	0.0	0.97
61577 to 124632 households with incomes between $25k to $50k	17%	22%	–12.2	<.01	17%	17%	–0.3	0.62
131215 to 736852 households with incomes between $25k to $50k	15%	22%	–18.8	<.01	15%	16%	–1.5	<.01
0 to 14951 households with incomes between $50k to $100k	26%	16%	23.3	<.01	26%	25%	1.1	0.06
15017 to 43655 households with incomes between $50k to $100k	21%	19%	4.7	<.01	21%	21%	–0.1	0.88
43863 to 89258 households with incomes between $50k to $100k	20%	20%	0.2	0.70	20%	20%	1.2	0.03
91048 to 163531 households with incomes between $50k to $100k	19%	21%	–7.1	<.01	19%	19%	–0.6	0.30
167657 to 953211 households with incomes between $50k to $100k	14%	23%	–22.2	<.01	14%	15%	–1.7	<.01
0 to 7585 households with incomes of $100k or more	26%	16%	23.5	<.01	26%	25%	1.2	0.05
7587 to 31118 households with incomes of $100k or more	21%	19%	5.2	<.01	21%	21%	0.0	0.96
31342 to 70479 households with incomes of $100k or more	21%	20%	1.9	<.01	21%	20%	0.9	0.09
72464 to 146932 households with incomes of $100k or more	18%	22%	–10.3	<.01	18%	18%	–0.8	0.14
148369 to 803223 households with incomes of $100k or more	15%	23%	–21.3	<.01	15%	15%	–1.4	0.01
0 to 33664 people aged 18 to 39	26%	16%	23.9	<.01	26%	26%	0.9	0.13
33760 to 106393 people aged 18 to 39	22%	19%	5.8	<.01	22%	21%	0.3	0.56
107737 to 229801 people aged 18 to 39	21%	20%	2.3	<.01	21%	20%	1.4	0.01
229910 to 479006 people aged 18 to 39	17%	22%	–10.9	<.01	17%	18%	–0.9	0.10
486867 to 3194385 people aged 18 to 39	14%	23%	–22.3	<.01	14%	15%	–1.8	<.01

General county demographic variables, continued

	Unmatched				Matched			
Variable	REC participant	Non-participant	Standardized difference	p-value	REC participant	Non-participant	Standardized difference	p-value
0 to 39959 people aged 40 to 64	26%	16%	23.5	<.01	26%	25%	1.1	0.06
40025 to 122099 people aged 40 to 64	21%	19%	4.9	<.01	21%	21%	0.0	1.00
123319 to 264165 people aged 40 to 64	21%	20%	1.3	0.01	21%	20%	1.6	<.01
264465 to 488529 people aged 40 to 64	18%	21%	–7.0	<.01	18%	19%	–1.4	0.01
506892 to 3105533 people aged 40 to 64	14%	23%	–23.8	<.01	14%	15%	–1.4	0.01
0 to 16619 people age 65 years or older	26%	17%	22.1	<.01	26%	25%	1.2	0.05
16687 to 46545 people age 65 years or older	22%	19%	7.6	<.01	22%	22%	0.3	0.63
46606 to 95224 people age 65 years or older	19%	21%	–3.9	<.01	19%	19%	0.7	0.17
96102 to 198541 people age 65 years or older	18%	21%	–8.0	<.01	18%	18%	–0.8	0.15
201793 to 1065699 people age 65 years or older	15%	23%	–18.7	<.01	15%	16%	–1.5	<.01
population of 0 to 131500	26%	16%	23.0	<.01	26%	25%	1.2	0.04
population of 131506 to 382748	22%	19%	5.8	<.01	22%	21%	0.2	0.69
population of 384504 to 799874	20%	20%	1.7	<.01	20%	20%	1.4	0.01
population of 800647 to 1510271	18%	22%	–9.4	<.01	18%	18%	–1.0	0.05
population of 1526006 to 9818609	14%	23%	–22.3	<.01	14%	15%	–1.8	<.01
State 1	<1%	<1%	5.2	<.01	<1%	<1%	–1.7	0.01
State 2	1%	1%	–0.9	0.07	1%	1%	0.4	0.47
State 3	1%	1%	3.7	<.01	1%	1%	–1.8	<.01
State 4	2%	2%	–4.5	<.01	2%	2%	–0.6	0.25
State 5	8%	15%	–21.8	<.01	8%	8%	–1.1	0.02
State 6	2%	2%	–3.1	<.01	2%	2%	–0.5	0.36
State 7	1%	2%	–5.3	<.01	1%	1%	0.5	0.31
State 8	<1%	<1%	–3.0	<.01	<1%	<1%	–0.1	0.91
State 9	<1%	<1%	3.6	<.01	<1%	<1%	0.4	0.54
State 10	6%	7%	–2.9	<.01	6%	6%	–0.7	0.22
State 11	2%	3%	–4.6	<.01	2%	3%	–0.5	0.36
State 12	<1%	1%	–1.9	<.01	<1%	1%	–1.0	0.06
State 13	1%	1%	7.9	<.01	1%	1%	–0.7	0.26

General county demographic variables, continued

	Unmatched				Matched			
Variable	REC participant	Non-participant	Standardized difference	p-value	REC participant	Non-participant	Standardized difference	p-value
State 14	1%	<1%	5.4	<.01	1%	1%	0.7	0.27
State 15	3%	4%	–8.8	<.01	3%	3%	–0.8	0.10
State 16	2%	2%	4.3	<.01	2%	2%	–0.4	0.51
State 17	1%	1%	1.3	0.01	1%	1%	0.1	0.86
State 18	2%	1%	4.9	<.01	2%	1%	0.6	0.36
State 19	1%	1%	–4.1	<.01	1%	1%	0.1	0.82
State 20	2%	2%	–0.6	0.23	2%	2%	0.7	0.17
State 21	2%	3%	–5.9	<.01	2%	2%	0.3	0.52
State 22	1%	<1%	3.0	<.01	1%	1%	0.6	0.28
State 23	3%	3%	–0.6	0.22	3%	3%	1.0	0.07
State 24	3%	1%	13.8	<.01	3%	3%	0.6	0.39
State 25	1%	2%	–6.0	<.01	1%	1%	–0.1	0.91
State 26	1%	1%	0.3	0.58	1%	1%	0.0	0.95
State 27	<1%	<1%	2.2	<.01	<1%	<1%	–0.3	0.59
State 28	3%	2%	8.9	<.01	3%	3%	0.8	0.17
State 29	<1%	<1%	3.8	<.01	<1%	<1%	1.3	0.03
State 30	1%	<1%	7.4	<.01	1%	1%	1.4	0.02
State 31	1%	1%	2.9	<.01	1%	1%	0.1	0.80
State 32	5%	2%	17.1	<.01	5%	6%	–0.3	0.62
State 33	1%	1%	1.4	<.01	1%	1%	–0.9	0.14
State 34	1%	1%	–3.0	<.01	1%	1%	–0.2	0.67
State 35	8%	8%	1.6	<.01	8%	8%	0.5	0.33
State 36	6%	3%	11.4	<.01	6%	6%	0.0	0.97
State 37	1%	2%	–8.5	<.01	1%	1%	0.7	0.12
State 38	2%	1%	10.7	<.01	2%	2%	1.9	<.01
State 39	4%	4%	2.1	<.01	4%	4%	–0.1	0.83
State 40	3%	1%	8.3	<.01	3%	3%	–1.8	<.01

General county demographic variables, continued

	Unmatched				Matched			
Variable	REC participant	Non-participant	Standardized difference	p-value	REC participant	Non-participant	Standardized difference	p-value
State 41	1%	<1%	4.9	<.01	1%	1%	0.1	0.85
State 42	1%	1%	1.4	<.01	1%	1%	–0.3	0.62
State 43	1%	<1%	6.7	<.01	1%	<1%	1.1	0.11
State 44	1%	2%	–9.8	<.01	1%	1%	0.2	0.63
State 45	5%	8%	–14.0	<.01	5%	5%	–0.1	0.76
State 46	1%	<1%	3.8	<.01	1%	1%	0.2	0.78
State 47	2%	2%	1.8	<.01	2%	2%	0.0	0.94
State 48	1%	<1%	6.6	<.01	1%	<1%	0.9	0.17
State 49	2%	2%	1.8	<.01	2%	2%	0.5	0.38
State 50	2%	1%	1.5	<.01	2%	1%	0.4	0.50
State 51	1%	<1%	6.4	<.01	1%	1%	1.1	0.08
State 52	<1%	<1%	0.6	0.22	<1%	<1%	0.5	0.32

Appendix E. Instrument Development and Instruments

Cognitive interviews

Methods, procedures, and participants. The purpose of the cognitive interviews was to explore concepts and language in the screening questionnaire and survey from the perspective of an eligible respondent to help reduce response error. Interviewees were primary care providers participating in the REC program and primary care providers *not* participating in the REC program. Inclusion criteria were:

- Primary care providers, nurse practitioners, or practice managers (e.g., general practice, general preventive medicine, internal medicine, OB/GYN, pediatrics, adolescent medicine, public health) AND
- Practices of 10 or fewer providers OR working in settings serving more than 30 percent Medicaid or uninsured patients.

REC participants. REC Project Officers contacted their REC provider networks to recruit interviewees to participate in remote telephone interviews. Interviewees contacted AIR if they were interested in participating and met the inclusion criteria.

Nonparticipants. AIR worked with the American Academy of Family Physicians (AAFP) to identify interviewees from its member network *not* participating in the REC program to take part in remote telephone interviews. A recruitment message was distributed to AAFP's "Electronic Medical Record" listserv—approximately 1,000 physicians—explaining the purpose of the cognitive interviews. Interviewees contacted AIR if they were interested in participating and met the inclusion criteria.

AIR also worked with a professional recruitment firm to identify interviewees from primary care practices *not* participating in the REC program. The firm identified eligible participants to participate in in-person interviews with AIR staff in the San Francisco Bay Area and the Washington, DC, Metro Area.

AIR staff conducted nine, 60-minute telephone interviews and three in-person cognitive interviews in March and April 2013. Respondent characteristics are shown in Exhibit E1.

Exhibit E1. Summary of Cognitive Interview Respondents

REC participant?	Role in practice	Number of staff in practice
Yes	Nurse practitioner	20 physicians
Yes	Physician	1 medical doctor, 1 physician assistant
Yes	Practice owner	Solo practice
Yes	Physician	n/a
Yes	Nurse practitioner	n/a
No	Family medicine	14 physicians (9 primary care); >45% Medicaid patients
No	Family physician	2-physician private practice
No	Nurse	4 doctors, 3 nurse practitioners, 6 administrative
No	Staff physician (family medicine)	n/a
No	Office manager	4 doctors, 2 administrative
No	Practice manager	4 doctors, 4 medical assistants, 5 administrative
No	Physician	3-physician practice

Screening questionnaire

Form Approved
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Exp. Date 03/31/2017

This study seeks to understand challenges with adopting and using EHRs and the help that practices that provide primary care services, like yours, have received to meet those challenges. The survey should be completed by the person most familiar with EHR selection, implementation, and use in your practice. This may be you, another clinician, practice manager, nurse, Information Technology staff, or another employee.

It should take you about 5 minutes to answer these questions. All the information you provide will be kept confidential.

Please answer each question as best you can by placing a check mark or an X to the left of the answer you choose. Sometimes you will be asked to skip a question. When this happens, an arrow to the right of the answer choice will tell you what question to skip to.

For example:

____ Yes → Go to Question 3
____ No → Go to Question 3

Please Turn to the Other Side

According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0955-0015. The time required to complete this information collection is estimated to average 5 minutes per response, including the time to review instructions, search existing data resources, gather the data needed, and complete and review the information collection. If you have comments concerning the accuracy of the time estimate(s) or suggestions for improving this form, please write to U.S. Department of Health & Human Services, OS/OCIO/PRA, 200 Independence Avenue, SW, Suite 336-E, Washington DC 20201, Attention: PRA Reports Clearance Officer.

1. Does this practice use an electronic health record (EHR) or electronic medical record (EMR) system? Do not include billing record systems.

   a) ____ Yes, all electronic → Go to Question 2
   b) ____ Yes, part paper and part electronic → Go to Question 2
   c) ____ No → Go to Question 3
   d) ____ Uncertain → Go to Question 3

2. In which year did you install your current EHR?

   __ __ __ __ Year (YYYY) → Go to Question 5
   __ __ __ __ Uncertain → Go to Question 5

3. At this practice, are there plans for installing a new EHR system within the next 12 months?

   a) ____ Yes, currently in process of installing an EHR → Go to Question 5
   b) ____ Yes, there are plans to install an EHR within the next 12 months → Go to Question 5
   c) ____ No, there are no plans to install an EHR within the next 12 months → Go to Question 4
   d) ____ Maybe → Go to Question 4
   e) ____ Unknown → Go to Question 4

4. If you do not have an EHR system, why would your practice *not* plan on purchasing and installing an EHR system in the next 12 months? *(Check all that apply)***.**

   a) ____ Physician(s) plan to retire soon
   b) ____ Lack of time
   c) ____ Lack of staff
   d) ____ Lack of financial resources
   e) ____ Privacy/security concerns
   f) ____ No interest in doing so
   g) ____ Don't see enough patients to justify purchasing and installing an EHR system
   h) ____ Other. Please specify:_____

5. Which of the following would you classify your practice as? *(Circle only* one *response for each item.)*

		Yes	**No**
a)	Private office-based solo or group practice?	Y	N
b)	Freestanding clinic/urgicenter (not part of a hospital outpatient department)?	Y	N
c)	Community Health Center (e.g., Federally Qualified Health Center (FQHC), federally funded clinic or "look-alike" clinic)?	Y	N
d)	Mental Health Center?	Y	N
e)	Non-federal government clinic (e.g., state, county, city, maternal-child health, etc.)?	Y	N
f)	Family planning clinic (including Planned Parenthood)?	Y	N
g)	Health maintenance organization or other pre-paid practice (e.g., Kaiser Permanente)?	Y	N
h)	Faculty practice plan (an organized group of physicians that treat patients referred to an academic medical center)?	Y	N

i) Hospital emergency department?.....Y N

6. How many of the following types of staff are working at this practice, including yourself? If none, please write 0.
   a) ____ Number of physicians (MD, DO)
   b) ____ Number of nurse practitioners (NP), certified nurse midwives, and physician assistants (PA)
   c) ____ Number of nurses
   d) ____ Number of medical assistants (MA) and other clinical staff (e.g., Laboratory technician)
   e) ____ Number of Information Technology (IT) staff
   f) ____ Number of other administrative/other non-clinical staff (e.g., executives, practice managers, billing specialists, front office staff)

7. Roughly, what percent of the patients treated at this practice are:
   a) Insured by Medicare? ____%
   b) Insured by Medicaid? ____%
   c) Uninsured? ____%

8. We may call to hear more about your practice's experiences with EHR systems. We would like to speak with the person most familiar with EHR selection, implementation, and use in your practice. This may be you, a clinician, a practice manager, a nurse, Information Technology staff, or some other employee. Who is the person most familiar with EHR selection, implementation, and use in your practice?

   What is the name of this person? *(Please print name)*

   _____
   First Name Last Name

   What is the best time and day(s) of the week to call him/her?

   _____
   Day(s) Time(s)

   What is the best work number to reach him/her?

   (_____) _____
   Area Code Phone Number

Thank you very much for completing this survey. We appreciate your time. Please return this survey in the enclosed envelope (no postage is necessary).

Survey

Form Approved
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Exp. Date 03/31/2017

1. Does this practice use an electronic health record (EHR) or electronic medical record (EMR) system? Do not include billing record systems.

   a) ____ Yes → Go to Q2.
   b) ____ No → Screen out, go to Q36.
   c) ____ Uncertain → Screen out, go to Q36.

2. Did your practice transition from using paper charts to an EHR **(READ a–c)?**

   a) ____ Yes, we transitioned from paper charts to using an EHR
   b) ____ No, this practice opened with an EHR
   c) ____ Uncertain

3. In which year did you install your current EHR?

   a) _____ Year (YYYY)
   b) ____ Uncertain

4. Is your current EHR system certified to meet meaningful use, as defined by the Department of Health and Human Services? **[If needed by respondent, interviewer can provide definition.]**

   Meaningful use is a way to optimize health care and use technology to improve patient care and is defined by standards set by the Department of Health and Human Services. Certified EHRs meet these established standards and other criteria for structured data. Certified EHR technology gives assurance to purchasers and other users that an EHR system or module offers the necessary technological capability, functionality, and security to help them meet the meaningful use criteria. Certification also helps providers and patients be confident that the electronic health IT products and systems they use are secure, can maintain data confidentially, and can work with other systems to share information. **[After reading, ask Q4 again.]**

   a) ____ Yes → Go to Q5.
   b) ____ No → Go to Q6.
   c) ____ Uncertain → Go to Q6.

5. To meet the *meaningful use* certification standards, did you have to **(READ a–c)**

   a) ____ Upgrade your EHR software? → Go to Q7.
   b) ____ Install a different EHR system? → Go to Q7.
   c) ____ Neither upgrade your EHR system nor install a different EHR system? → Go to Q7.
   d) ____ Uncertain → Go to Q7.

6. To meet the *meaningful use* certification standards, do you plan **(READ a–c)**
   a) ____ To upgrade your EHR software to a new version?
   b) ____ To install an entirely new EHR system?
   c) ____ Neither to upgrade your EHR system nor install a different EHR system?
   d) ____ Uncertain.

7. Medicare and Medicaid offer incentive programs to providers that demonstrate "meaningful use of their EHR system." Have you applied for the *Medicare* Incentive Program?
   a) ____ Yes → Go to Q9.
   b) ____ No → Go to Q8.
   c) ____ Uncertain → Go to Q8.

8. Have you applied for the *Medicaid* Incentive Program?
   a) ____ Yes → Go to Q9.
   b) ____ No → Go to Q12.
   c) ____ Uncertain → Go to Q12.

9. In what year did you first apply for an EHR incentive program **(READ a–d)?**
   a) ____ 2011
   b) ____ 2012
   c) ____ 2013
   d) ____ 2014
   e) ____ Uncertain

10. How easy or difficult was it for you to use the online system to attest to the *meaningful use* criteria? Was it **(READ a–e)**
    a) ____ Extremely easy → Go to Q16.
    b) ____ Somewhat easy → Go to Q16.
    c) ____ Somewhat difficult → Go to Q11.
    d) ____ Extremely difficult → Go to Q11.
    e) ____ Uncertain → Go to Q16.

11. Did you receive help or assistance to address this difficulty?
    a) ____ Yes → Go to Q16.
    b) ____ No → Go to Q16.
    c) ____ Uncertain → Go to Q16.

12. Do you intend to apply for an EHR incentive program **(READ a–c)?**
    a) ____ Yes, I intend to apply → Go to Q13.
    b) ____ No, I do not intend to apply → Go to Q15.
    c) ____ Uncertain if I will apply → Go to Q15.

13. In what year do you intend to apply for an EHR incentive program **(READ a–c)?**
    a) ____ 2014
    b) ____ 2015 or later
    c) ____ Unknown

14. Which incentive program do you intend to apply for? Do you intend to apply for **(READ a–b)**

a) ____ The Medicare Incentive Program → Go to Q16.
b) ____ The Medicaid Incentive Program → Go to Q16.
c) ____ Uncertain → Go to Q16.

15. Which of the following are reasons you have not applied for an EHR incentive program? The first is **(READ a–h)**

	Yes	No
a) You are not qualified as an "eligible provider"?	Y	N
b) You do not see enough Medicaid patients?	Y	N
c) You do not see enough Medicare patients?	Y	N
d) The process to apply is difficult?	Y	N
e) You are not familiar with the incentive program(s)?	Y	N
f) You are unsure that incentives will actually be paid?	Y	N
g) Your EHR system does not exchange health information **e**lectronically with other providers (e.g., EHR systems "don't talk to each other")?	Y	N
h) You are not prepared to implement electronic prescribing?	Y	N

16. I'm going to read some statements about your practice's EHR.

Please tell me whether you *Strongly agree, Agree, Disagree, or Strongly disagree* with each of the following statements (READ a–c).	**Strongly agree**	**Agree**	**Disagree**	**Strongly disagree**	**Uncertain**
a) Your EHR provides financial benefits for your practice.	SA	A	D	SD	U
b) Overall, your practice has functioned more efficiently with an EHR system.	SA	A	D	SD	U
c) Your EHR helps your practice to deliver better patient care.	SA	A	D	SD	U

17. Overall, how satisfied or dissatisfied are you with your EHR system **(READ a–d)?**

a) ____ Very satisfied
b) ____ Satisfied
c) ____ Dissatisfied
d) ____ Very dissatisfied

18. On a scale of 0 to 10, with 0 being not at all likely and 10 being extremely likely, how likely are you to recommend your EHR system to others?

Extremely likely										**Not at all likely**
10	9	8	7	6	5	4	3	2	1	0

This next section focuses on challenges or difficulties that your practice may have faced with your EHR and assistance that you may have received to address those difficulties.

Adopting and implementing

19. I'm going to name some issues that some practices face during the transition from using paper records to electronic health records or when upgrading from a previous EHR system to a new version of the same software.

Please indicate how difficult or easy each issue was for your practice, using the scale of extremely difficult, somewhat difficult, neither difficult nor easy, somewhat easy, or extremely easy. (READ a–k.)	**Extremely difficult**	**Somewhat difficult**	**Neither difficult nor easy**	**Somewhat easy**	**Extremely easy**
a) Assess your practice's hardware requirements	ED	SD	N	SE	EE
b) Assess your practice's software requirements, including Internet connectivity	ED	SD	N	SE	EE
c) Select your current EHR system	ED	SD	N	SE	EE
d) Negotiate a contract for your current EHR with a vendor or company	ED	SD	N	SE	EE
e) **(ONLY ASK IF INSTALLED NEW EHR PER Q5.)** Get support or customer help from the maker of your current EHR system during *installation* of your current system, if needed?	ED	SD	N	SE	EE
f) (ONLY ASK IF INSTALLED NEW EHR PER Q5.) Get support or customer help from the maker of your current EHR system during *implementation* of your current system, if needed?	ED	SD	N	SE	EE
g) (ONLY ASK IF UPGRADED EHR PER Q5.) To get support from the maker of your current EHR system when upgrading to your current EHR version, if needed	ED	SD	N	SE	EE
h) Design or redesign your practice's workflow to accommodate your current EHR system	ED	SD	N	SE	EE
i) Implement the workflow design or redesign that accommodates your current EHR system	ED	SD	N	SE	EE

Please indicate how difficult or easy each issue was for your practice, using the scale of extremely difficult, somewhat difficult, neither difficult nor easy, somewhat easy, or extremely easy. (READ a–k.)	**Extremely difficult**	**Somewhat difficult**	**Neither difficult nor easy**	**Somewhat easy**	**Extremely easy**
j) Initially train staff to use your current EHR system	ED	SD	N	SE	EE
k) Protect the privacy and security of electronic health information	ED	SD	N	SE	EE

20. Did you receive any help or assistance in adopting and implementing your current EHR system?
    a) ____ Yes
    b) ____ No
    c) ____ Uncertain

21. During the implementation of your current EHR system, did your practice experience a *decrease* in the number of patient visits per week?
    a) ____ Yes → Go to Q22.
    b) ____ No → Go to next section

22. Is your practice back to the same number of patient visits per week as before EHR implementation?
    a) ____ Yes → Go to Q23
    b) ____ No → Go to next section.

23. How many months did it take your practice to get back to the same number of patient visits?
    a) _____ months

Use and meaningful use

(If Yes/Uncertain to Q4, start at beginning of the section.)
(If No to Q4, skip to Q30—care transformation.)

This section deals with issues and difficulties that some practices face when "meaningfully using" their EHR systems.

(READ.) As a reminder, meaningful use is the set of standards from the Department of Health and Human Services about use of electronic health records (EHRs). The goal of meaningful use is to promote the spread of EHRs to improve health care.

Meaningful use focuses on

- Capturing health information in a standard format and using that information to track key clinical conditions
- Communicating information for care coordination
- Initiating the reporting of clinical quality measures and public health information
- Using information to engage patients and their families in their care

24. I'm going to name some common features of EHR systems that practices use to demonstrate meaningful use of their EHR systems.

For each feature named, please let me know whether your practice routinely uses the function, and if not, whether your EHR system has the feature. Do you routinely use your EHR for (READ a–p)	**Routine use**		**(ASK IF NO TO ROUTINE USE): Does your EHR have this feature?**	
	Yes	**No**	**Yes**	**No**
a) Recording demographic information	Y	N	Y	N
b) Recording a patient problem list	Y	N	Y	N
c) Recording and charting vital signs	Y	N	Y	N
d) Recording patient smoking status	Y	N	Y	N
e) Recording clinical notes that include active medications	Y	N	Y	N
f) Recording clinical notes that include active medication allergies	Y	N	Y	N
g) Ordering prescriptions	Y	N	Y	N
h) If yes, are prescriptions sent electronically to the pharmacy?	Y	N	Y	N
i) If yes, are warnings of drug interactions or contraindications provided?	Y	N	Y	N
j) Providing reminders for guideline-based interventions or screening tests	Y	N	Y	N

For each feature named, please let me know whether your practice routinely uses the function, and if not, whether your EHR system has the feature. Do you routinely use your EHR for (READ a–p)	Routine use		(ASK IF NO TO ROUTINE USE): Does your EHR have this feature?	
k) Reporting clinical quality measures to federal or state agencies (such as CMS or Medicaid)	Y	N	Y	N
l) Generating lists of patients with particular health conditions	Y	N	Y	N
m) Electronic reporting to immunization registries	Y	N	Y	N
n) Providing patients with clinical summaries for each visit	Y	N	Y	N
o) Exchanging secure messages with patients	Y	N	Y	N
p) Providing patients with an electronic copy of their health information	Y	N	Y	N

25. **(Ask if respondent replied Yes to routinely using any of the EHR features per Q24, a–p.)** You've reported routinely using at least one of the features of an EHR system to show achievement of meaningful use. Some practices may experience difficulties in routinely using these features. How easy or difficult was it to routinely use the function(s) of your EHR system?

    a) ____ Extremely easy
    b) ____ Somewhat easy
    c) ____ Neither easy nor difficult
    d) ____ Somewhat difficult
    e) ____ Extremely difficult

26. **(Ask if respondent replied Yes to routinely using any of the EHR features per Q24, a–p.)** Did your practice receive any help or assistance in routinely using the meaningful use function(s) of your EHR?

    a) ____ Yes
    b) ____ No
    c) ____ Uncertain

27. **(Ask if Yes to Q20, Yes to Q26, or Yes to both Q20 and Q26.)** You've reported getting help with adopting, implementing, and/or routinely using your practice's EHR system. I'm going to read several organizations to find out whether you received help from any of them and, if so, whether the help you received met your needs.

Did you receive help from (READ a–e)	Received help			(ASK IF YES TO RECEIVED HELP.) Did the help that you received from them meet your needs?		
	Yes	**No**	**Don't know**	**Yes**	**No**	**Don't know**
a) An EHR vendor or the company that sold you your EHR?	Y	N	DK	Y	N	DK
b) A local Regional Extension Center or affiliate?	Y	N	DK	Y	N	DK
c) A professional association (e.g., the American Association of Family Physicians)?	Y	N	DK	Y	N	DK
d) A local hospital or health system?	Y	N	DK	Y	N	DK
e) A payer/insurance company?	Y	N	DK	Y	N	DK

28. Were there any other external organization(s) your practice paid to help you with meaningful use?
    a) ____ Yes → Go to Q29.
    b) ____ No → Go to Q30.
    c) ____ Don't know → Go to Q30.

29. Did the help that you received from those other external organization(s) meet your needs?
    a) ____ Yes
    b) ____ No
    c) ____ Don't know

This next section focuses on care transformation.

Care transformation

30. Entities that certify practices as Patient-Centered Medical Homes, or PCMHs, include the National Committee for Quality Assurance, the Joint Commission, URAC, Bridges to Excellence, insurers, and some other state and national groups. Is your practice
    a) ____ Currently participating in a PCMH arrangement? Yes → Go to Q31.
    b) ____ In the process of receiving certification as a PCMH? Yes → Go to Q31.
    c) ____ Neither? → Go to Q32.

31. Does your practice receive compensation, other than fees for routine visits, for offering Patient-Centered Medical Home services?
    a) ____ Yes → Go to Q33.
    b) ____ No → Go to Q33.
    c) ____ Uncertain→ Go to Q33.

32. Does your practice seek to participate in a PCMH arrangement within the next 12 months?
    a) ____ Yes
    b) ____ No
    c) ____ Uncertain

33. Does your practice participate in a pay-for-performance program or bundled payment arrangement in which you can receive financial bonuses based on your performance?
    a) ____ Yes → Go to Q35.
    b) ____ No → Go to Q34.
    c) ____ Uncertain → Go to Q35.

34. Does your practice plan to participate in a pay-for-performance program or bundled payment arrangement within the next 12 months?
    a) ____ Yes
    b) ____ No
    c) ____ Uncertain

35. Does your practice participate in an accountable care organization or other similar arrangement by which you may share savings with insurers, such as private insurance, Medicare, Medicaid, and other public options?
    a) ____ Yes → Go to Q37.
    b) ____ No → Go to Q36.
    c) ____ Uncertain → Go to Q37.

36. Does your practice plan to participate in an accountable care organization within the next 12 months?
    a) ____ Yes
    b) ____ No
    c) ____ Uncertain

This final section asks a few questions about you and your practice.

System information and demographics

37. What is your main job function or role?
    a) ____ Physician
    b) ____ Nurse practitioner, certified nurse midwife, physician's assistant
    c) ____ Nurse
    d) ____ Medical assistant
    e) ____ Other clinical staff
    f) ____ Practice/office manager
    g) ____ IT staff
    h) ____ Billing specialist
    i) ____ Executive staff (CEO, COO, CFO, etc.)
    j) ____ Other administrative/nonclinical staff
    k) ____ Other. Please specify: _____

38. Is this practice or clinic a single- or multispecialty (group) practice?

a) ____ Single
b) ____ Multispecialty

Before we end, I'd like to give you a chance to share any additional thoughts or comments about the information we talked about today. Is there anything else you would like to add?

(SPECIFY): _____

Thank you very much for participating in this survey today. We appreciate your time.

—END OF SURVEY—

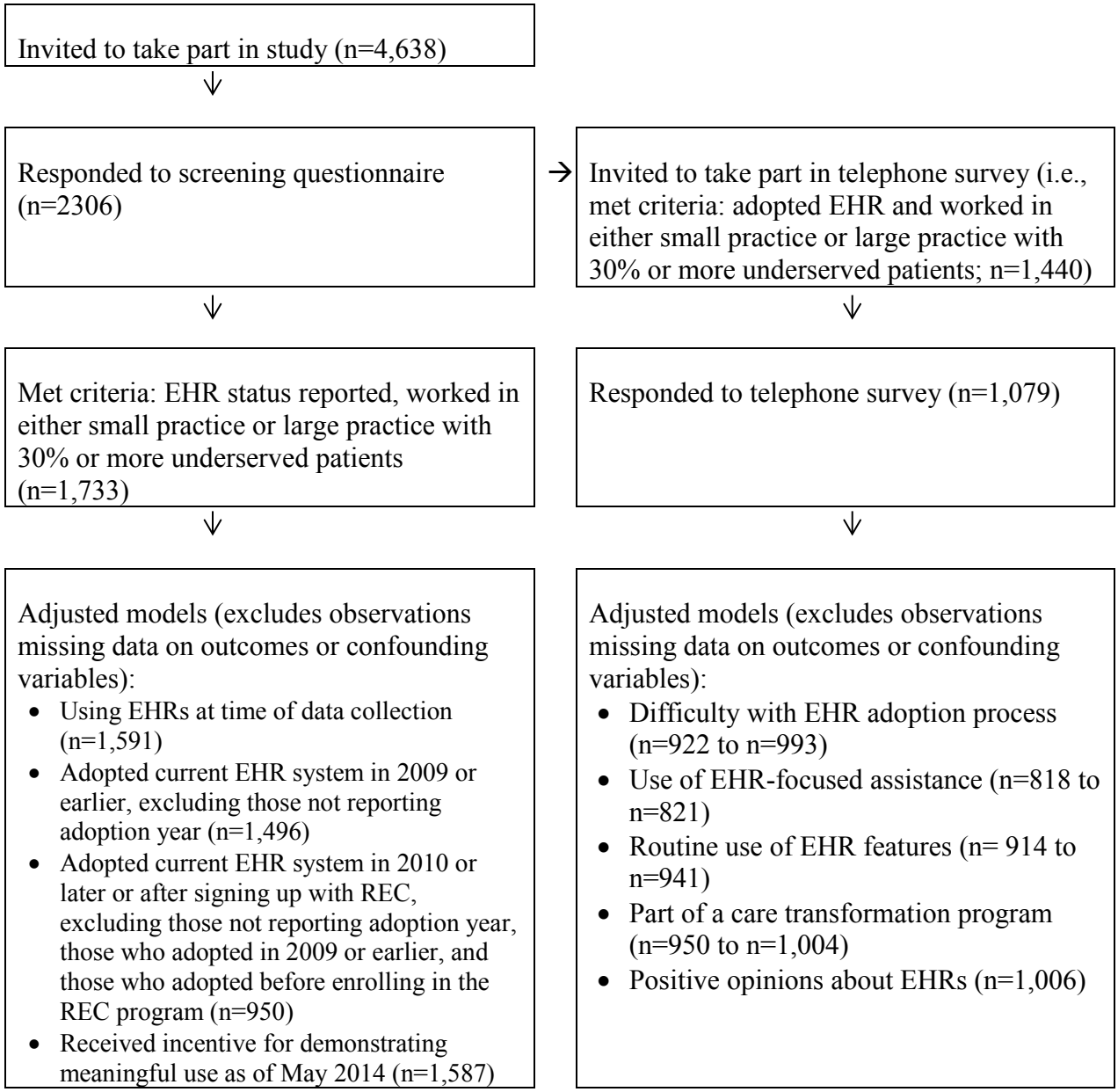
Appendix F. Outcome Categories, Variables, Values, and Data Sources

Outcome categories	Variable	Values	Data sources, year
Experienced difficulty with EHR adoption	▪ Assessing hardware requirements ▪ Assessing software requirements ▪ Selecting EHR system ▪ Negotiating contract with EHR vendor ▪ Designing or redesigning workflow ▪ Implementing workflow that accommodates EHRs ▪ Training staff to use EHR ▪ Protecting data privacy and security	Somewhat easy, Extremely easy, or Neither difficult nor easy (0); Somewhat difficult or Extremely difficult (1)	Telephone Survey, 2014
Used assistance services	▪ EHR vendor ▪ Professional association ▪ Local hospital or health system ▪ Payer/insurance company	No/uncertain (0); Yes (1)	Telephone Survey, 2014
Adopted EHRs	▪ Currently using an EHR ▪ Acquired current EHR in 2009 or earlier (excluding those missing adoption year) ▪ Acquired current EHR after signing on with an REC or in 2010 or later (excluding those missing adoption year, those who adopted in 2009 or earlier, and those who adopted their EHR before signing on with REC)	No (0); all EHR or part paper part EHR (1)	Screening questionnaire, 2014
Routinely used EHRs' meaningful use features	▪ Recording demographic information ▪ Recording a patient problem list ▪ Recording and charting vital signs ▪ Recording patient smoking status ▪ Recording clinical notes that include active medications ▪ Recording clinical notes that include active medication allergies ▪ Ordering prescriptions ▪ Providing reminders for guideline-based interventions or screenings ▪ Reporting clinical quality measures to federal or state agencies ▪ Generating lists of patients with particular health conditions ▪ Electronic reporting to immunization registries ▪ Providing patients with clinical summaries for each visit ▪ Exchanging secure messages with patients ▪ Providing patients with an electronic copy of their health information	No (0); Yes (1)	Telephone Survey, 2014

Outcome categories	Variable	Values	Data sources, year
Received incentives	▪ Received incentives through the CMS Medicare and Medicaid Incentive Programs after signing up for REC participation if REC participant or at all if nonparticipant	No (0); Yes (1)	Administrative data, 2014 (NOTE 1)
Took part in a care transformation program	▪ Pay for performance ▪ Accountable care organization ▪ Patient-Centered Medical Home (PCMH)	No/uncertain (0); Yes (1)	Telephone Survey, 2014 (NOTE 2)
Held positive opinions about EHRs	▪ EHR provides financial benefits ▪ Practice functions more efficiently with EHR ▪ EHR helps practice deliver better patient care	Strongly disagree, Disagree, or Neither disagree nor agree (0); Strongly agree or Agree (1)	Telephone Survey, 2014

(NOTE 1) This secondary data source from ONC lists providers who achieved Stage 1 meaningful use and who received incentives through the Medicare and Medicaid Incentive Programs. Data were acquired in May 2014.
(NOTE 2) These survey items about care transformation programs were modeled after similar items in the National Ambulatory Medical Care Survey. The items asked, "Does your practice participate in a pay-for-performance program or bundled payment arrangement in which you can receive financial bonuses based on your performance? Does your practice participate in an accountable care organization or other similar arrangement by which you may share savings with insurers, such as private insurance, Medicare, Medicaid, and other public options?" (http://www.cdc.gov/nchs/data/ahcd/2013_NAMCS_Physician_Workflow_Supplement_for_EHR_Adopters.pdf)

Appendix G. Sample Sizes at Each Study Step



Appendix H. Characteristics of the Physicians Who Completed the Screening Questionnaire and Survey, by REC Participation, Unadjusted

Exhibit H1. Characteristics of Physicians Who Completed the Screening Questionnaire, by REC Participation

Category	Variable	Non-participants (n=706)	REC participants (n=1027)	Total (n=1733)	p-value
Individual	Age (years)	51.54	51.44	51.49	0.84
	Doctor of osteopathy (%)	11.76	9.93	10.68	0.23
	Female (%)	38.81	41.09	40.16	0.34
	Family practice (%)	38.67	40.02	39.47	0.57
	Internal medicine, geriatrics, public health (%)	24.08	26.97	25.79	0.18
	Pediatrics (%)	19.83	19.77	19.79	0.97
	Obstetrics/gynecology (%)	17.42	13.24	14.95	0.02
Practice	Private (%)	88.67	85.20	86.61	0.04
	Federally qualified health centers (%)	7.37	15.00	11.89	<0.01
	Medicare in practice (%)	24.40	28.10	26.59	<0.01
	Medicaid in practice (%)	18.73	26.17	23.17	<0.01
	Total practice size for all staff	40.15	36.58	38.03	0.61
County	Number of FQHCs in county	10.32	8.56	9.27	0.07
	Number of rural clinics in county	0.67	0.80	0.75	0.31
	Practices in a Beacon community (%)	6.52	6.43	6.46	0.94
	Number of hospitals in county, 6–49 beds	1.19	1.00	1.08	0.03
	50–99 beds	1.29	1.13	1.19	0.14
	100–199 beds	0.91	0.73	0.80	0.03
	200–299 beds	0.33	0.27	0.29	0.09
	300 or more beds	0.40	0.30	0.34	0.01
	Percent with Medicare in county (%)	12.85	12.98	12.93	0.44
	Percent with Medicaid in county (%)	19.42	19.47	19.45	0.92
	Percent under 65 and uninsured in county (%)	16.68	16.71	16.70	0.93
	Urban area	0.17	0.18	0.17	0.47
	Unemployment rate in county (%)	9.60	9.65	9.63	0.70

Exhibit H2. Characteristics of Physicians Who Completed the Telephone Survey, by REC Participation

Category	Variable	Non-participants (n=345)	REC participants (n=734)	Total (n=1079)	p-value
Individual	Age (years)	50.08	51.59	51.11	0.02
	Doctor of osteopathy (%)	12.46	10.49	11.12	0.34
	Female (%)	42.31	41.42	41.71	0.78
	Family practice (%)	41.45	42.23	41.98	0.81
	Internal medicine, geriatrics, public health (%)	22.90	24.52	24.00	0.56
	Pediatrics (%)	18.84	20.03	19.65	0.65
	Obstetrics/gynecology (%)	16.81	13.22	14.37	0.12
Practice	Private (%)	87.25	87.60	87.49	0.87
	Federally qualified health centers (%)	10.72	15.26	13.81	0.04
	Medicare in practice (%)	23.60	28.03	26.61	<0.01
	Medicaid in practice (%)	21.43	25.97	24.53	<0.01
	Total practice size for all staff	45.92	36.46	39.47	0.31
County	Number of FQHCs in county	8.81	8.78	8.79	0.98
	Number of rural clinics in county	0.57	0.82	0.74	0.06
	Practices in a Beacon community (%)	6.96	5.99	6.30	0.54
	Number of hospitals in county, 6–49 beds	1.08	0.96	1.00	0.30
	50–99 beds	1.10	1.10	1.10	0.99
	100–199 beds	0.82	0.72	0.75	0.38
	200–299 beds	0.30	0.27	0.28	0.60
	300 or more beds	0.35	0.31	0.32	0.32
	Percent with Medicare in county (%)	12.82	13.06	12.98	0.25
	Percent with Medicaid in county (%)	18.91	19.63	19.40	0.18
	Percent under 65 and uninsured in county (%)	16.62	16.84	16.77	0.57
	Urban area	0.15	0.20	0.19	0.06
	Unemployment rate in county (%)	9.50	9.58	9.55	0.66

Appendix I. Limitations and Sensitivity Analyses

Selection bias

An important study limitation (partially addressed with propensity score matching and other statistical controls) is positive or negative selection of individual physicians into the REC program. Although we identified a suitable comparison group based on observable characteristics, we are unable to account for unobservable characteristics. For example, nonparticipants may (a) already have adopted EHRs and therefore not needed REC help or (b) have been fundamentally uninterested in health IT and, therefore, unwilling to participate at all. To the extent that the observed background variables used in the propensity score matching were uncorrelated with these selection variables, bias may affect results.

To address remaining bias, we conducted sensitivity analyses that used exogenous instrumental variables to remove physician-level selection bias from estimates. We used historical local factors—total teaching physicians and total general practice teaching physicians in 2005, and number of hospitals with medical school affiliation in 2010—at the county level as our instrumental variables. Results were generally consistent with those in Chapter 5. We used the instrumental variable approach to assess only the sensitivity of estimates potentially affected by selection bias because instrumental variables-based estimates tend to be imprecise.[8]

As discussed in the methods chapter, we matched REC participants and nonparticipants, sampled physicians, and then administered a screening questionnaire. The additional background information from the screening questionnaire allowed us to refine the matching procedure. We conducted a sensitivity analysis to see if such a second round of propensity score matching would change the impact results and found no substantial differences. Instead of doing two rounds of propensity score matching, we included background variables on which REC participants and nonparticipants differed as statistical control variables in the impact analyses.

Exhibit I1. Comparison of Analyses for EHR Adoption Outcome, Among Screening Questionnaire Respondents

Category	Logistic regression (main finding)	Propensity score matching of REC participants to nonparticipants followed by logistic regression on outcomes	Instrumental variable
n	950	711	950
Odds ratio (95% CI)	6.52 (4.86, 8.74)	5.68 (4.04, 7.99)	10.15 (4.52, 22.76)
Pseudo R^2	0.17	0.16	0.17

[8] Instrumental variables analysis uses exogenous variation in program participation (unaffected by individual-level selection) to estimate the impact of participation on an outcome. The exogenous instrumental variable typically only explains a small part of the overall variation in participation, resulting in imprecision.

Category	Logistic regression (main finding)	Propensity score matching of REC participants to nonparticipants followed by logistic regression on outcomes	Instrumental variable
Pearson-Windmeijer goodness-of-fit test	p=0.88	p=0.22	p=0.87
Confounders (REC participants and nonparticipants differed on these factors)	Whether respondent was in obstetrics/gynecology, worked in a private practice, worked in an FQHC, percentage of patients with Medicare, percentage of patients with Medicaid, number of hospitals in the county with 6 to 49 beds, number with 100 to 199 beds, number with 300 or more beds	Total practice size, Hospitals with 50–99 beds, percent of county with Medicaid, percent of county with Medicare, per capita primary care providers, urban setting, percent of population in urban setting, and number of household incomes below $10k	Whether respondent was in obstetrics/gynecology, worked in a private practice, worked in an FQHC, percentage of patients with Medicare, percentage of patients with Medicaid, number of hospitals in the county with 6 to 49 beds, number with 100 to 199 beds, number with 300 or more beds
IV strength	Not applicable	Not applicable	p=0.0002

NOTE. EHR adoption defined as "Adopted Current Full or Partial EHR in 2010 or Later" or "Adopted Current Full or Partial EHR After REC Signup Date." To generate propensity scores, we conducted logistic regression modeling of REC enrollment on factors for which REC participants and nonparticipants differed (i.e., whether respondent was in obstetrics/gynecology, worked in a private practice, worked in an FQHC, percentage of patients with Medicare, percentage of patients with Medicaid, number of hospitals in the county with 6 to 49 beds, number with 100 to 199 beds, number with 300 or more beds). Here, we applied a caliper matching procedure to match REC participants to nonparticipants on propensity score.

Exhibit I2. Comparison of Analyses for Receiving Incentive Outcome, Among Screening Questionnaire Respondents

Category	Logistic regression (main finding)	Propensity score matching of REC participants to nonparticipants followed by logistic regression	Instrumental variable
N	1,587	1,135	1,587
Odds ratio (95% CI)	18.33 (12.85, 26.14)	17.54 (12.20, 25.23)	12.13 (6.29, 23.34)
Pseudo R^2	0.28	0.28	0.28
Pearson-Windmeijer goodness-of-fit test	p=0.06	p=0.03	p=0.006
Confounders (REC participants and nonparticipants differed on these factors)	Whether respondent was in obstetrics/gynecology, worked in a private practice, worked in an FQHC, percentage of patients with Medicare, percentage of patients with Medicaid, number of hospitals in the county with 6 to 49 beds, number with 100 to 199 beds, number with 300 or more beds	Total practice size, Hospitals with 50–99 beds, percent of county with Medicaid, percent of county with Medicare, per capita primary care providers, urban setting, percent of population in urban setting, and number of household incomes below $10k	Whether respondent was in obstetrics/gynecology, worked in a private practice, worked in an FQHC, percentage of patients with Medicare, percentage of patients with Medicaid, number of hospitals in the county with 6 to 49 beds, number with 100 to 199 beds, number with 300 or more beds
IV strength	Not applicable	Not applicable	p=0.0002

NOTE. Receiving incentive outcome defined as "Received an Incentive Payment at Any Time for Nonparticipants" or "Received an Incentive Payment After Signup Date for REC Participants." To generate propensity scores, we conducted logistic regression modeling of REC enrollment on factors for which REC participants and nonparticipants differed (i.e., whether respondent was in obstetrics/gynecology, worked in a private practice, worked in an FQHC, percentage of patients with Medicare, percentage of patients with Medicaid, number of hospitals in the county with 6 to 49 beds, number with 100 to 199 beds, number with 300 or more beds). We applied a caliper matching procedure to match REC participants to nonparticipants on propensity score.

Generalizability

A limitation is whether our findings are generalizable to all primary care physicians. We conducted sensitivity analyses using only administrative data (vs. physicians sampled to take part in the study). Sensitivity analysis results were consistent with findings reported in Chapter 5.

To conduct sensitivity analyses, we built an analytic data using only administrative data. Then we conducted three models. For the dataset, we used a National Provider Identifier (NPI) to merge the American Medical Association (AMA) Masterfile and the customer relationship management (CRM) data. After excluding individuals in the CRM whose NPI did not match with the AMA database, we identified REC participants and nonparticipants. Second, we categorized individual physicians into one of 3,230 U.S. counties by using zip codes from the

AMA Masterfile. On the basis of county, we merged in information from the Area Health Resource File about the region. Then we excluded people missing county-level data, people without valid zip codes, and people working outside of the United States.

Model 1. Logistic regression on entire population from administrative data

We conducted a logistic regression to estimate the association of any incentive payment with REC participation, controlling for confounders. We stratified analyses by a variable within the AMA dataset that indicated solo practice, two-doctor practice, and group practice. This is because the incentive programs and RECs focused on small practice with 10 or fewer providers or large practices with at least 30 percent underserved patients. We clustered on REC to adjust standard errors and evaluated model quality, using Pseudo R^2 and H-L goodness of fit.

Model 2. Logistic regression of p-score matched sample

A limitation of Model 1 is selection bias, or inadequately addressing differences between REC participants and nonparticipants on both observed and unobserved characteristics. To address this limitation, we matched REC participants and nonparticipants on observable individual-level and county-level variables that likely predicted REC participation. This was intended to reduce the bias introduced by observable differences between the two groups. We used a caliper with replacement propensity-score matching procedures.

Model 3. Instrumental variable approach with entire population from administrative data

A limitation of Model 2 is that it does not account for unobservable characteristics (e.g., technology affinity) that may influence outcomes. These characteristics can bias estimates of REC participation on outcomes. For example, people who are more likely to get an incentive may become REC participants. To address this limitation, we apply an IV approach. This approach utilizes a set of variables that is correlated with REC participation but does not directly affect the outcome.

We use a set of historical local factors—total teaching M.D.s and total general practice teaching M.D.s in 2005, and number of hospitals with medical school affiliation in 2010—at the county level from Area Health Resource File (AHRF) as our instrumental variables to address omitted-variable bias.

Results for the three models

The following results show that REC participants had significantly higher odds of receiving an incentive for achieving Stage 1 meaningful use compared with nonparticipants after controlling for individual and county characteristics. The odds ratios show a decrease from Model 1 to Model 2 and then from Model 2 to Model 3 as we account for the influence of observable and unobservable differences between participants and nonparticipants that bias results. While these findings are for primary care providers in clinical practice, our main findings, reported in Chapter 5, are specific to those in small practices of 10 or fewer providers or large practices with greater than 30 percent Medicaid or uninsured patients.

Exhibit I3. Incentive Payment for REC Participants, Compared With Nonparticipants

Analysis population	All from administrative data	P-score matched sample from administrative data	All from administrative data, IV
n in models	▪ All n=178,143 ▪ Solo n=33,487 ▪ 2-doc n=7,618 ▪ Group n=92,682	▪ All n=120,666 ▪ Solo n=17,333 ▪ 2-doc n=4,957 ▪ Group n=67,047	▪ All n=178,143 ▪ Solo n=33,487 ▪ 2-doc n=7,618 ▪ Group n=92,682
OR (95% CI)	▪ All 37.84 (29.42, 48.66) ▪ Solo 44.28 (34.02, 57.63) ▪ 2-doc 37.05 (27.39, 50.10) ▪ Group 30.94 (23.53, 40.69)	▪ All 35.76 (27.49, 46.52) ▪ Solo 38.13 (30.45, 47.75) ▪ 2-doc 33.23 (23.66, 46.68) ▪ Group 30.07 (22.96, 39.38)	▪ All 36.83 (25.04, 54.16) ▪ Solo 28.46 (14.14, 57.26) ▪ 2-doc 20.44 (5.45, 76.72) ▪ Group 32.17 (21.22, 48.79)
Pseudo R^2	▪ All 0.4147 ▪ Solo 0.4442 ▪ 2-doc 0.4346 ▪ Group 0.3898	▪ All 0.3846 ▪ Solo 0.3938 ▪ 2-doc 0.3886 ▪ Group 0.3695	▪ All 0.4002 ▪ Solo 0.4461 ▪ 2-doc 0.4237 ▪ Group 0.3680
Goodness of fit, chi2	▪ All $p < 0.0001$ ▪ Solo p=1.0 ▪ 2-doc p=0.9965 ▪ Group p=0.0005	▪ All $p < 0.0001$ ▪ Solo p=0.9377 ▪ 2-doc p=0.7753 ▪ Group p=0.0001	▪ All p=0.9770 ▪ Solo p=1.0 ▪ 2-doc=1.0 ▪ Group=1.0
IV strength	Not applicable	Not applicable	P= 0.0010
Confounders used in all analyses	▪ Individual: age; graduation, female, M.D./D.O.; subspecialty in primary care ▪ Health care variables: FQHCs in county (continuous), hospitals by size in county ▪ Insurance variables: percentage of county population with Medicare, Medicaid, uninsured ▪ Health supply: number of rural clinics in county, primary care physicians per capita, Beacon community ▪ Demographics: urban setting, unemployed ▪ State dummies		

Response Bias Analysis

With response rates in the 50 percent range, we were concerned about response bias (e.g., REC participants with positive or negative experiences were more eager to respond to the survey). To identify the effect of nonresponse bias on our estimation, we first compared the regression results for the receipt of incentive outcome for screening questionnaire respondents with the full survey sample. Without excluding physicians working in HMOs, ERs, and large practices with less than 30 percent underserved, the difference in odds ratio of REC status is within 10 percent (full sample OR: 24.75; screening questionnaire respondent OR: 22.16). The regressions include the same individual and contextual variables as the main analyses, as covariates.

Second, we used a Heckman selection model to diagnose possible nonresponse bias (and to provide us with a statistical tool to remove it if we would find it). When inviting people to take

the survey, sample members were randomized to two mail types (Priority Mail or First-Class Mail) and four different incentive amounts (no incentive, $2, $5, or $10). Because these different mail and incentive types significantly predicted response status, we could use the variables associated with these methods in a Heckman selection model to account for the selection of individuals into either response or nonresponse groups.[9]

The Heckman selection model includes two equations: the main impact regression, which only includes survey participants and a separate selection model that estimates how participation in the survey varied with the incentive types. In the selection equation of incentive types, the dependent variable is a dummy flagging screening questionnaire response status, and the explanatory variable is incentive types, controlling for demographic and geographic background variables based on the full survey sample (n=4,630). The full impact regression equation is a probit model using the same dependent variables (i.e., EHR adoption, incentive payment) and independent variables as in the main analysis but with an additional variable constructed from the selection equation, the inverse Mills ratio (Heckman's lambda). The regression analysis also included statistical controls for the clustering of observations by REC. We used heckprobit from Stata 13 to conduct the analysis.[10]

We compared the result of a probit estimation from the screening questionnaire response sample without a Heckman selection correction with a similar estimation using the heckprobit function and found the results to be very similar. The differences in the coefficient on the REC participation variable were within 7 percent between the two probit models. For EHR adoption, the estimates were 1.07 from the screening questionnaire response sample vs. 0.99 from the Heckman model; for incentive payment, the estimates were 1.81 from the screening questionnaire response sample vs. 1.82 from the Heckman model. Thus, our main analyses do not appear to encounter significant nonresponse bias.

[9] This method assumes that the survey selection process induced by the mailing methods and incentives reasonably represents the same process in the full survey sample.

[10] Because Stata does not provide a logit option for the Heckman selection model, we used probit estimation for both Heckman Selection model and the screening questionnaire response only model for comparison.

Appendix J. Adoption of EHRs, Among Screening Questionnaire Respondents Working in Small Practices or Large Practices With >30 percent Medicaid or Uninsured Patients

Outcome *	n	REC participants with all or part EHR	Non-participants with all or part EHR	Odds ratio (reference is non-participants)	p-value	95% confidence interval—low	95% confidence interval—high
Physician used EHR at time of survey	1591	95%	69%	8.53	<0.01	6.47	11.26
Physician adopted current EHR system in 2009 or earlier	1496	35%	21%	2.02	<0.01	1.56	2.61

NOTE. Adjusted figures control for whether respondent was in obstetrics/gynecology, worked in a private practice, worked in an FQHC, percentage of patients with Medicare, percentage of patients with Medicaid, number of hospitals in the county with six to 49 beds, number with 100 to 199 beds, number with 300 or more beds. Analysis of adopted current EHR in 2009 or earlier excludes those missing adoption year.
Source: Screening questionnaire (April to September 2014).
* Outcomes are binary with 0=No; 1=All or part EHR.

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