

The Office of the National Coordinator for
Health Information Technology



Capturing High Quality Electronic Health Records Data to Support Performance Improvement

A Learning Guide

*Presenting lessons learned by the 17 Beacon Community Awardees
of the Office of the National Coordinator for Health Information
Technology in the U.S. Department of Health and Human Services*

July 2013

The Beacon Community Cooperative Agreement Program demonstrates how health information technology (health IT) investments and Meaningful Use of electronic health records (EHR) advance the vision of patient-centered care, while supporting better health, better care at lower cost. The Department of Health and Human Services, Office of the National Coordinator for Health IT (ONC) is providing \$250 million over three years to 17 selected communities throughout the United States that have already made inroads in the development of secure, private, and accurate systems of EHR adoption and health information exchange. Each of the 17 communities—with its unique population and regional context—is actively pursuing the following areas of focus:

- Building and strengthening the health IT infrastructure and exchange capabilities within communities, positioning each community to pursue a new level of sustainable health care quality and efficiency over the coming years;
- Translating investments in health IT to measureable improvements in cost, quality, and population health; and
- Developing innovative approaches to performance measurement, technology, and care delivery to accelerate evidence generation for new approaches.

For more information about the Beacon Community Program visit <http://www.healthit.gov>.

This Learning Guide was developed by the Beacon Nation Project, funded by the Hawaii Island Beacon Community, an awardee of the ONC Beacon Community Program. The Beacon Nation project seeks to promote innovation in health IT by gathering and disseminating lessons learned from the 17 Beacon Communities about building and strengthening health IT infrastructure, testing innovative approaches, and making strides toward better care, better health, and lower costs.

For more information about the Beacon Nation project visit <http://www.beaconnation.org>.

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Background

The Health Information Technology for Economic and Clinical Health (HITECH) Act and the Affordable Care Act (ACA) established a number of programs intended to accelerate the transformation of the United States' health care delivery system. Under HITECH, eligible health care professionals and hospitals can qualify for Medicare and Medicaid incentive payments when they adopt certified electronic health record (EHR) technology and use it to achieve specified objectives. Meaningful use is the set of standards defined by the Centers for Medicare & Medicaid Services (CMS) Incentive Programs that governs the use of EHRs and allows eligible providers and hospitals to earn incentive payments by meeting specific criteria. The goal of meaningful use is to promote the spread of EHRs to improve health care in the United States. An EHR can improve the ability of health care professionals to engage in evidence-based knowledge management and aids decision-making during patient care. Research has demonstrated the ability of EHRs to improve health care efficiency and quality through chronic condition prevention and management.¹

In addition to Meaningful Use (MU), HITECH and the ACA have created or spurred other programs and initiatives providers are actively engaged in, for example:

- Participation in Accountable Care Organizations (ACO)
- Participation in payment reform initiatives that tie payment to patient outcomes
- Use of Clinical Decision Support (CDS) systems to improve care at the point of service
- Performance measurement, benchmarking, and reporting initiatives
- Quality improvement program development and implementation
- Implementation of population health management strategies.

These programs and initiatives are key drivers to improve data quality, requiring high-quality data that accurately represents care provided to patients. The term *high quality* is used in this Learning Guide to mean *data that is stored and presented in a manner that makes it usable and results in reliable, accurate, and actionable information*. Research has revealed highly variable results on the correctness and completeness of EHR data.²

There has been a steady increase in the adoption of health IT and MU of EHRs by May 2013; nearly 50% of eligible providers had received MU incentive payments.³ The increased availability of EHR data and intent for MU increases the importance of having high quality data.

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Research on EHR data quality has revealed highly variable results. A literature review found that the **correctness** of EHR data ranged between **44% and 100%**, and **completeness** between **1% and 100%**.²
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As the industry moves toward value-based reimbursement—reimbursement based on quality and cost measures—improving the quality of the data used for measurement is imperative. While the Meaningful Use program emphasizes improvements in standards around data capture, current EHR-derived quality measurement has limitations due to several factors, most notably variations in EHR content, structure and data format, as well as local data capture and extraction procedures.^{4, 5} Documentation practices by providers vary and the necessary data entered into the EHR may not be interpreted or recognized by standard EHR software programming. Measures derived from EHRs have yet to be validated as representative of provider performance for performance incentives or comparative purposes.⁶ However, unlike most claims-based quality measurement, measures derived from EHRs can incorporate more detailed clinical findings, allowing for the tracking of intermediate outcomes, such as blood pressure and body mass index. The following examples illustrate real-world scenarios that highlight the need to focus on data quality improvement through improved data capture and workflow.

- **Example 1:** The EHR has two places for nurses to document family history. Nurses documenting in one section cannot see the documentation from the other. Further, the data from these sections is stored in different locations in the database. A quality report only pulls data from one location, potentially missing information that may be present in the other location.
- **Example 2:** The system does not guide practice staff to document immunization data in the EHR’s immunization assessment. Some staff members document the information in the correct location; others manually input the information into the “current medications” section. An immunization report based solely on the immunization assessment would miss information captured in the other location.
- **Example 3:** The EHR does not standardize how blood pressure should be entered, nor is it made into a mandatory field. Some providers enter it as a number, others enter it as text, while others may document it elsewhere in notes.

This Learning Guide, targeted to individual practices as well as communities, discusses the key steps necessary to improve EHR data quality to support performance improvement activities, including quality measurement and improvement, performance reporting, and data needed to support payment reform initiatives. EHR data quality improvement activities occur at the grassroots level within practices, where a focus on people, process, and technology is key to accomplishing enduring, long-term results.

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[Learning Guide: A Learning Guide describes a promising IT-enabled intervention that can be deployed in a community to accelerate health care transformation.](#)

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Rhode Island Beacon Community: How Generating Performance Reports Led to the Realization of the Need to Improve Data Quality

The Rhode Island Beacon Community goals included improving the health of patients with diabetes across five diabetes measures. As practices within the community began to access EHR data in order to report on improvements in diabetes care, they discovered anomalies in performance across and within sites. A closer review of the EHR data identified data quality issues that prevented accurate and reliable performance reporting. The data quality issues mostly resulted from missing or inaccessible data or wide variation in quarter-to-quarter performance that could not be explained by the actual delivery of care. Practices were entering diagnosis information in multiple fields with the EHR, for example, or capturing data in a format that could not be accessed for the analytics needed to calculate results. Standard performance reports could only be used in one of every three data pulls because of the data quality issues.



This experience highlighted the need for practices to focus resources on improving EHR data capture and quality before using results to create quality improvement strategies and tactics.

Beacon Communities

The U.S. Department of Health and Human Services (HHS) Office of the National Coordinator for Health IT (ONC) provided \$250 million over three years (2010–2013) to 17 selected Beacon Communities throughout the United States that had already made inroads in using health IT as a foundation for local improvement and innovation. The Beacon Community Program is part of ONC's innovation portfolio and brings together many aspects of ONC's efforts to modernize the nation's health care.

Each of the 17 Beacon Communities is building and strengthening local health IT infrastructure, testing innovative approaches for using connected technology to improve care delivery, and supporting measurable improvements in health, care and costs. Through these efforts, each community serves as a model of change that can help instruct the work of other cities, counties, and regions.

Beacon Nation Project and Learning Guides

The Beacon Nation Project, launched by the Hawaii Beacon Community in early 2013, translated the experiences and lessons learned from the Beacon Communities into actionable information that can be adapted for use by physician practices and communities. This information is included in Learning Guides, which are a set of materials describing a promising IT-enabled intervention that can be deployed in a community to accelerate health care transformation.

This Learning Guide documents the approaches, lessons learned, and best practices of Beacon Communities for improving the quality of data captured within EHRs. It includes Implementation

Objectives and supporting tactics for success, provider stories, resource and cost considerations, and reference documents. Following are a few items to keep in mind while reviewing the materials:

- A Learning Guide is not an implementation manual with detailed checklists for a technical review and revision of clinical data systems architecture and infrastructure. Instead, the materials lay out the most important decisions and considerations for practices and communities interested in implementing processes that result in improved documentation and data capture of currently installed EHR systems.
- Steps are laid out sequentially but could happen in parallel. For example, an organization may choose to begin implementing activities to improve EHR data quality (Implementation Objective #3) at the same time as establishing continuous data quality monitoring processes (Implementation Objective #4).
- This Learning Guide discusses the key steps necessary to improve EHR data quality for the purpose of reporting, performance improvement activities, and patient care. These include quality measurement, performance reporting, and outcome measures required for reimbursement under new payment models. EHR data quality improvement activities occur at the grassroots level within practices, where a focus on people, process, and technology is key to accomplishing enduring, long-term results.
- A wide variety of organizations can use this Learning Guide to develop and implement activities to improve EHR data quality, including individual practices, hospitals, communities (which may include practices of differing levels of sophistication in EHR usage and reporting capabilities), and other data quality stakeholders.

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Target Audience: This Learning Guide is designed for individual practices or data aggregators that have a stated goal to improve EHR data quality to facilitate performance improvement and payment reform activities. Data aggregators include a partnership of community stakeholders (e.g., a hospital system and its affiliated practices), state, HIE partnerships, non-EHR vendors, quality improvement organizations (QIO), and ACOs that track performance across time, organizations, and patient populations.

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Setting the Stage for Success

As the Beacon Community experience shows, many health care providers were not initially focused on measurement or the quality of data in their EHR. Until their engagement with the Beacon program, they often had not assessed whether their data were reliable, accurate, and actionable and, therefore, sufficient to support implementation of care transformation programs and initiatives. When extracting EHR data to measure performance, practices uncovered data quality problems and realized the critical importance of focusing on improving data quality. Practices were often surprised by the extent of their data quality issues, and they concluded that a focused effort

was required to improve data quality to the level necessary to support quality improvement and accurately represent provider performance.

Drawing from the experiences of the Beacon Communities, practices and communities pursuing this work can anticipate an early need to focus on data quality in the early stages of planning, as a pre-implementation step, for performance measurement, reporting, and improvement activities. There are several items to consider before implementing activities to improve EHR data quality, including:

- **The current status of EHR implementation within the community and individual practices,**
- **The availability of necessary resources to perform EHR data quality improvement work, and**
- **The level of commitment, understanding, and buy-in by both community and practice leaders and frontline staff.**

To clarify terminology used in this Learning Guide, a practice is a group of physicians in a single location who share office space and financial, staff, and IT resources to support the provision of care to patients. A practice shares a single EHR. A community refers to a local group of practices with or without one or more hospitals. Multiple EHR systems are likely to be present within a community.

A single or small group of practices can perform EHR data quality improvement activities or a group of community stakeholders may organize, sponsor, and implement a larger initiative that includes multiple practices, hospitals, and other stakeholders, such as laboratories and long-term care facilities. Practice-level initiatives, such as quality improvement programs, implementation of CDS systems, or the desire to participate in community-wide performance improvement initiatives, result in practice-driven data quality improvement activities. Practice-level activities are more limited in scope at the start and may focus on data improvement activities to support performance goals for a single disease condition and a small number of performance measures. A single practice or group of practices can successfully perform the activities necessary to improve data quality as long as it has access to required resources.

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Goals for EHR Data Quality Improvement Activities Include:

- Obtain data that accurately represents practice performance
 - Allow for successful data aggregation and exchange across sites and systems for quality improvement and payment initiatives
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Community-level initiatives, such as payment reform pilots or the need to exchange data across entities, result in community-driven data quality improvement activities. While the bulk of the work will still take place in individual practices, community-level initiatives are generally larger in scope and focus on data improvement activities to support performance goals for a larger set of performance measures that cross multiple disease conditions, patient populations, and geographies. Whether EHR data quality improvement activities are practice-driven or community-driven will determine the resources and strategies needed to successfully improve data quality.

This Learning Guide contains information that both practices and communities can use to improve EHR data quality. As noted throughout, some content is more applicable to the community level

while other content is targeted to practices. Beacon Communities recognized the importance of several factors that supported success of these projects, such as strong leadership, vision and project goal alignment, and technical capacity to execute the improvement plan. These foundational elements are described in Exhibit 1.

Exhibit 1: Foundational Elements for Success

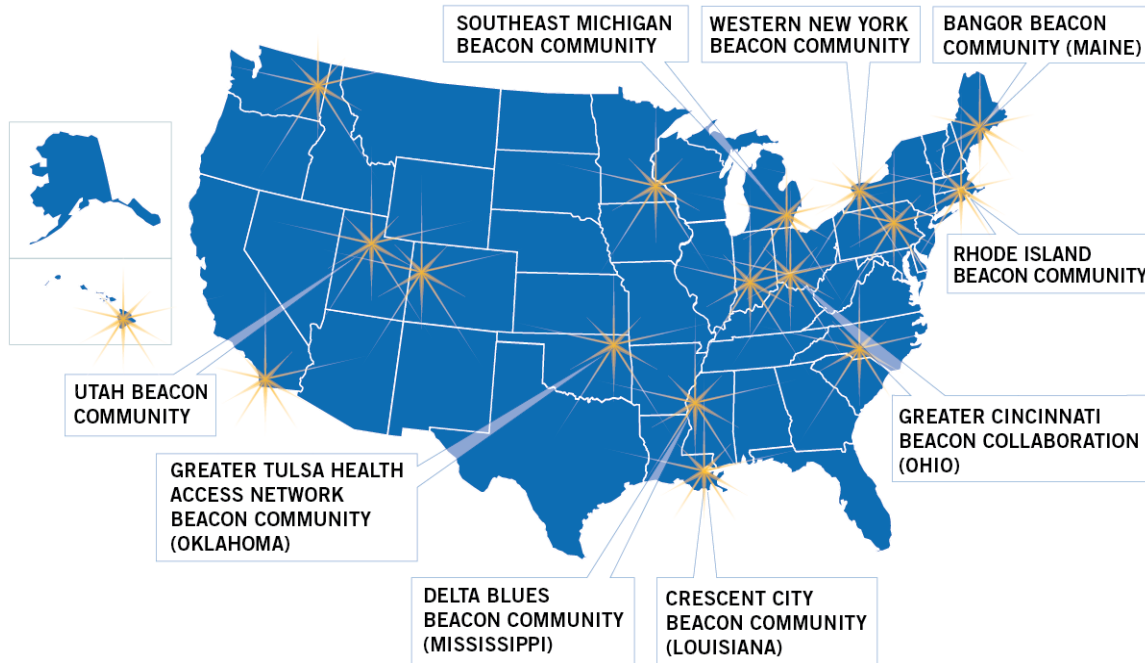
Element	Considerations
Health IT	<ul style="list-style-type: none"> • Have practices implemented or are they in the process of implementing EHRs and working toward MU certification? • If the initiative extends beyond one practice, how fragmented is the EHR market in the community? Are there 1 or 2 EHR products in use in the community, or are there many different EHR products in use? • Are the EHRs certified by ONC (http://www.healthit.gov/buzz-blog/meaningful-use/certified-ehr-health-it-products-list-available)?
Leadership, Commitment and Collaboration	<ul style="list-style-type: none"> • Are there providers or practices that have successfully undertaken data quality improvement initiatives and would be willing to provide leadership and direction for this project? • If the initiative extends beyond one practice (i.e., includes multiple practices, a health system, or public health entities), is there a data governance body in place or does the community have the expertise from within to create one? • Is there awareness and agreement among physicians and practices of the need to improve EHR data quality to support activities, such as preparing for a new quality improvement program targeting patients with diabetes or participation in a Pay for Performance program? • Is there a willingness to commit resources to improving data quality in support of shared goals?
Performance Measurement and Evaluation	<ul style="list-style-type: none"> • Do practices or the community already have clear performance goals or target areas of focus (e.g., reducing hospital readmissions, improved care outcomes for diabetics) or a process to facilitate goal setting? • Have measures been identified to track progress in meeting goals and the required data elements identified to enable reporting on these measures?
Quality Improvement	<ul style="list-style-type: none"> • Are there quality goals or activities in the marketplace that would benefit from improvements in EHR data quality?

Element	Considerations
Sustainability and Resources	<ul style="list-style-type: none"> • Do the practices or the community understand the value and benefits of improving EHR data quality? • Do practices or the community have the resources in place to support activities to improve EHR data quality, and support practice workflow redesign? If not, is there a commitment to acquire the necessary resources? • Are there resources that can provide on-the-ground assistance to implement and maintain EHRs, such as a Regional Extension Center (REC)? (More information on RECs can be found at http://www.healthit.gov/providers-professionals/regional-extension-centers-recs).

Lessons from Beacon Communities

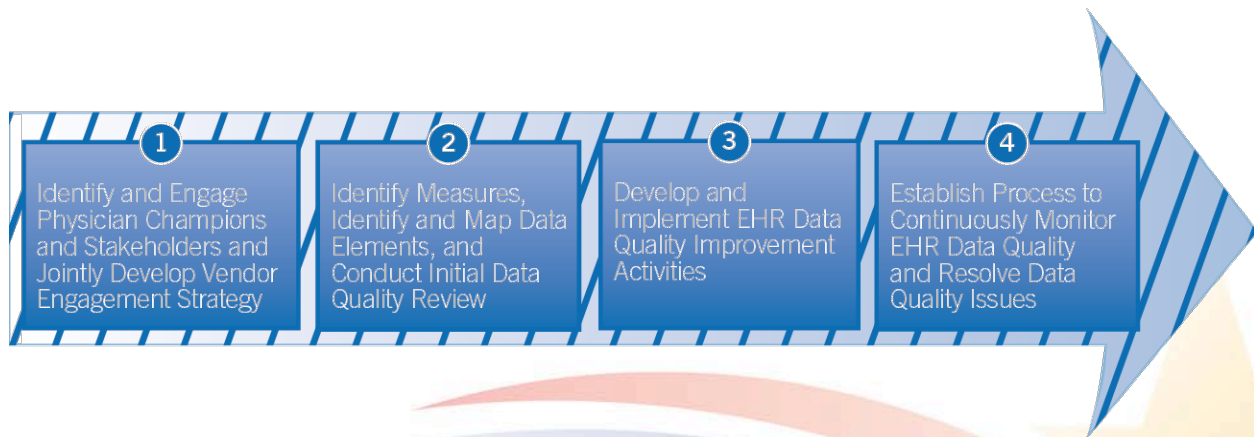
Many of the Beacon Communities developed programs to work with health care practices to improve EHR data quality, driven by an interest in accurately representing clinical performance, facilitating quality improvement, and enabling the exchange of health information across their community. EHR data quality improvement initiatives varied depending on performance improvement and data-sharing goals, current EHR usage, and reporting sophistication. Beacon Communities exist in a wide range of markets, including those with well-integrated health care delivery systems and those with loosely organized practices and hospital systems. Beacon Communities with experience improving EHR data quality have contributed to the development of this Learning Guide; they include (see Exhibit 2) Bangor Beacon Community (Maine), Crescent City Beacon Community (Louisiana), Delta BLUES Beacon Community (Mississippi), Greater Cincinnati Beacon Collaboration (Ohio), Greater Tulsa Health Access Network Beacon Community (Oklahoma), Rhode Island Beacon Community, Southeast Michigan Beacon Community, Utah Beacon Community, and Western New York Beacon Community.

Exhibit 2: Contributing Beacon Communities



The experiences of these Communities are synthesized into four primary objectives (see Exhibit 3), which reflect the key implementation steps for EHR data quality improvement. Each objective is described in detail in the following sections. Appendix A: Implementation Objectives Summary has a summary of the Implementation Objectives and the major action steps that support each objective.

Exhibit 3: Implementation Objectives



Implementation Objective #1: Identify and Engage Physician Champions and Stakeholders and Jointly Develop Vendor Engagement Strategy

The first Implementation Objective includes identifying and engaging physician champions and stakeholders within the practice or community, setting performance improvement goals, and developing a vendor engagement strategy. It discusses the key steps that Beacon Communities used to successfully engage physicians and other key practice staff and to determine a vendor engagement strategy based on performance improvement goals. The steps include:

1. Identify physician champion(s) and engage stakeholders
2. Determine vendor engagement strategy
3. Clarify and articulate the local benefits and funding requirements for improving EHR data quality

A physician champion can advocate for the need to improve EHR data quality, and the vendor engagement strategy will ensure support for possible system changes needed during implementation of activities to improve EHR data quality. Data quality improvement that includes a single practice will likely have a small number of stakeholders, limited to leadership and staff within the practice. A community-driven approach, however, may include a number of stakeholders within and across organizations in the community.

During the stakeholder engagement process, practices or the community will come to a consensus on performance improvement goals that will determine the scope of the EHR data quality improvement activities. For example, once a practice has engaged appropriate staff or, in a community-driven approach, leadership from practices across the community have been engaged, the consensus may be to focus on five diabetes measures to improve the care of patients with diabetes. The data quality improvement activities, therefore, will focus on ensuring that the data elements necessary to calculate those measures are accurately captured and accessible for reporting performance. Appendix B: Guidance for Setting Performance Improvement Goals discusses key issues to consider when establishing improvement goals.

1.1 Identify Physician Champion(s) and Engage Stakeholders

Identify Physician Champion(s)

It is important that practice leadership support an effort to improve data quality, as efforts to do so can be challenging and time consuming. Using a physician champion can be an effective strategy to engaging physician leadership and obtaining buy-in and support for improving EHR data quality. In addition to leading engagement and buy-in, physician champions can be integral to the improvement team by playing a role in decision-making, ensuring changes positively influence care, and brainstorming ideas for change. Peer-to-peer relationship building can be an effective method of using a physician to perform outreach to other physicians in leadership roles within the practice.

An important first step is to identify and enlist a physician who understands how high-quality data will support performance improvement activities and is willing to spread the word to practice leaders. The physician champion will come from within the practice in a practice-driven initiative, while communities generally identify a physician champion who is well known and respected at the community level and has

expertise in data quality issues. This individual is responsible for meeting with physician practice leaders to educate them on the need for high-quality data and to gain support to organize resources within their practices to implement data quality improvement activities.

Engage Stakeholders to Support EHR Data Improvement Activities

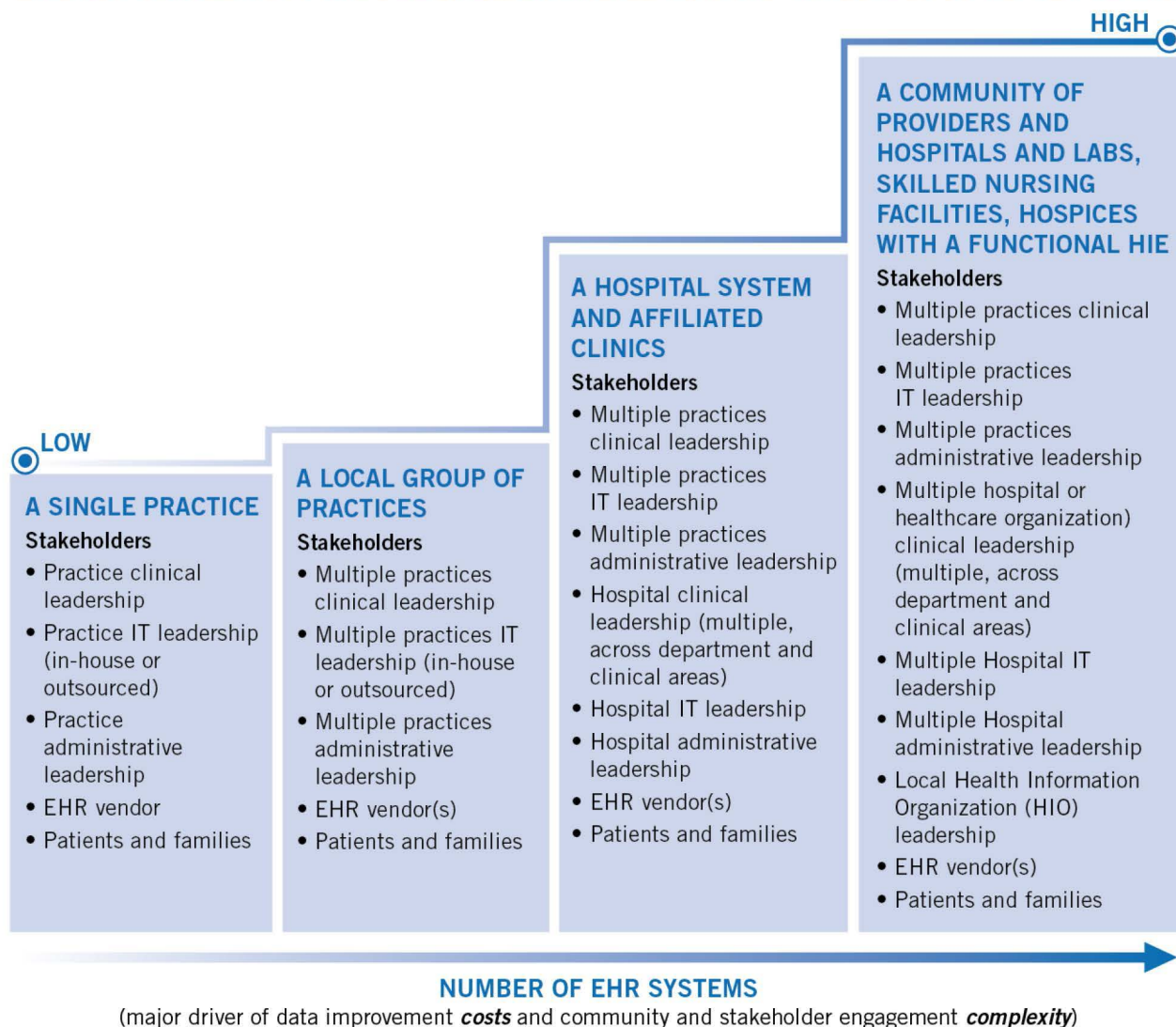
Engaging and convening stakeholders is important for a practice and community planning to implement EHR data quality improvement activities. Practices can supplement the physician champion role with other expert support, such as data stewards, to champion the importance of high-quality data and also have in-depth operational data expertise. Data stewards can work with practice staff on a day-to-day basis to shepherd data quality improvement activities. While physician champions focus on gaining physician buy-in, data stewards work with other practice staff to ensure IT and administrative leadership support and to shepherd progress in improving data quality and resolving barriers that impede high-quality data capture.

In a community-driven approach, the physician champion may work for one practice but visit multiple practices to advocate for data quality improvement, while each practice might have its own data steward. Community-driven improvement initiatives may also have multiple physician champions and data stewards, while in a single practice the physician champion and data steward may be the same person.

The task of engaging stakeholders and the cost of pursuing a data quality improvement initiative become larger as the number of participating clinical sites increases. As shown in Exhibit 4, individual practice efforts will only need to focus on stakeholders within that organization, while community-level data quality improvement efforts require buy-in and engagement from multiple stakeholders from a variety of provider organizations. The number of stakeholder considerations grows as the number of stakeholders increases, as disparate organizational priorities and different EHR systems must be taken into account. In general, the Beacon Communities fall at the more complex end of the spectrum.

Exhibit 4: Key Stakeholder Engagement Process Complexity Continuum

GREATER COMPLEXITY IN THE STAKEHOLDER ENGAGEMENT AND CONSENSUS-BUILDING PROCESS



All stakeholders must assess for themselves whether to participate in the data quality improvement initiative. Communities will have additional considerations beyond those of an individual practice, such as engaging stakeholders across multiple organizations and resolving data quality issues to enable the aggregation of high-quality data from across the care continuum. Exhibit 5 describes considerations for stakeholders who could potentially participate in a data quality improvement initiative.

Exhibit 5: Key Stakeholder Group Considerations for Implementing an EHR Data Quality Improvement Initiative

Stakeholder Group	Organizational Considerations	Resource and Structural Considerations	Workflow and System Impacts
Administrative leadership and staff	<ul style="list-style-type: none"> • Impact on staff roles and responsibilities 	<ul style="list-style-type: none"> • Ability to identify and make available individuals(s) to support the quality improvement aspects of the project, physicians are of particular importance • Access to training and coaching for non-clinical staff 	<ul style="list-style-type: none"> • Support and administrative staff workflow impacts
Clinical leadership	<ul style="list-style-type: none"> • Alignment of practice goals with community initiatives, such as: • MU • Payment reform and incentives • Quality improvement collaboratives • Provider performance reporting • Population health improvement initiatives 	<ul style="list-style-type: none"> • Costs and benefits: Providers within individual practices and executive leadership within larger systems • Ability to review and respond to identified data deficiencies 	<ul style="list-style-type: none"> • Workflow implications and access to training and coaching for staff
EHR vendor(s)	<ul style="list-style-type: none"> • Ability to engage and work with practice staff 	<ul style="list-style-type: none"> • Level of effort (LOE) to make necessary system changes • Costs to implement system changes 	<ul style="list-style-type: none"> • EHR system structure and architecture impacts

Stakeholder Group	Organizational Considerations	Resource and Structural Considerations	Workflow and System Impacts
Health IT leadership and medical informatics staff	<ul style="list-style-type: none"> • Priority-setting versus current IT strategies and tactics 	<ul style="list-style-type: none"> • Feasibility and cost of implementing system changes • Alignment of technical work with quality improvement work • Alignment with practice goals and initiatives 	<ul style="list-style-type: none"> • EHR and data system impacts
Patients and patient families	<ul style="list-style-type: none"> • Impact on quality of care • Impact on experience with providers during physician visits 	<ul style="list-style-type: none"> • Implications for privacy and security of patient data 	<ul style="list-style-type: none"> • Duration of impact on provision of care and clinical workflow
Payers	<ul style="list-style-type: none"> • Role in support of EHR implementation and improvement in data quality • Access to practice patient-level data 	<ul style="list-style-type: none"> • Pay for Performance programs that include incentives based on adoption of health IT • Physician partnerships that include financial support for EHR acquisition and implementation 	<ul style="list-style-type: none"> • Connectivity of practice EHR and health IT systems with payer IT systems

1.2 Determine Vendor Engagement Strategy

Vendor participation can play an important role in a successful data quality initiative because of their extensive system expertise and the ability to develop enhancements to existing functionality. This section discusses guidelines that communities have identified as helpful for engaging vendors. It is important to note that practices and communities may be able to make a substantial amount of progress in improving EHR data quality without vendor engagement. When vendor engagement is difficult or time consuming (for example, when there are multiple different vendors supporting practices within a community), leadership may decide to proceed with data improvement activities within practices' capabilities prior to engaging vendors.

Beacon Communities have identified the following guidelines as helpful when engaging vendors:

- **Understand the vendor organization and how to contact the appropriate personnel.** A practice's primary point of contact may be a salesperson, who may not be the right person in the organization to assist with technical fixes and enhancements. The practice needs to know the go-to technical resource. In conversations with a sales person or account executive, the practice should ask about the company structure and the types of resources, especially technical, that would assist in a data quality improvement effort.
- **Address data quality with vendor before purchasing EHR product and executing service level agreement.** Many health care providers, both large and small, are requesting EHR vendors to address data quality issues in their purchase contract as well as in their maintenance contract.
- **Define the problem.** A vendor representative can only point a practice to the right set of vendor resources to provide a solution if the practice understands the issue that needs resolution. For example, if the problem relates to where data is stored in the database, a data architect from the vendor may be a helpful resource (see Objective #2 for more information on assessing data quality). Further, a well-defined problem includes both what does not work and the intended or ideal outcome.
- **Identify community partners that use the same EHR vendor and explore collaboration in getting the vendor engaged and committed to a timeline.** For example, a practice affiliated with a hospital system, independent physician association (IPA), or physician-hospital organization may have additional resources to collaboratively engage with the vendor. The vendor may have competing priorities that make it difficult to respond to a single practice's needs. Even so, the same or similar request by multiple practices increases the likelihood of getting the vendor's attention and commitment.
- **Have a support budget.** While some vendor services may be covered under an existing maintenance contract, assistance for a data quality initiative will most likely require additional funding for vendor staff time and software development, and the amount of money needed will vary depending on the size of the problem and the scope of the

Getting Vendor Support for Data Quality Improvement and Reporting

The Beacon Communities stress the importance of engaging the EHR vendor early in the data quality improvement process and addressing data quality with vendors before buying an EHR. Ideally, the EHR vendor contract will include provisions that the vendor will use to work with the practice to make the future system configuration changes or enhancements needed to improve high-quality data capture. It is unlikely vendors will commit to open-ended contract provisions that do not identify or limit scope, so practices and the community may codify performance improvement goals and data requirements into the contract to the extent possible.

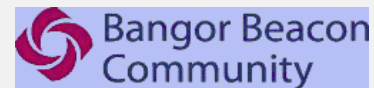
When an enhancement provision is not in the vendor contract, it may be more effective to engage the vendor if a coalition of community stakeholders comes together and provides a more compelling business case to the vendor for why it should respond to practices' and the community's needs.

organization (e.g., a small single practice versus a large, multi-specialty practice). Software development might be required, for example, if the reporting tools embedded in the EHR do not access all the required data (i.e., need to add a data element to the overall data structure) or a customized query needs to be developed to pull similar data from multiple locations in the database.

- **Understand the vendor's software development life cycle.** To address some data quality issues, new applications or software modifications may be required. Understanding vendor constraints and timelines are important inputs into the improvement plan, may affect timing of workflow changes, and may have financial implications. New software must be designed, developed, and tested, which can take weeks to months, depending on the complexity of the new development. Vendors may also delay new development until a scheduled release. Practices may have to accommodate the vendor's software development cycles, depending on the size and severity of the request.
- **Ensure there is the staff capacity and expertise to work with the vendor when needed.** Once the vendor assigns resources, it helps to ensure that the internal points of contact are also ready to kickoff. Internal delays after the vendor has assigned resources can cause unnecessary costs due to inefficient use of vendor resources. Generally, a vendor will provide a date when it will start work, and that date should be communicated to those working closely with the vendor so that resources are available when vendor services commence.

Bangor Beacon Community: Aligning the Community to Set Common Goals and Tackle Common Issues

The Bangor Beacon Community Performance Improvement Project is an example of an effective collaboration among nine primary care practices from three unaffiliated health care



organizations, comprising 65% of the region's primary care providers. With a common goal of improving care quality and tracking progress using key quality measures, this unlikely group of collaborators built a foundation of trust that has produced real improvements. By consensus, the collaborative approved quality measure data definitions, revised operational terms, identified regional target goals, and created common EHR patient encounter forms and workflow processes. A data registry reporting tool gathers clinical data abstracted directly from the EHRs, and all reports are shared and discussed in an open forum; they are then used to develop a 90-Day Action Plan for each practice.

On the path to developing consensus, the Bangor Beacon Community encountered numerous issues related to technology, workflow, and governance. In doing this work, participants identified several key lessons and promising practices. First, they acknowledged the importance of building trust, maintaining good relations across organizations, and making decisions by consensus. Second, establishing a third-party, centralized disease registry fostered a simplified, less competitive environment for negotiating data-sharing agreements. Third, the multi-stakeholder collaborative benefited from regular meetings to openly discuss and review data, resolve issues, and monitor progress. Finally, designating internal team members and a centralized group to audit the data, identify errors, and maintain report integrity was deemed essential; this enhanced trust in the quality reports as well as engagement among providers.

1.3 Clarify and Articulate the Local Benefits and Funding Requirements

Understand Costs and Potential Savings from Achieving Quality Improvement Goals

Discussing the shared cost and expected savings from improving quality of care and other goals within a practice or with each stakeholder group will assist in gaining buy-in and support. In recent years, more incentives have been put in place that encourage a focus on improving data quality, including public reporting on population health measures, Pay for Performance programs, and ACO shared savings programs. Having high-quality EHR data allows practices and communities to accurately measure performance, identify care delivery and workflow issues, and make needed corrections to deliver the highest quality, evidence-based care.

Consider Potential Impact in Revenue Resulting from Payment Reform

Data quality is an essential ingredient for many of the functions that providers will have to perform in a world that is transitioning to value-based payment. While this transition will be incremental, an increase in these arrangements is occurring in the industry as represented by federal programs, such as the Pioneer ACO Program, the Medicare Shared Savings Program, and the Physician Quality Reporting System (PQRS) Program, as well as a proliferation of value-based contracts from private payers. Providers who have done the work to increase the quality of their data are well-positioned to manage the total quality and cost of care across patient populations and to succeed under these arrangements. Hospitals, medical practices, and communities participating in these programs have strong incentives to ensure that the data used to measure and link their performance to payment is accurate and comprehensive. Having high-quality data supports the primary use of EHR data—to improve patient care—enabling the better use of EHR tools (e.g., CDS) to improve care and accurately target improvement resources.

Identify and Plan for the Resources Needed to Effectively Implement Data Quality Improvement Activities

An explicit discussion of resource requirements, as well as funding sources, is necessary to know whether or not to proceed with the identified EHR data quality improvement activities. The LOE needed to engage EHR vendors for timely support in executing any necessary system changes is an important consideration. While an individual practice will likely only need to work with a single vendor, a community may have to deal with multiple vendors, thus increasing the time and resource intensity needed to meaningfully engage vendors.

Costs generally fall into two categories: technical and non-technical. Technical costs include data extraction software or services, system reconfiguration, and developing or purchasing reporting and analytics software. Non-technical costs include training and coaching staff on workflow changes and the staff time required to perform the data quality review and resolution process. Exhibit 6 illustrates the relative cost of various approaches to improving data quality (applicable to Implementation Objectives #2 and #3, which are discussed in detail later in this document).

Lessons Learned from the Physician Champion Identification and Vendor Engagement Strategy Process

- Identify a physician champion to focus on engaging key individuals, such as a data steward, medical director, or nurse supervisor
- Align the value proposition with practice and community quality improvement incentives
- Engage vendors early in process and codify agreement for future support within vendor contracts
- Clearly communicate the level of effort needed to improve data quality and the potential impacts on workflow

Exhibit 6: Relative Cost and Resource Use Considerations

Implementation Objective #2

Identify Measures, Identify and Map Data Elements, and Conduct Initial Data Quality Review

LOW

Performance improvement goals across a few practices for a small number of key measures of a single disease condition that requires data that is consistently captured within the EHR in a standardized way

HIGH

Performance improvement goals across a multiple hospital systems and affiliated physician practices that focus on EHR-based measures for multiple disease conditions included as part of a payment reform initiative

COST DRIVERS/RESOURCES

1. A local group of practices pooling IT and clinical expertise to perform data extraction from a single EHR system (lower) vs. a community of practices and hospitals that need to access data from multiple EHR system to support reporting for a more complex measure set (higher)
2. Performing a data quality review that focuses on data elements from a single practice's EHR (lower) vs. a review of a large number of data elements that cross different EHRs from a community of practices' and hospitals' EHR systems (higher)
3. Using existing IT staff to map data elements for a starter set of easily calculated measures (lower) vs. working with an EHR vendor or other third-party vendor to perform data mapping for a full set of measure across multiple disease conditions (higher)

Implementation Objective #3

Develop and Implement EHR Data Quality Improvement Activities

LOW

A practice focused on a key measures for single condition that uses a staff person for training (e.g. through an REC or third-party vendor) on optimal workflow processes that improve capture of key clinical and patient demographic data

HIGH

A large multi-hospital system and affiliated physician practices that use a third-party vendor to assess data quality across practices and perform workflow analyses in support of reporting measures for multiple chronic conditions; practices have unique data quality issues, so vendor staff must development customized workflow improvement plans for each

COST DRIVERS/RESOURCES

1. Identifying internal staff to learn the optimal workflow that supports data collection for a few key measures for one disease condition and to coach practice staff (lower) vs. hiring an outside vendor to perform workflow analyses and customized coaching for staff across many practices (higher)
2. Use of existing IT staff resources to make system changes to improve ease of data capture and enable data extraction (lower) vs. engaging with vendor to make system changes and to modify or create new code that enables data extraction (higher)
3. Resolving straightforward data capture issues for data elements that support multiple measures (e.g. birthdate) (lower) vs. resolving more complex data quality issues impacted by data capture standards (e.g. birthdate) and data capture methods (e.g. blood pressure measurement with patient standing vs. lying down) (higher)

Implementation Objective #2: Identify Measures, Identify and Map Data Elements, and Conduct Initial Data Quality Review

Implementation Objective #2 begins to move the work from the strategic level of stakeholder engagement and planning to the more detailed work of mapping data elements and reviewing existing data quality. This objective is geared toward a broad audience, including communities in the early stages of collaborating to aggregate data, practices who are new to using EHR data for performance measurement, and practices that have been using EHR data for measurement but see an opportunity to improve their data capture and extraction processes. It discusses the importance of identifying measures and documenting data elements needed for analysis and reporting in three steps:

1. Identify measures and related data elements
2. Confirm ability to extract data from EHR for reporting purposes.
3. Determine data quality assessment method and implement data quality review.

2.1 *Identify Measures and Related Data Elements*

Identify EHR-Based Measures to Assess Performance Improvement

Clinical quality measures generated using EHR-based data are known as eMeasures (i.e., electronic measures). eMeasures are standardized performance measures in an electronic format that were developed specifically for EHRs to improve access to clinical data and promote more accurate, efficient, and comprehensive performance measurement.⁷ eMeasures help ensure that measures are consistently defined, implemented, and compatible across clinical IT systems. The National Quality Forum (NQF) helped to facilitate the process of retooling 113 industry-endorsed measures from a paper-based format to an eMeasures format. Forty-four of those measures are included in Stage 1 of HHS' MU EHR Incentive Program. Additional information on eMeasures can be accessed on the NQF website.⁸

The data elements required to calculate eMeasures are defined by each measure's electronic specifications (e-specifications) or instructions on how to calculate the measure. The e-specifications include the data elements, logic, and definitions for measures in a standard that can be captured or stored in the EHR so that the data can be sent or shared electronically. The measures that practices and communities select will likely be driven by participation in a federal or other payment or performance reporting program, so the e-specifications will be available as part of the program's information resources. If, however, a practice or community chooses to report on other measures (e.g., claims or paper-based measures), Appendix C: Sample List of Performance Measure Developers and Endorsers and Disseminators includes a list of measure developers, stewards, and endorsers, as well as federally sponsored national reporting programs.

Once a practice has confirmed the measures that will be used to track progress toward goals, practices will need to confirm that they have access to the data needed to report on the selected measures (i.e., ability to extract data from EHR). The process of extracting data will identify any issues that exist in the data quality that prevent accurate reporting of performance and will then drive the data quality assessment method the practices will use to better understand where data quality issues exist (i.e., the data quality review). Practices can then develop strategies and tactics to resolve the issues and enable performance reporting that accurately reflects the quality of care provided to patients.

Individual practices may only select a small number of measures to target for a single condition, whereas a community may focus on an entire measure set for multiple conditions. The Beacon Community experience has shown that physicians are most supportive of measures that are evidence-based, standardized, applicable across multiple programs, industry-vetted, and account for differences in the severity of patients' illnesses. Caution is advised when deciding to use measures not publicly available and aligned with national or state efforts.

Map Data Elements to EHR Documentation

Once measures and specifications are confirmed, the required data elements can be mapped from where documentation occurs in the EHR (front end) to where it is stored within the database (back end). The data mapping process is important because it helps focus the data quality assessment and can identify data issues immediately, such as having the same data elements captured in multiple places within the system. Vendors can be an important contact during this process, particularly for help with ensuring that the map accurately depicts how and where the system stores data. They can provide numerous services, ranging from sharing documentation to should-to-shoulder engagement. Vendor assistance can be especially important for individual practices that may not have the necessary internal resources or expertise to perform data mapping activities. In a community-driven or multi-practice initiative, there may be resources pooled at the community level that can be disseminated into practices to perform the data-mapping activities. Appendix D: Crescent City Beacon Community (New Orleans) Pap Test Data Quality Assurance Plan Template provides a template for a Data Quality Assurance Plan completed by the Crescent City Beacon Community (New Orleans) for Pap Tests.

Insights on Measures Selection: There are several considerations that a practice or community should consider when selecting measures to track progress and goals:

- Confirm availability and access to the data needed to report on the selected measures
- Select measures that are evidence-based, standardized, applicable across multiple programs, industry-vetted, and account for differences in the severity of patients' illnesses.
- Use caution when deciding to use measures that are not publically available and aligned with national or state efforts.

2.2 Confirm Ability to Extract Data from EHR for Reporting Purposes

In addition to mapping required data elements, a practice can determine its ability to extract data and run a baseline set of reports. Evaluating reporting capabilities early in the process prevents the risk of improving data sets without a corresponding way to view or analyze the newly cleaned information. Problems with reporting capabilities can be costly and time-consuming to resolve, so testing reporting capabilities early provides more time to resolve any issues. And, running a baseline set of reports will show the current state of performance based on the current quality of the data. During the vendor selection process or prior to a data quality improvement effort, practices can also check with their EHR vendors to determine what standard eMeasures are supported by the system’s existing reporting tools and where there may be deviations from national or community standards. This research can also help with early identification of potential reporting problems.

Extracting Data from an EHR for Reporting

Many practices use current EHR reporting capabilities or supplement them with additional analytical tools. These tools may have limitations when extracting or displaying data due to how data is stored within the database infrastructure or because of reporting functionality weaknesses. See Exhibit 7 for common examples of data extraction barriers, followed by potential strategies to address these barriers.

Exhibit 7: Common EHR Data Extraction Barriers

Barrier	Description and Example
Unavailable queries (database-level, table-level, or item-level)	A particular database or table is not included in the system’s reporting capabilities and is not able to be queried. The system can pull some items, but not all, for a given query. For instance, it can pull the ordering physician’s name but not his or her specialty.
Inconsistency across data elements	Two items that the organization wants to compare are incompatible. For example, lab results could be linked with the original order while radiology report narratives and impressions could be received as notes without the associated order information.
Timeframe restrictions	A query asks for all data in the last 12 months, but it can only report for a given calendar year.
Data segmentation	It is impossible to segment data for a given population (e.g., mental health) because the data lacks sufficient specificity or the reporting tool is not robust enough to identify these data sets.
Tracking completed tasks	It is impossible to report on whether an action has been taken because the workflow does not provide a way for users to document that it is complete.
Information not stored	The EHR does not track a given function (e.g., chart last viewed by) for use by the reporting system.

Barrier	Description and Example
Data stored in multiple places	An EHR, for example, could have two places to document an assessment, like smoking cessation, but the reporting tool could pull data only from one location and miss the other documentation for that patient.

Potential solutions to data extraction barriers include:

- Training physicians and other practice staff.** Before engaging the vendor for technical assistance (i.e., to perform any sort of customization), practices and communities should first determine whether staff and provider training on data capture, storage, and extraction would be sufficient to overcome data extraction barriers. Engaging the vendor may have additional costs and, depending on the issue, can be expensive. Research done on a New York-based program to assist more than 3,000 providers in adopting and using an EHR showed the value of training on the practice’s ability to use EHRs to reliably track and improve quality.⁹ In the study, providers were trained by both the EHR vendor’s training staff and practice consultants, who provided onsite technical assistance. Providers were taught to re-adjust the practice’s workflows to document diagnoses and key preventive services in structured fields that are searchable and capable of generating the quality measures and preventive service reminders. Providers were also shown how to view their EHR calculated quality measures both within the EHR and through monthly reports that the program created and emailed to individual providers.
- Collaborating with other practices or organizations to share analytics capabilities.** Some communities may already have analytics capabilities, and a practice could seek to access to that capability rather than incurring the time and costs to acquire a new analytic tool.
- Engaging the vendor to fix deficiencies in reporting functionality.** Depending on the complexity of the issue, vendors may require a significant development timeline, along with additional fees, to implement change requests. As discussed in Implementation Objective #1, vendors can be engaged early to help identify and resolve issues in a timely manner.
- Acquiring a new reporting capability.** Some organizations internally develop or acquire additional reporting capabilities from the vendor or a third party to supplement the functionality found within the EHR. It is important to confirm that any supplemental software will successfully interface with the EHR. Acquiring additional reporting capabilities will likely incur additional costs to practices. Alternatively, some organizations will extract data into a neutral format, such as a comma-separated values or Microsoft Excel file, and manually run calculations or upload it into a secondary tool.
- Redesigning quality reports to accommodate the system limitations.** For problems that are unresolvable in the short or even long term, a practice may decide to acknowledge the limitation and redesign planned reports. The practice may also set appropriate expectations with stakeholders as to what the reports can include.

Western New York Beacon Community: Insights Gained through the Data Mapping Process



The Western New York Beacon Community learned that gaps in data sets were often caused by EHRs that allowed users to document in multiple locations rather than indicate genuine problems with quality of care. For example:

- Smoking cessation documentation could be found in five different locations within the same EHR.
- Blood pressure measurements did not have labels for resting, sitting, or standing, which lead to different results. Further, clinicians could document blood pressure in multiple locations.
- Influenza immunizations had become more difficult to capture because patients would receive them outside of the practice and it would not be reflected in the EHR, if the EHR had a place to document vaccinations at all.
- Lab tests presented multiple challenges. Community laboratories and practices could have different names for the same test, which needed to be thoroughly mapped. In addition, lab reference ranges vary depending on specimen type (e.g., lab versus urine), which required that the compendium also be able to correctly match reference ranges based on the test and specimen type.
- System upgrades and software patches inevitably change locations for or characteristics of at least a few elements and require that the organization update existing reports.

Western New York provides each of its practices with quarterly reports containing a series of graphs that summarize the proportion of missing and invalid data in the clinical registry, allowing practices to proactively resolve data quality issues.

Extracting Data from Legacy and Stand-Alone Systems

Some practices have historical data stored in legacy systems (e.g., a previous EHR) or in other electronic systems (e.g., a stand-alone practice management system or a best-of-breed medical specialty system) that are not interoperable with the EHR. As a result, the data cannot be easily used for reports. A common issue for practices, for example, is when demographic information is stored in the practice management system, clinical information is stored in the EHR, and reports need to include both demographic and clinical data. Legacy systems become a challenge for practices that want to run reports on historical trends, particularly for those practices that have recently converted to a new system and may have only limited patient records available in the current EHR.

After determining if this data is necessary for performance-reporting purposes, a practice has some options for consolidating the data. The practice could consider migrating legacy data via an interface or manually into the live EHR. For stand-alone systems, the practice could build an interface to connect the systems so that relevant data can be stored in the EHR as part of the patient record. Alternatively, the practice could also automatically or manually extract the data from its systems into a separate analytics database. If a community or group of practices wants to exchange and aggregate health information to run analytics reports centrally for multiple organizations, it will need to validate that the data can be cleanly exchanged and be in an acceptably consistent format to enable reporting. Even organizations using the same EHR can have different configurations and struggle to share even a basic continuity of care record (CCR). Community stakeholders could define what the measures and required data elements are as well as ensure that there is some level of consistency in how users input and systems extract data. This consistency can be helped through standardizing medical vocabularies and code sets (e.g., ensuring that everyone uses the same code or term for diabetes).

Options for Extracting Data from Legacy and Stand-Alone Systems:

- Create a new interface between the system and the EHR
- Manually migrate data into the EHR (e.g., download from the first system and upload into the new system)
- Maintain a separate analytics database and migrate data from the EHR and legacy/standalone system via new interfaces or manual transfer

2.3 Determine Assessment Method and Implement Data Quality Review

An understanding of required data elements and data extraction limitations sets the stage for determining which data quality assessment method to implement. Determining which assessment method to use to analyze data quality is important to ensuring that key data quality issues can be identified and resolved. Each practice can select which assessment method to use based on its unique issues identified during data extraction process. Once a practice has selected an assessment method, the data quality review can occur.

There is no widely accepted taxonomy for assessing data quality. To address this lack of consistency, Weiskopf and Weng identify five dimensions of data quality and link them to seven quality assessment methods. This section discusses the five dimensions of EHR data quality and the method(s) that can be used to capture each dimension.¹⁰

Identify Data Quality Dimensions

The decision on which assessment method to use influences which and how many dimensions of data quality can be effectively measured. Five major dimensions of data quality are: (1) completeness, (2) correctness, (3) concordance, (4) currency, and (5) plausibility, as identified through empirical research.¹¹ Exhibit 8 defines each data quality dimension.

Exhibit 8: EHR Data Quality Dimensions

Data Quality Dimension	Definition
Completeness	Is a truth about a patient present in the EHR?
Correctness	Is an element that is present in the EHR true?
Concordance	Is there agreement between elements in the EHR or between the EHR and another data source?
Currency	Is an element in the EHR a relevant representation of the patient state at a given time?
Plausibility	Does an element in the EHR make sense in light of other knowledge about what the element is measuring?

Identify Data Quality Assessment Methods

There are seven general data quality assessment methods, each of which can be mapped to one or more quality dimensions. The seven data quality assessment methods include: (1) Gold Standard, (2) Data Element Agreement, (3) Element Presence, (4) Data Source Agreement, (5) Distribution Comparison, (6) Validity Check, and 7) Log Review.¹² Exhibit 9 defines each of the methods.

Exhibit 9: EHR Data Quality Assessment Methods

Data Quality Assessment Method	Definition
Gold Standard	A data set drawn from another source or multiple sources, with or without information from the EHR, is used as a gold standard.
Data Element Agreement	Two or more elements within an EHR are compared to see if they report the same or compatible information.
Element Presence	A determination is made as to whether or not desired or expected data elements are present. In some cases, the same data element may be stored in multiple system locations, usually the result of staff and providers using outdated workflows.
Data Source Agreement	Data from the EHR is compared with data from another source to determine if they are in agreement.
Distribution Comparison	Distributions or summary statistics of aggregated data from the EHR are compared with the expected distributions for the clinical concepts of interest.

Data Quality Assessment Method	Definition
Validity Check	Data in the EHR are assessed using various techniques that determine if values make sense.
Log Review	Information on the actual data entry practices (e.g., dates, times, edits) is examined.

Implement Initial Data Quality Review

The data extraction process will highlight which data dimensions may be most problematic; this can drive which assessment method a practice implements. For example, if completeness was the primary data issue discovered, a practice may implement the Element Presence assessment method. If correctness and currency were the primary data issues, a practice may implement the Log Review assessment method. The Beacon Community experience has shown that most data quality issues are related to completeness or correctness, so practices may consider initially focusing on these dimensions. Incomplete data hinders the calculation of measures and is an important place to start. Once data fields are complete, correctness or concordance are the next dimensions to assess and help engage buy-in from providers that the performance measures are accurately representing the care provided to their patients.

Different assessment methods may be applicable for different practices, an occurrence of particular importance within a community-driven data quality improvement initiative because different practices may need different solutions and interventions to resolve data quality issues. In some cases, multiple assessment methods, or hybrid methods, may be needed to comprehensively assess EHR data quality. Exhibit 10 describes which data quality dimensions are reviewed by each assessment method.

Exhibit 10: Assessment Method Mapping to Dimensions

Data Quality Assessment Method	Data Quality Dimensions Reviewed
Gold Standard	Completeness, Correctness
Data Element Agreement	Completeness, Correctness, Concordance
Element Presence	Completeness
Data Source Agreement	Completeness, Correctness, Concordance, Plausibility
Distribution Comparison	Completeness, Concordance, Plausibility
Validity Check	Correctness, Plausibility
Log Review	Correctness, Currency

The data quality review may include the development of assessment tools and methodologies that examine specific data element fields to determine data quality. Beacon Communities have performed the data quality review using diverse methods, from on-the-spot feedback to practices during and after a review to more formal reviews of data quality followed by comprehensive, in-depth data quality reports that highlight issues. This step may also benefit from vendor support; for example, a vendor representative may be able to contribute to discussions on a data element's "plausibility" due to his or her familiarity with system functions.

Staff responsible for data mapping activities and performing data quality reviews will vary across practices, based on their size and resources available to them. While larger practices may employ the necessary support staff (e.g., project manager, IT staff, trainer) who can evaluate existing workflows and work with the system administrator to map required elements to the database, smaller practices may choose to enlist the help of a third-party organization to perform the quality reviews and work with a system administrator or the vendor directly to perform the necessary mapping. When community driven, resources can be pooled or the data aggregator may supplement practice staffing as needed with outside resources to complete the necessary data mapping and quality review activities.

Lessons Learned from the Measure and Data Element Identification and Data Quality Review:

- Determine whether the practice can extract data from EHR and generate reports before beginning data quality improvement activities.
 - Smaller practices may need external resources (i.e., assistance from a third-party vendor) to implement the necessary data mapping and quality review activities.
 - Focusing the initial data quality review on data element completeness and correctness is an efficient way to identify the most common data quality issues.
-

Implementation Objective #3: Develop and Implement EHR Data Quality Improvement Activities

The results of the initial data quality assessment can be translated into strategies and tactics to improve data quality. Focus on three main areas—people, process, and technology—to help identify and institutionalize changes that improve data capture through standardized and systematic workflow processes. People refers to the staff (providers and support staff) responsible for capturing patient information and those who will be the focus of workflow improvement strategies. Process refers to the activities staff performs to obtain desired results during a patient’s visit (e.g., updating patient contact information or recording vital signs). Technology refers to the tools that assist staff and facilitate the implementation of desired processes and vendor input into functionality design and development. Appendix E: Workflow Background and Knowledge Area Primer,¹³ includes information with which practices should become familiar before implementing workflow change strategies.

This section discusses the steps necessary to improve EHR data quality.

1. Review current workflows, and document necessary changes to remediate data quality issues (Process).
2. Implement data integrity checks and protocols to ensure documentation compliance (Technology).
3. Provide training and coaching to staff (People).

Resolving data quality issues within a practice may require implementing a mix of process, technical, and training-based solutions. Depending on the outcome of the data quality review and the issues identified, practices may need to add new steps to the workflow, adjust screens to guide documentation, or provide “at the elbow” (one-on-one, in-person training) to help staff understand how to use health IT systems. Some issues may require vendor assistance for needed system (re)configuration or new development, while other issues may not have a technical solution but require additional training or creative workarounds for staff to ensure the completeness and accuracy of required data. Ultimately, a practice may have to assess and reassess its progress toward producing high-quality data and use varied types of solutions to resolve issues.

3.1 Review Current Workflows, and Document Necessary Changes To Remediate Data Quality Issues (Process)

Practices can first map and understand the baseline workflow, which includes the steps that tie to the specific data elements collected for each measure. Doing so facilitates identification of workflow steps that need revising, adding, or removing. See Appendix F: Rhode Island Beacon Community Optimal Diabetes Care Workflow for example diabetes workflow documentation from the Rhode Island Beacon Community.

Baseline Workflow Review to Identify Sources of Quality Issues

After IT and clinical leadership identify data quality issues, they can work with physicians and support staff to analyze the baseline workflow to pinpoint missteps that resulted in the data quality

issues. For example, a practice might discover that highly variable results on a diabetes blood sugar control measure resulted from inconsistent coding of lab results within the EHR. Needed changes can be simple or more complex, depending on—

- Current **degree of compliance** with documentation and the data-capture processes, including use of structured data, standard formats, and data dictionaries
- The **quantity of data** quality deficiencies that exist based on the data quality review
- The **extent of workflow changes** needed to resolve data quality issues
- The **number of data elements** needed to accurately support measure calculation and performance reporting.

A practice may have a relatively easy data issue to resolve (e.g., completeness), where a few data fields do not contain data. Practices can resolve this issue by training the appropriate staff on what information to input into the EHR. Or, a practice may have a number of data quality issues that touch several staff members, add more steps into the workflow, or require greater intensity and duration of training. Practices may also engage the EHR vendor to discuss how they can work together to identify and resolve more technical data quality issues—for example, making certain data elements “required” if they are critical to calculating a performance measure.

Physician and staff documentation habits vary, and standard EHR software programming may not interpret or recognize data entered into the EHR.

Research has shown that workflow and documentation habits have a profound impact on EHR-derived quality measure results. Unstandardized documentation may lead to undercounting of patients eligible for a preventive service (e.g., diagnosis of cardiovascular disease), receiving a recommended treatment (e.g., screening or medication), or meeting a recommended target (e.g., blood pressure [BP] control). Common workflow issues include—

- **Information documented in a free-text location instead of a discrete field.** For example, a clinician may document vital signs in a note rather than enter the items into the discrete fields for height, weight, BP, etc.
- **Lack of familiarity with uncommon workflows.** Staff may be less comfortable with documentation requirements for situations that apply to a small minority of patients.
- **Misinterpreted fields.** Staff may regularly fill out an assessment item without understanding its intended purpose and the information it should contain. This is common when different specialties (e.g., nursing and physical therapy) use the same electronic assessment but have different documentation requirements.

Common Indications of EHR Data Quality Issues

The two most common indications of data quality issues Beacon Communities experienced after a review of initial performance reports were (1) the existence of performance outliers and (2) highly variable results over multiple time periods.

Physician Dictation Documentation

Physician notes present a challenge to performance reporting, because they are free text and generally dictated and transcribed through voice recognition software or a transcriptionist. Physicians may resist a change to typing notes into discrete EHR fields because of the potential impact on productivity. Even if a physician manually types a note using standardized templates, that information may not be captured discretely in the database for reporting. Practices may choose to prioritize only some physician documentation for direct, discrete data entry, such as medications and diagnoses, and allow other items, such as the history of patient information, to remain free text. Natural language processing, a technology that can convert free text into a standardized format, is one method for increasing the accessibility of physician notes to EHR analytics and reporting software to support performance monitoring.

3.2 *Implement Data Integrity Checks and Protocols To Ensure Documentation Compliance (Technology)*

To supplement workflow training and coaching, practices can implement user-facing and back-end data integrity checks to provide insight into the effectiveness of the workflow training and coaching. Although solutions may vary or be constrained by a practice's electronic system, practices can begin by looking for ways to resolve specific issues, such as—

- **Staff cannot reach a module to perform necessary documentation.** The practice can review its security settings to ensure that staff can access appropriate screens.
- **An important field is not being filled out.** The practice can determine the feasibility of reorganizing the workflow to better highlight the field or evaluate the system's ability to enforce completion of the field.
- **Information is inconsistently formatted.** If some users type “yes” and others “y” for a given field, for example, the practice can determine whether the system can use a standard list that drives users to make consistent selections for that field. Systems may also be able to convert information into the correct format—for instance, displaying height measurements in either metric or standard units.

Exhibit 11 highlights common data quality issues and their impact on the clinical workflow, along with sample solutions. The EHR vendor can be an effective partner for identifying and recommending specific solutions or generally in helping a practice decide which configuration steps to take to best meet data quality goals. Working with the vendor can also save time. For example, a vendor can research what other customers have done to resolve an issue or whether something requires new development to correct. This engagement, however, can often come with additional costs. Practices may choose to prioritize issues so that vendor resources focus on the most important fixes.

The Colorado Beacon Consortium: Validating Data To Ensure Reporting Accuracy

The Colorado Beacon Consortium has adopted a validation process to ensure data accuracy before calculating quality measures for reporting and improvement purposes. The process has three steps:



1. Verify that the EHR can routinely and systematically produce a consistent output for a measure or set of measures.
2. Review outputs with clinicians, and assess their comfort with the output as a good representation of their work (e.g., is a consistent workflow in place to assure that data elements are consistently entered in the correct field?).
3. Validate the output by comparing it to the input via a review of the EHR.

In the Colorado Beacon Consortium catchment area, this process is repeated whenever any significant change is made to the clinical workflow, the EHR system, or a performance measure’s definition.

Exhibit 11: Common Data Quality Issues and Sample Solutions

Issue	Description/Example	Sample Solution
Information is not discretely captured	Information may be captured in dictations or free-text notes or not documented at all, either because staff do not have a way to enter it as discrete data or do not regularly update the field.	Implement an electronic system, or add a new module or workflow to an existing system to cover the missing information.
Information fragmentation	It is impossible to produce a longitudinal view of the patient’s care, because they were treated outside the practice, such as at a hospital or specialty clinic, which leaves gaps in the medical record. Information fragmentation is typically the result of practices or providers not following up on care received at other facilities or scanning results into the EHR that should have been manually entered to ensure that data was input properly.	Form a partnership with local health care organizations to exchange health information.
Format inconsistencies	Free-text fields allow staff to document inconsistently across patients. For example, one person could report gender as “m,” another as “male.”	Configure the electronic system to limit free-text fields and prompt users to select an answer from a predefined list.

Issue	Description/Example	Sample Solution
Coding inconsistencies	Using “non-standardized codes,” such as tacking on local identifiers beyond the standardized International Classification of Diseases (ICD) or Current Procedural Terminology (CPT) code—for example, instead of using 83036 for an HbA1c test, a staff member enters 83036DC or 83036PT to represent different collaboratives or special projects that an organization may be participating in that would not be recognized in a query for the standard HbA1c test.	Implement a more physician-friendly diagnosis terminology standard, such as Systematized Nomenclature of Medicine - Clinical Terms (SNOMED).
Patient error	For patient-reported data, a patient could give differing information about his or her family, social, and medical history and prescriptions.	Configure the electronic system to display past answers or treatments to the clinician for review during the next visit (e.g., have new prescriptions appear on a current medications list).
Incorrect location	Staff captures the necessary information but document it in different places, leading to reports with missing data.	In addition to training, streamline workflows and modules to guide users to the correct documentation location.

3.3 Provide Training and Coaching to Staff (People)

Identify Staff Who Require Training and Coaching

Coupled with improved workflows and better system configurations, training reinforces good documentation practices and educates staff on the new workflows and changes to the system. Some staff may have limited computer proficiency and require additional training on basic skills such as using a mouse or documentation best practices. Others may need to understand how a workflow will change and the impact it has on their day-to-day work or simply be notified that they will see changes to a frequently used form for documentation.

After identifying process and technical changes, the next step is to determine which staff need coaching and training to improve data capture and data quality. This is an important step, because the types of staff that need training and coaching will determine the training and coaching strategy. The strategy for providers, for example, will be different from the strategy used to engage receptionists or other administrative and support staff.

Beacon Communities most often identified medical assistants (MA), non-licensed allied health professionals who perform administrative or clinical tasks to support patient care, for training and coaching. MAs perform routine tasks and procedures, including scheduling appointments, taking patient history, measuring vital signs, helping with patient examinations, and giving the patient injections as directed by the physician. Because of the MAs’ role in documentation within Beacon

Community practices, they were often the focus of training and coaching activities, but other practice staff may also need training and coaching depending on the data issue to be resolved (i.e., administrative data capture vs. clinical data capture).

Utah Beacon Community: Empowering Medical Assistants To Improve Workflow

The Utah Beacon Community is focused on improving the management and coordination of care for patients with diabetes through the use of data from clinic EHRs to measure improvement. One tactic to accomplish this is assisting practices in adjusting their workflow to collect high quality data. MAs spend a great amount of time with patients in the office and in after-care follow-up. MAs were highly affected by workflow changes and needed assistance to improve capture of high-quality data. They were empowered and trained to assess patients with diabetes for complications and needed care without the need for authorization from the physician using developed protocols and EHR order sets. MAs were trained on how to properly document and enter information into the EHR.



Outreach to physicians is particularly important after data quality issues have been identified and tactics created to resolve issues. Depending on the data quality issues, physicians may have immediate insights into potential causes, such as known unstandardized entry of a specific data element needed for a diabetes measure. Practices can create a patient-level name list to help physicians understand problems, errors, and missing data to promote buy-in and ensure active participation in resolving data quality issues. Keeping physicians engaged throughout the data quality improvement process is critical to maintaining their long-term support and engagement.

ONC and the California Health Information Partnership and Services Organization (CalHIPSPO) developed two illustrations that describe common roles that different staff within practices have and how these roles contribute to improving data quality as a means to support obtaining MU certification. The illustration of typical staff roles within smaller practices can be found at http://calhipso.org/documents/MU_Is_A_Team_Sport_SmallPractice.pdf.

Create a Training Strategy

An important consideration that practices and communities may want answered is where they will obtain the resources to train and coach staff on needed workflow changes. Three questions may help address this issue:


1. **Should current staff be trained (train the trainer)?** Are resources available (either through RECs, a third-party vendor, or other community resources) that a current staff member (or multiple staff for larger practices or community-wide initiatives) can receive on identified workflow changes who can then train other staff within the practice or community? How much would this approach cost? How long would it take to train staff within all practices? Practices can also bring in their EHR vendor for a short refresher that reinforces optimal workflow and configuration to streamline provider documentation.



2. **Should additional staff be hired?** Would be it more efficient and cost-effective to hire outside expertise that can quickly be deployed across practices to train staff? Will additional staff be need over a longer term (1 or more years) to train practice staff? (Hiring additional staff will generally only be feasible for larger practices or communities with multiple stakeholders.)
3. **Should training be outsourced?** Can community resources with appropriate expertise be cost-effectively acquired to efficiently train staff across a larger number of practices? Does the community have the resources to hire outside expertise?

When community-driven, opportunities may exist to create shared learning environments or collaboratives in which practices focused on resolving similar data quality issues can learn from one another. For example, a community can organize and facilitate a shared-learning forum for practices focused on resolving data-extraction issues, improving standardization of vital sign data capture, or resolving technical issues related to lab interfaces and capture of lab data. Communities can also use these forums for early adopters to share lessons learned with practices dealing with issues they have previously resolved.

The Beacon Community experience shows a diversity of approaches to training and coaching practice staff on workflow changes. Exhibit 12 provides examples of how some Beacon Communities provided training and coaching to practices in their local areas.

Exhibit 12: Beacon Community Training and Coaching Approaches

Beacon Community	Training and Coaching Approach
<p>Greater Cincinnati Beacon Community</p> 	<p>The Greater Cincinnati Beacon Collaboration, working with a multidisciplinary team, has a multipronged approach to training staff. They have posters to facilitate educating staff of the workflow processes and clinical requirements to help staff understand the measurements. Content areas include practice engagement and Patient-Centered Medical Home (PCMH) and MU elements. Beacon Community and the REC staff have worked together to align teaching tools for practices. These tools align quality processes so one tool can monitor multiple quality initiatives. The practice’s progress is measured against a visual representation for the practice. A Beacon Community representative also visits the practices and completes a workflow evaluation. This report is given to each practice to help improve workflow, data entry, validation, and EHR reporting. In addition, the Beacon Community/REC team has developed laminated pocket tools that describe the workflow diagram of each MU core and menu item. These tools include visual screenshots that depict the data entry path and steps to enter data into an EHR. Tools were developed to illustrate role and task assignments to help staff focus on the data they are responsible for. To further assist in implementation, collaborative meetings are held across the Beacon Community/REC programs to address problems and barriers that practices have identified and to maintain a practice-centric approach for the greatest benefit for the health care team.</p>

Beacon Community	Training and Coaching Approach
<p>Utah Beacon Community</p> 	<p>The Utah Beacon Community worked with 53 primary care clinics to acquire de-identified and aggregated data related to eight diabetes quality measures for approximately 22,000 patients. It identified a baseline performance for each measure and calculated a clinic goal based on a target improvement in the reduction in failure rate for all eight quality measures. HealthInsight clinic coordinators assisted recruited clinics in identifying opportunities for improving these measures. Data was collected from participating clinics' EHRs periodically, and graphical representations to depict the changing trends for all eight measures were created for each clinic. The graphs included line indicators to represent the quality improvement goal and the clinic's current performance and improvement over time. The number of patients needed to be screened or be in control to achieve the goal was calculated and displayed for each quality measure. Clinic coordinators used the line graphs to provide feedback and consultation and to evaluate the success of Plan, Do, Study, Act cycles that were conducted in collaboration with the clinic staff.</p>
<p>Crescent City Beacon Community (Louisiana)</p> 	<p>The Crescent City Beacon Community hired practice coaches to act as consultants to work with practices and assist with project implementation. Practice coaches guided practices via learning sessions and support calls in registry development, implementing care management strategies, and effective use of clinical decision support tools. Crescent City Beacon Community staff supported these activities with technical assistance on data quality (e.g., error identification and rapid feedback to troubleshoot data errors and quality measure miscalculations), co-hosting quarterly data workshops with EHR vendor report design experts and generating comparative performance feedback reports (such as shown in Appendix G), allowing for performance comparisons at the practice level, Community level, and against national benchmarks.</p>

Lessons Learned from the Data Quality Improvement Plan Development and Implementation:

- Determine whether the practice can extract data from EHR and generate reports before beginning data quality improvement activities
- Smaller practices may need external resources (i.e., assistance from a third-party vendor) to implement the necessary data mapping and quality review activities.
- Focusing the initial data quality review on data element completeness and correctness is an efficient way to identify the most common data quality issues.

Implementation Objective #4: Establish Process To Continuously Monitor EHR Data Quality and Resolve Data Quality Issues

Improving data quality is a continuous process that can be central to a practice's business operations rather than a one-time or time-limited activity. Practice leadership may set the expectation with staff that ongoing data quality monitoring will be institutionalized in the practice's way of doing business. This section discusses considerations for ongoing data quality maintenance:

1. Establish ongoing data quality monitoring processes.
2. Determine feedback mechanisms to practices.
3. Document and implement ongoing processes and procedures to address data quality issues.

Over time, a practice's goals may change and new measures selected to monitor progress in meeting new or revised goals, underscoring the need for ongoing data quality monitoring and improvement. After practices establish ongoing data quality monitoring processes, they can create protocols to identify and resolve future issues based on what worked best during initial data quality improvement activities. This can include identifying specific individuals within the practice who will be accountable for the ongoing monitoring activity. Community-driven approaches can monitor data quality through a centralized function to support practices throughout the community.

4.1 *Establish Ongoing Data Quality Monitoring Processes*

The practice or community determines the method and frequency for ongoing data quality monitoring and reporting as well as which staff will be accountable for reviewing and acting on data quality issues. Data quality improvement is not a one-time or finite set of activities. As organizational and community goals grow and shift, practices may need different data to produce additional performance reports that will depend on high-quality data. A few examples of ongoing data monitoring approaches include—

- Monitoring progress on measure results (e.g., MU measures, disease-specific individual and composite measures) on a regular schedule (e.g., monthly) and evaluating the barriers to improvement
- Reviewing regular measure reports for outliers that could point to a data integrity issue
- Onsite walkthroughs with staff to observe workflow and documentation practices.

The reviews can be ad hoc, simultaneous with quality measure report updates, or on a scheduled review timeline. Organizations with multiple practices may need to sequence reviews according to the number of sites and available resources. Practices need to be educated on the data quality monitoring process so that they understand the timelines and expectations following feedback on data quality issues.

The EHR vendor may also require ongoing engagement. In addition to ongoing issue resolution, software releases present both opportunities and challenges. Practices may need help installing upgrades as well as understanding how best to use new functionality to improve data quality. New versions can also cause new data quality problems. For example, an upgrade could change how the

system stores data elements, which makes existing data maps obsolete and could break quality reports. Changes to functionality could alter the user workflow experience and cause staff to miss high-priority items. Practices may need to plan and budget for vendor assistance during upgrades, for future data quality projects, and for long-term maintenance in addition to support during the initial data quality improvement project.

If data quality improves activities cross a community, resources can be pooled and used to support ongoing monitoring (e.g., monthly, quarterly) of data quality and production of reports for practices that identify data issues. A dedicated function to ongoing monitoring can ensure that data review processes are standardized across practices, comprehensive, and occur with the necessary frequency to identify issues in a timely manner. A community can also engage the necessary IT and clinical expertise and resources to ensure that the reports back to practices are easily understood, informative, and actionable.

Crescent City Beacon Community (New Orleans): Aligning Efforts with Community Leaders and Vendors for Successful Implementation

The Crescent City Beacon Community embarked on a pilot study in 2011 with the primary goal of assessing the feasibility of implementing transformational chronic care management interventions among 17 community health centers. A secondary goal was to assess the capabilities of practices to report on quality measures. This study revealed the need to partner with practices to help them improve data quality and overcome anxiety about generating quality measures within the community.



Community Players. The community decision-makers for this project were clinical and quality improvement (QI) leads from three organizations, each representing several practice sites and chosen by the community to serve as clinic representatives on New Orleans' Chronic Care Management Workgroup. Although having an EHR in place was an original requirement of the ONC Beacon Community Program, a few organizations were allowed to participate while they were in the process of implementing their EHRs. No organization was required to already have reporting functionality or processes in place for chronic conditions.

The Issue. The practices and providers were initially reluctant to measure and report their performance on quality measures to peers, because they did not trust that their data was of sufficient quality to produce accurate results, even though they were already generating reports for PCMH recognition and MU attestation and to comply with the state's Medicaid waiver reporting requirements. However, their mistrust in the data was not unfounded—one practice, for example, once generated three separate reports for the same diabetes measures and got three different sets of results.

The Solution. Beacon Community staff launched a Data Reporting Project consisting of dissemination of measure reference sheets and a reporting manual containing relevant technical specifications, deployment of standardized reporting templates built in partnership with EMR vendors, quarterly data workshops co-hosted with EHR data reporting experts, quality checks guided by chart audits and data quality planning tools, and rapid feedback regarding data errors. The goal of project was to create measure harmonization, bring practices into alignment with national reporting specifications, and build community-wide trust in the clinical EHR data. To overcome the practices' reluctance to report their data to the larger community, reporting was initially at an aggregate level only and de-identified. The reporting occurred in waves that included at least three practices per wave. Over time, the practices successfully reduced errors (from 33% to 13%) and became more confident in their data, more knowledgeable about the factors affecting their data and strategies to resolve them, and more comfortable showing their performance to their peers.

4.2 Determine Feedback Mechanism to Practices

As mentioned in Implementation Objective #1, an important aspect of the planning phase of the data quality improvement program is to develop feedback channels to the practices and clinicians to deliver data quality and improvement progress reports. Practices will need to know where deficiencies exist in their EHR data so that they know which aspects of their clinical process and workflow to focus on after any quality reporting issues with the vendor have been resolved. Practices will also need to know how successful they are at resolving specific data quality issues. It is important to recognize improvements in data quality and performance, even if they do not meet targets, to maintain staff engagement. Key aspects of the feedback process to consider include—

- **Report Design.** Reports must clearly identify (1) what data quality issues exist, (2) the extent of the data quality issues (e.g., data field X completeness = 20%, data field Y completeness = 80%), (3) improvement over time, (4) the time period the report represents, and (5) if possible, the minimum acceptable data quality for each data element based on measure requirements to produce valid results.
- **Report Delivery Mechanism.** Audience needs should determine how reports are delivered. For instance, if practices can and prefer to receive reports electronically (i.e., by email or via an electronic interface), a process could be designed to deliver reports in that method (if not cost-prohibitive).
- **Report Frequency.** Establishing a report delivery schedule helps practices know when to expect reports. Delivery frequency depends on several variables, such as practice preferences, resources required and available to produce reports, and expected timeframe for data issue resolution (i.e., some issues may be resolved quickly, while others may take months because they require changes in the clinical workflow).
- **Report Recipients.** It is essential to identify the correct stakeholders to receive the reports. These individuals may be chief information officers, data champions and stewards, practice leaders (e.g., clinical leaders, finance leaders, administrative leaders), or IT and data management staff (or, for small practices, someone identified to assume this role). Individuals receiving the reports should at least include decision-makers and those directly involved in the data quality improvement effort.

If monitoring data quality at the community level, additional options, such as automated report delivery to practices, can occur. This method uses fewer resources than having staff manually produce reports each time. The community could develop a system that automatically generates and emails reports directly to the appropriate contacts within practices. The reports could also be comparative and show how a practice's data quality issues compare with other practices or highlight other practices with a similar pattern of data issues. This may encourage practices to partner and collaborate on ways to resolve issues.

4.3 Document and Implement Ongoing Processes and Procedures To Address Data Quality Issues

Documented processes and procedures for data quality issues identified through ongoing monitoring will vary according to the scope and nature of the problem (e.g., an individual user struggling with documentation vs. a large organization struggling with standardization across

departments). Policies may outline how issues will be triaged, who will review and prioritize the list of issues, who will work on resolving them, and how the resolutions will be released to staff or to the live system. Documentation could also provide answers for the following scenarios:

- If changing a workflow or user screens, how will staff be trained? Online? Tip sheet? At the elbow?
- If making a technical fix, how long will it take? According to the usual release process? Ad hoc?
- If an individual user resists recommended solutions, what is the escalation path?
- If the issue relates to an organization-wide problem, who will coordinate and facilitate the resolution process across stakeholders?

[Appendix H](#) includes a publication that describes how the Utah Beacon Community extracted data from EHRs and provided reports to individual clinics that displayed performance on a set of diabetes measures and highlighted data-extraction and quality issues.

Common Causes of New Data Quality Issues

Practices and communities can also plan for and address new data quality issues as they arise. Common sources of new data integrity issues are listed in Exhibit 13. As with data quality issues identified during the initial implementation, practices may need to engage vendor resources or other resources in the community (e.g., an IPA) for assistance.

Exhibit 13: Common Sources of Data Integrity Issues

Issue	Description or Example	Sample Solutions
System configuration	Modifications to an EHR to fix one problem cause a different one	Build in thorough testing and communication processes to catch impacts to other workflows before launch
Workflow changes	Modifications to a clinical or registration workflow change how users interact with the system, leading to new data issues	Facilitate meetings between the technology leads and business process leads to test the workflow from data entry to storage.
System upgrades	Software disrupts or breaks existing functionality	Include reporting as part of system upgrade testing and, post-upgrade, validate reports against previous baselines for unexpected outliers.

Issue	Description or Example	Sample Solutions
Report updates	Changes to how reports calculate results identify new data issues (or cause the appearance of problems when the reports, in fact, need to be fixed)	Trace data elements back to source during report design to locate discrepancies.
A new practice joins the community	The organization must be included in existing data quality efforts and, for example, its data is mistranslated or misattribution to the wrong clinic	Create an onboarding process for new facilities, which includes participation in data quality initiatives and updates to reports.
Technology changes in the community	For example, a practice deploys a new EHR that breaks an exchange interface.	Facilitate communication during the implementation to resolve problems and ensure interface testing is included to catch avoidable issues.
New local, state, or federal reporting regulations	The community was in compliance but, because of new regulations, must adapt to the new requirements	Create a report updating process, including owner and escalation to vendor, if needed
Adding new measures or new data elements	New goals or strategic objectives may result in the need to monitor performance on new measures	Create a report updating process, including owner and escalation to vendor, if needed

Lessons Learned from Establishing a Continuous Data Quality Monitoring Process:

- Determine who is responsible for reviewing and acting on data quality reports as well as what the process is to correct data issues once identified.
- Recognize improvement, even if it falls below targets, to maintain staff engagement.
- Develop transitions so key ongoing data quality monitoring activities continue during turnover.
- Plan for ongoing vendor engagement to address system upgrades, new data quality initiatives, and ongoing issue resolution.

Looking Ahead

With increasing adoption of EHRs, driven by the Meaningful Use Incentive Program and other incentives, the volume of electronic health data available for use continues to expand. At the same time, there is increasing interest in using data collected during the course of patient care for several purposes, including quality improvement, population health management and performance reporting, health services research, and support for payment reform initiatives. The National Institutes of Health (NIH) has called for increasing the reuse of electronic record data for research, and the clinical research community has been actively seeking methods to enable secondary uses of clinical data.¹⁴ These factors are driving a broader awareness of data quality challenges and an imperative to address them.

The increasing prevalence of high-quality data will enable both primary and secondary uses of data and support the development of a learning health care system.¹⁵ The following list includes programs, initiatives, and activities that benefit from increasingly high-quality EHR data:

- **Using Data to Drive Quality Improvement.** Providers are increasingly using data to drive their quality improvement activities, both to determine how to focus their efforts and assess their progress.
 - **Run Charts to Measure Performance Improvement.** Practices and communities may consider the use of “run charts” to measure progress in meeting performance improvement goals. Appendix I: Using Run Charts to Drive and Assess Performance Improvement includes a sample run chart and a publication that describes run charts in detail and discusses the construction, use, and interpretation of run charts in health care. Individual practices may generate run charts or, in a Community-driven initiative, run charts can be created at the Community level, and then drill-down reports created for each practice. An on-demand course from the Institute for Healthcare Improvement on how to use run charts is available at IHI Run Chart Course Website.
 - **Performance Reporting and Benchmarking.** This refers to internal comparative performance reporting at the provider, practice, and Community level and public reporting of physician group and hospital performance on prevalent and high-cost population health measures. Goals of performance reporting and benchmarking include informing providers of how effectively they are providing high-quality care and encouraging providers to focus on patients or conditions where care is suboptimal.
 - **Clinical Decision Support.** CDS is a relatively new technology, increasingly used to support evidence-based patient care. CDS is an interactive decision support system designed to assist physicians and other health professionals with decision-making tasks, such as determining diagnosis of patient data. CDSs link health observations with health knowledge to influence health choices by clinicians for improved health care.
- **Health Information Exchange (HIE).** This refers to the electronic movement of health-related information among organizations according to nationally recognized standards. The

goal of exchange is to facilitate access to and retrieval of clinical data to provide safer, timelier, efficient, effective, equitable, patient-centered care. HIOs support electronic exchange of clinical information among disparate health care information systems while maintaining the meaning of the information being exchanged. HIOs also govern and fund the infrastructure for secondary use of clinical data for purposes such as public health; clinical, biomedical, and consumer health informatics research; and institution and provider quality assessment and improvement.

- **Patient Engagement.** The increasing ability of patients to record and share health data electronically, such as through a personal health record or remote monitoring system, has highlighted the use of patient-generated health data (PGHD) to assess quality of care and patient outcomes. PGHD includes health history, symptoms, biometric data, treatment history, and lifestyle choices. PGHD is distinct from data generated in clinical settings and through encounters with providers, because patients, not providers, are primarily responsible for capturing or recording this data, and patients direct the sharing or distributing of the data to health care providers and other stakeholders. In these ways, PGHD complements provider-directed capture and flow of health-related data across the health care system. The National eHealth Collaborative's Patient Engagement Framework includes additional information on how PGHD supports the MU program objectives ([National eHealth Collaborative Patient Engagement Framework](#)).
- **Payment Reform and Pay for Performance.** This refers to providing data on the effectiveness of care provided to patients based on specific measures and targets and used to calculate provider reimbursement or bonuses and penalties based on performance.
- **Health Services Research.** This refers to the investigation of how social factors, financing systems, organizational structures and processes, medical technology, and personal behaviors affect access to health care, the quality and cost of health care, and quantity and quality of life. The primary goals of health services research are to identify the most effective ways to organize, manage, finance, and deliver high-quality care; reduce medical errors; and improve patient safety.¹⁶

Use of EHR data can enhance health care experiences for individuals, expand knowledge about disease and appropriate treatments, strengthen understanding about the effectiveness and efficiency of health care systems, support public health and security goals, and aid businesses in meeting the needs of their customers. Retrospective analysis of health data holds promise to expedite scientific discovery in medicine and constitutes a significant part of clinical research. Currently, use of clinical data collected during patient care is still at its early stage,¹⁷ but national initiatives have been created to facilitate widening use of EHR to support clinical research and quality monitoring in the United States. Below are examples of Beacon Communities that have made progress in improving EHR data quality and using this data to support the goals of improving the health care system and the health care provided to patients within their Communities.

Looking Ahead: Greater Tulsa Health Access Network Beacon Community Making Data Actionable



The Greater Tulsa Health Access Network Beacon Community is using and expanding its health IT infrastructure to deepen the analytic capacity at the practice level, which can provide high-value patient-level information as well as allow for more effective management of patient panels. In this Beacon Community, a coalition of more than 150 providers in the MyHealth Access Network has implemented an advanced health analytics system with data integration and analysis capabilities and a comprehensive data warehouse for calculating and reporting outcome measures. Staff on the business intelligence and epidemiology teams use the analytics system to import and aggregate data from disparate sources (e.g., HIE, EHR, claims, and referral systems) and address issues of data standardization and completeness to ensure that high-quality data is available for analysis. Through an accessible, interactive web-based interface, users can view data in standard reports and at-a-glance dashboards, run custom calculations to quickly understand trends and anomalies, and easily identify patients in need of intervention. These analytics are being used throughout the community to drive QI initiatives.

For example, at the University of Oklahoma School of Community Medicine, in a free clinic that serves uninsured patients with chronic conditions, a diverse team of students under faculty supervision uses the analytics system to manage a patient panel with many diabetic patients. The students use the system to calculate the patient panel average for vital statistics (e.g., HbA1c, BP, cholesterol levels); build custom reports to track this information over time; and see their individual performance, practice group performance, and clinic care measures. The ability to manage patients at a panel level drives students to ask engaging questions about the data and allows for immediate identification of areas for improvement.

Looking Ahead: Rhode Island Beacon Community Making Data Actionable



Building on its work to harmonize measure specifications, the Rhode Island Beacon Community established a comparative data methodology to engage Beacon Community providers and QI teams in discussions around their clinical outcomes and performance. Displaying practice-level performance relative to that of others in the community provides a strong foundation for improvement. The Rhode Island Beacon Community's comparative performance reporting process involves the following components:

- Calculating community-level and practice-level results;
- Ranking and displaying performance levels for each clinical quality measure and a five-measure composite score using randomly blinded practice, site, and provider identities;
- Using simple, color-coded performance charts indicating performance relative to targets as below (red), near (yellow), or above (green);
- Recognition for making comparative improvements even if below target values; and
- Disseminating results to all parties in a convenient and efficient forum.

The Rhode Island Beacon Community has also made this work transparent. All Beacon Community practices can access these data through a collaborative portal, and they each receive posters summarizing community-wide data, individual practice data, and comparative data, which they can display to their care teams and in their patient waiting rooms. By promoting transparency in this way, they aim to more actively engage patients in the measures associated with their conditions and the measurable outcomes of their treatment. Practice leaders also use this comparative data to foster dialogue between providers and QI directors. Making comparative data available has helped some providers realize that they are not all performing as well as they thought relative to peers within and outside their practice. They now have evidence that there is room for improvement.

Appendices

Appendix A: Implementation Objectives Summary

Use Exhibit A-1 as a guide to determine whether the Community has the structural elements in place to begin implementation of EHR data quality improvement activities.

Exhibit A-1: Foundational Elements for Success

Element	Considerations
Health IT	<ul style="list-style-type: none"> • Have practices implemented or are they in the process of implementing EHRs and working toward MU certification? • If the initiative extends beyond one practice, how fragmented is the EHR market in the community? Are there 1 or 2 EHR products in use in the community, or are there many different EHR products in use? • Are the EHRs certified by ONC (http://www.healthit.gov/buzz-blog/meaningful-use/certified-ehr-health-it-products-list-available)?
Leadership, Commitment and Collaboration	<ul style="list-style-type: none"> • Are there providers or practices that have successfully undertaken data quality improvement initiatives and would be willing to provide leadership and direction for this project? • If the initiative extends beyond one practice (i.e., includes multiple practices, a health system, or public health entities), is there a data governance body in place or does the community have the expertise from within to create one? • Is there awareness and agreement among physicians and practices of the need to improve EHR data quality to support activities, such as preparing for a new quality improvement program targeting patients with diabetes or participation in a Pay for Performance program? • Is there a willingness to commit resources to improving data quality in support of shared goals?
Performance Measurement and Evaluation	<ul style="list-style-type: none"> • Do practices or the community already have clear performance goals or target areas of focus (e.g., reducing hospital readmissions, improved care outcomes for diabetics) or a process to facilitate goal setting? • Have measures been identified to track progress in meeting goals and the required data elements identified to enable reporting on these measures?
Quality Improvement	<ul style="list-style-type: none"> • Are there quality goals or activities in the marketplace that would benefit from improvements in EHR data quality?

Element	Considerations
Sustainability and Resources	<ul style="list-style-type: none"> Do the practices or the community understand the value and benefits of improving EHR data quality? Do practices or the community have the resources in place to support activities to improve EHR data quality, and support practice workflow redesign? If not, is there a commitment to acquire the necessary resources? Are there resources that can provide on-the-ground assistance to implement and maintain EHRs, such as a Regional Extension Center (REC)? (More information on RECs can be found at http://www.healthit.gov/providers-professionals/regional-extension-centers-recs).

Exhibit A-2 provides a high-level summary of the Implementation Objectives and action steps described for implementation of EHR data quality improvement activities.

Exhibit A-2: Implementation Objectives Summary and Action Steps

#	Objective	Actions
1	Identify and Engage Physician Champions and Stakeholders and Jointly Develop Vendor Engagement Strategy	<ol style="list-style-type: none"> Identify physician champion(s) and engage stakeholders Determine vendor engagement strategy Clarify and articulate the local benefits and funding requirements for improving EHR data quality
2	Identify Measures, Identify and Map Data Elements, and Conduct Initial Data Quality Review	<ol style="list-style-type: none"> Identify EHR-based measures and the data elements needed to calculate them Confirm ability to extract data from EHR for reporting purposes Determine data quality assessment method and implement data quality review
3	Develop and Implement EHR Data Quality Improvement Activities	<ol style="list-style-type: none"> Review current workflows and document necessary changes to remediate data quality issues (Process) Implement data integrity checks and protocols to ensure documentation compliance (Technology) Provide training and coaching to staff (People)

#	Objective	Actions
4	Establish Process to Continuously Monitor EHR Data Quality and Resolve Data Quality Issues	10. Establish ongoing data quality monitoring process 11. Design feedback mechanism to practices 12. Document and implement ongoing processes and procedures to address data quality

Appendix B: Guidance for Setting Performance Improvement Goals

Beacon Communities identified performance improvement goals when applying for Beacon Community Program grants. When community goals were not already in place, Beacon Communities went through a consensus-building process to set goals. Improvement goals for practices and communities will determine the time and resources required during each phase of the project. These goals included improving clinical quality and patient outcomes for prevalent chronic conditions, increasing patient engagement, improving PCMH reporting requirements, increasing medication adherence rates, and fostering community-wide HIE capabilities by enabling information sharing between hospitals and providers. The ability to achieve these and other goals depends on having high-quality data. The Beacon Community experience has shown that the following considerations are key issues to consider during the goal-setting process:

- Alignment with Practice and Community Goals.** Improvement goals result from strategic QI and cost-management goals of practices and communities. HIOs, practices, payers, and hospitals may be involved in several concurrent quality and performance improvement activities. To align existing efforts, an important first step is to develop an inventory of community and practice-based quality and performance improvement initiatives. A subcommittee of an existing governance body or a QI committee within the community may be tasked to conduct this inventory and assess existing quality programs, including the respective roles, resources, and required stakeholders’ effort. This activity will help articulate the benefits of improving EHR data quality, building on existing efforts, and strategically aligning with community-wide goals to improve health and care at lower costs.
- Alignment with Industry Movement.** A practice’s or community’s goals could be aligned with market trends related to QI and cost management. Because providers are typically already focused on government and private-sector efforts to measure and improve quality and cost management, improvement goals need to be aligned with current efforts to improve health and health care as well as with national programs such as MU, PQRS, PCMH, local payer initiatives, and Medicare QIO targets.
- Implementation Level of Effort (LOE).** Resources to implement improvement goals need to be estimated and viewed within the framework of current improvement activities practices are implementing.
- Reporting LOE.** Performance reporting will be needed to monitor progress toward meeting goals. The back-end database requirements and front-end report design, development, and dissemination activities will require resources to properly implement.

Practice- and community -level (i.e., aggregator) resources required for the performance reporting process need to be accurately projected and planned for.

Appendix C: Sample List of Performance Measure Developers and Endorsers and Disseminators

Organization (website home page)	Description	Measures Care Setting	Measure Specifications Site
MEASURE DEVELOPERS			
Joint Commission (www.jointcommission.org)	Accredits and certifies more than 20,000 health care organizations and programs in the United States. Joint Commission accreditation and certification is recognized nationwide as a symbol of quality that reflects an organization's commitment to meeting certain performance standards.	Inpatient Outpatient	ORYX Measures Fact Page
National Committee for Quality Assurance (NCQA; http://www.ncqa.org)	Manages voluntary accreditation programs for individual physicians, health plans, and medical groups. Health plans seek accreditation measure performance through the administration and submission of the Healthcare Effectiveness Data and Information Set and Consumer Assessment of Healthcare Providers and Systems survey.	Inpatient Outpatient	NCQA Measures Home Page
American Medical Association (AMA)	The AMA-convened Physician Consortium for Performance Improvement (PCPI) develops state-of-the art quality measures that are clinically relevant and grounded in a robust evidence base.	Inpatient Outpatient	AMA Measures Home Page
MEASURE ENDORSERS			
National Quality Forum (http://www.qualityforum.org)	Reviews, endorses, and recommends use of standardized health care performance measures.	Inpatient Outpatient	NQF Measures Home Page



Organization (website home page)	Description	Measures Care Setting	Measure Specifications Site
MEASURE STEWARDS			
Agency for Health Research and Quality (AHRQ) (http://www.ahrq.gov)	It mission is to improve the quality, safety, efficiency, and effectiveness of health care for all Americans. AHRQ supports research that helps people make more informed decisions and improves the quality of health care services.	Inpatient Outpatient	AHRQ Measures Home Page
Center for Clinical Standards and Quality (CCSQ; Centers for Medicare & Medicaid Services [CMS]; http://www.cms.gov/About-CMS/Agency-Information/CMSLeadership/Office_OCSQ.html)	CCSQ serves as the focal point for all quality, clinical, and medical science issues and policies for CMS programs. It develops, tests, evaluates, adopts, and supports performance measurement systems (i.e., quality measures) to evaluate care provided to CMS beneficiaries, except for demonstration projects residing in other components.	Inpatient Outpatient	CCSQ Home Page
REPORTING PROGRAMS			
Physician Quality Reporting System (http://www.cms.gov/PQRS)	This CMS-qualified registry is a voluntary quality reporting program that provides financial incentives for eligible health care professionals.	Inpatient Outpatient	PQRS Measures Home Page
Meaningful Use (http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/MeaningfulUse.html)	This EHR incentive program provides financial incentives for the “meaningful use” of certified EHR technology to improve patient care. Eligible health care professionals must meet established objectives to receive incentive payment.	Inpatient Outpatient	Meaningful Use Measures Home Page
Medicare Shared Savings Program (MSSP; http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/sharedsavingsprogram/index.html?redirect=/sharedsavingsprogram)	MSSP facilitates coordination and cooperation among providers to improve the quality of care for Medicare fee-for-service beneficiaries and reduce unnecessary costs. Eligible providers, hospitals, and suppliers can participate in the Shared Savings Program by creating or participating in an Accountable Care Organization (ACO).	Inpatient Outpatient	MSSP Measures Page

Organization (website home page)	Description	Measures Care Setting	Measure Specifications Site
<p>Pioneer ACOs (http://innovation.cms.gov/initiatives/Pioneer-ACO-Model)</p>	<p>Designed for health care organizations and providers already experienced in coordinating care for patients across care settings, the model allows provider groups to move more rapidly from a shared savings payment model to a population-based payment model on a track consistent with but separate from the MSSP. The model is designed to work in coordination with private payers by aligning provider incentives, which will improve quality and health outcomes for patients across the ACO, and achieve cost savings for Medicare, employers, and patients.</p>	<p>Inpatient Outpatient</p>	<p>Pioneer ACOs Measures Home Page</p>
<p>Comprehensive Primary Care (CPC) Initiative; http://innovation.cms.gov/initiatives/comprehensive-primary-care-initiative)</p>	<p>This multi-payer initiative fosters collaboration between public and private health care payers to strengthen primary care. Medicare will work with commercial and state health insurance plans and offer bonus payments to primary care physicians who better coordinate care for their patients. Primary care practices that choose to participate in this initiative will be given resources to better coordinate primary care for their Medicare patients.</p>	<p>Outpatient</p>	<p>(CPC Website)</p>

Appendix D: Crescent City Beacon Community (New Orleans) Pap Test Data Quality Assurance Plan Template

Goal: Incorporate data-entry protocols into care management processes and protocols to facilitate quality measurement and reporting.

PART A: (Exploration)

STEP 1 Measure Title: Pap Tests	STEP 2 Description:	STEP 3 Performance:	STEP 4 Location of data field in EMR	STEP 5 Structured data field? Able to be pulled into report via code, value, etc.? (Y/N/ Unsure)	STEP 6 Consistently used by appropriate staff? (Y/N/ Unsure)	STEP 7 Action needed? (Y/N)
Numerator	The number of patients included in the denominator who have had a pap test performed during the reporting period or the 2 years prior to the reporting period	15.5%	Chart→Path/Lab CPT codes: 88141-88145, 88148, 88150, 88152-88155, 88164-88167, 88174-88175 Medcin (to capture patients having test done outside of center) Medcin findings: 3380, 3381, 4073, 105565, 13051, 29285, 105575, 105577, 220432 (has to have the onset date to be counted)	Yes	Yes	No
Denominator	The number of female patients 24–64 years of age during the reporting period who have had at least one encounter during the period		Pt Admin→DOB, Gender Chart→Encounter Date (Visit Count)	Yes	No	Yes

PART B: (Action Plan)

Quality Control:

- Describe your process to identify errors or issues affecting data quality of this measure (e.g., who will do what, how frequently).
- Data Manager—Run a list of females included in the denominator and identified as not having a pap test.
- QI Manager or other team member—Check the charts of several patients on the list and look for patterns.
- Frequency—Monthly

Results Reporting:

INSERT FINDINGS: After checking 20 charts, it was identified that 15 of the 20 patients had had the test performed outside of the practice. The provider or staff documented that the test was performed but did not include the onset data, and the actual result was scanned into the patients' medical records.

Correction Process:

- Describe steps needed (who will do what, by when, and how will monitoring ensure that the process is working?)
- Designate staff to work the list and update those charts with the documentation scanned into the chart.
- Develop a protocol, have staff sign off that they have received the protocol, and quiz staff on the protocol.
- Train staff on the process for documenting pap test results when the test is performed by an outside facility. Monitor the list monthly.

Review Priorities:

What can be easily solved? What depends on something out of the staff member's control?

Training staff on the correct process for documenting

Protected time to go back and add the onset date

Training Needs:

- ▶ Describe the training topic needed, who needs the training, how will it be conducted, who will lead the training, etc. Providers and support staff (M.A., L.P.N., R.N.) lead training—QI staff, chief medical officer, health IT staff, super user of the EHR (any one of these people).
- ▶ Group training—Presentation showing the results of the audit, walk-through of the workflow in the EHR for documenting pap tests performed at an outside facility.

Quality Assurance:

- ▶ Describe your proactive process for avoiding these types of errors in the future.
- ▶ Train new staff, monitor performance on the measure monthly, and retrain staff. Have cheat sheets available, and report to the team the progress made on the measure.

Appendix E: Workflow Background and Knowledge Area Primer

Designation of Role-Based Access to Data

Role-based access to the data—sometimes referred to as create, read, update, and delete authority—must be defined, enforced, and built into system security functionality. Clear policies on the information access needed by a specific role or relationship to patient types must be developed. This is determined by the role and location of staff. Roles need to be identified and access provided based on the Health Insurance Portability and Accountability Act's (HIPAA) minimum necessary requirement, which states that staff should have access only to the information they need to do their job.

Creation of Data Dictionaries

A data dictionary exists for each information system, with standard data field definitions for each data element. These definitions should be clearly communicated to all staff accessing the record—especially those responsible for reporting EHR data. In addition, periodic validation of access must be in place. The data dictionary can also be built into system functionalities to ensure adherence on many levels. As an example, the distinction between ethnicity and race should be understood and consistently applied during the registration process. Selection options for these fields should be limited to choices that are in compliance with the data dictionary.

For all the systems that feed the EHR, clear policies, standards, procedures, and functionalities should be established to define who owns and has responsibility for maintaining and creating the data dictionary for each system and module. Having a single owner over the various dictionaries is helpful in reducing reporting errors. The consistent capture of key data is crucial.

Use of Standardized Formats To Ensure Consistency

A standardized format is used to ensure consistency. For example, to satisfy MU requirements, the problem list is developed using the SNOMED format to record current, active, and past diagnoses. Format validation is another method to improve consistency. Data fields can be set to force users to enter dates as mm/dd/yyyy or assigned a reference range to warn users that certain values do not make sense for that field, such as a heart rate of 1000 beats per minute. In addition, the use of standardized templates, checklists, and online forms should be required to the greatest extent possible for provider and staff documentation. Many EHRs also allow configuration of a set of screens that walk the user through the most important documentation steps; these should be appropriate for the role and guide users to fill out the key data elements. This too can be built into the system's functionality but should be developed with the appropriate key stakeholders involved in the process.

Use of Structured Data

Use of structured data is important to enable the sharing and exchange of health information via HIEs with other organizations. For example, consider using structured fields for medication information such as route, dose, and frequency rather than entering this information in a free-text instructions field. No matter what system body temperature or BP is entered into, the

format is always the same and can be more easily shared across systems. If the information were entered as free text, the formatting might be lost and the information misinterpreted.

Systems can also use structured drop-down lists that can be customized or network to a larger file (e.g., a SNOMED database for diagnoses codes) to reduce the challenges associated with inconsistency because of free-text entry, such as by constraining a physician to select a frequency of “twice daily” rather than type “BID” when ordering a medication.

Careful Use of Item Requirements

Required items, sometimes called hard stops, prevent the user from advancing through documentation until required information has been input into system, such as a patient’s Social Security number during registration or preventing staff from marking a patient visit as “complete” or “closed” until missing information is entered. These items prevent users from missing important data elements but should be used judiciously and thoroughly tested to avoid negatively affecting user productivity. For example, if a user is unable to fill in a required field because of a unique patient situation, the system may prevent the user from advancing to other documentation.

Creation of Documentation Dashboards

Some organizations create dashboards in the system or on a computer screensaver that displays to staff or managers the status of key documentation elements for a particular patient. These can be related to missing or incomplete documentation or to a patient’s progress toward health goals.

Adherence to State and Federal Laws

State and federal laws and regulations; accreditation standards; medical staff bylaws, rules, and regulations; and organizational policies and procedures mirror standardization decisions and should be followed by providers and staff. The Joint Commission’s Information Management and Record of Care standards, HIPAA rules, CMS Conditions of Participation, and Federal Rules of Civil Procedure related to electronic discovery are just a few of the standards that should be kept in mind when developing standards and procedures.

Compliance with Data Integrity Policies and Procedures

Data integrity policies and procedures must be followed. These policies may apply to processes for new patient file creation, handling duplicate records, and addressing overlays because two patients have been assigned the same unique identifier. It is important to implement policies and procedures to maintain the integrity of the data throughout the patient encounter for all information entered into the EHR. Individuals dedicated to the continuous auditing and EHR correction processes that monitor the system proactively and correct errors as they are identified play an important role in fine-tuning processes and ensuring the overall quality of the data.

Appendix F: Rhode Island Beacon Community Optimal Diabetes Care Workflow

The Rhode Island Beacon Community supports performance improvement efforts by offering onsite consultations for practices to support workflow redesign activities to improve care delivered to patients with diabetes. These consultations include focused efforts to ensure that patient information captured in EHRs is accurate and consistent across practices to make performance feedback reports credible and accurate and data transmitted to CurrentCare (HIO) of high quality.

The Rhode Island Beacon Community provides diabetes care workflow documentation to practices during the consultations. The information below is an example of what is provided. Note that this example is vendor specific and may not be applicable to other EHRs.

1. Record “Assessments,” Ensuring They Transfer to the “Problem List” Recommendation

- All diabetes diagnoses should be added as Assessments during an encounter, ensuring that the **PL** check box is selected (should be made a default setting), so the diagnoses are added to the Problem List.
- Patients with diabetes diagnoses that are not on the patients’ Problem List should have these diagnoses added to their Problem List.
- Diagnoses on the Problem List should be managed using the **clinical status** drop-down box as opposed to removing them from the Problem List.
- Adding a diagnosis as an Assessment, and then having it automatically added to the Problem List.

Rationale

- Adding a diagnosis as an Assessment, and then having it automatically added to the Problem List—Attaches a reliable date to a diagnosis, indicating when a patient’s diagnosis became active
- Yields accurate reports regarding the number of patients in a specific population and subsequently any additional quality of care measures for that patient population
- Uses “clinical status” to manage diagnoses on the Problem List
- Allows providers to actively manage their Problem Lists to reflect a patient’s most relevant problems
- Helps keep an accurate historical record in the EHR that can be easily and actively reported.

2. Use a Lab Interface

An electronic interface is the most efficient way to document lab results with LOINC codes, which are required to be reportable. Using a lab interface eliminates the time needed to document labs in the EHR and decreases the chance of making recording errors. In addition, auditing erroneous lab results will enable the practice to determine whether additional lab test should be performed and can provide an indication that the interface is not working properly. Note: Integrating structured lab values is part of MU.

Recommendation

All labs should enter the EHR via an electronic interface; all of the labs should have a LOINC code that is automatically documented as the lab result enters the EHR. In addition, audit any lab results that arrive as text instead of a numeric value or appear to be erroneous.

Rationale

An electronic interface is the most efficient way to document lab results with LOINC codes, which are required to be reportable. Using a lab interface eliminates the time needed to document labs in the EHR and decreases the chance of making recording errors. In addition, auditing erroneous lab results will enable the practice to determine whether additional lab test should be performed and can provide an indication that the interface is not working properly. Note that mapping lab values to LOINC codes is not always straightforward, and, depending on the EHR, it can be time-consuming to keep mapping tables up to date, because lab results delivered to an EHR may be LOINC-coded.

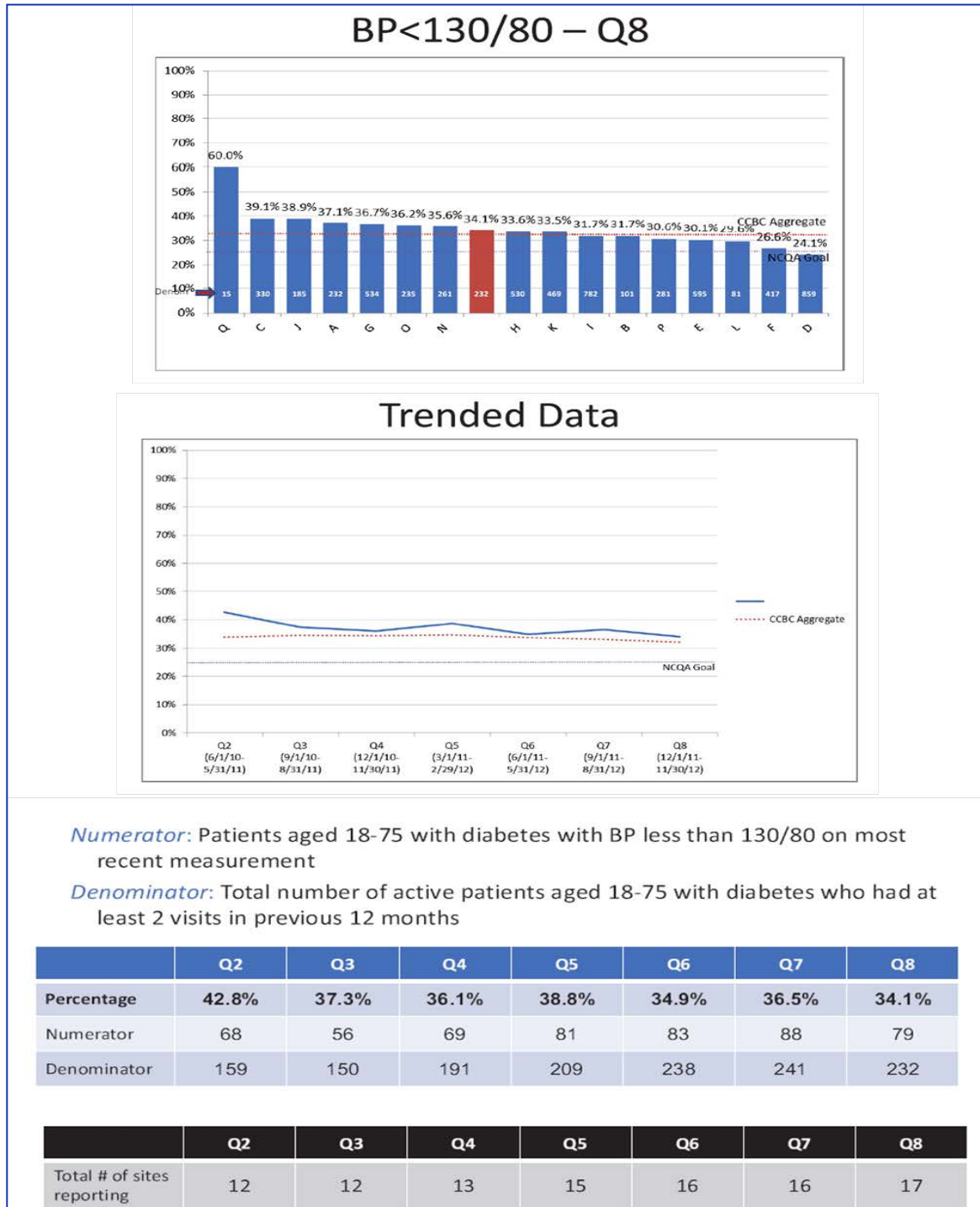
3. Record Blood Pressure in the “Vitals” Template

Recommendations

To record multiple BPs and choose the most appropriate BP reading for a given encounter, BP should be recorded as follows:

- Record BP in the Vitals table in the BP (mm Hg) column, using the “pop-up” option.
- If BP rechecks are necessary, record the additional BPs in the same column using the pop-up option.
- At the end of an encounter, choose a default reading to be reported on (if none is chosen, the last BP recorded will become the default).
- Rationale
- Using the pop-up functionality allows a provider to easily record multiple BPs with the appropriate modifiers.
- Choosing a default allows a provider to choose the most appropriate BP to be recorded for that encounter.
- Typing multiple BP readings into one field or adding letters in the field can cause reporting errors.

Appendix G: Sample Crescent City Beacon Community (New Orleans) Data Quality Report for a Blood Pressure Control Measure



Appendix H: Utah Beacon Community Publication on EHR Data Extraction To Support Diabetes Performance Measurement and Improvement

Extracting Data from Electronic Health Records to Evaluate Diabetes Care: The Utah Beacon Initiative

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Background: As the use of electronic health records (EHRs) become more prevalent, there are increasing opportunities to improve the quality of healthcare provided across healthcare facilities. As part of the Beacon community award funded by the Office of the National Coordinator for Health Information Technology (ONC), *HealthInsight* partnered with 53 primary care clinics to improve the health of patients with diabetes in the Salt Lake Metropolitan Area. However, deriving reliable and useful performance measurement data across these clinics was beyond the capacity of most EHRs. To address this gap, we developed a software system to extract data directly from the EHRs used by these clinics to evaluate the quality of healthcare provided to patients with diabetes. Data collected are based on eight National Quality Forum-endorsed process and outcome measures, which include hemoglobin A1c (screening and in-control), low-density lipoprotein cholesterol (screening and in-control), blood pressure (in-control), nephropathy screening, eye exams, and foot exams.

Design and Development: The system uses a client-server architecture model, wherein the main server is housed at the Amazon Web Server and each clinic connected to the system has a locally-installed application. The central server comprises of a MySQL database that uses the Amazon Relational Database Services to store metadata and quality measure results from the clients. The client installation at each clinic comprises: (a) a service application that once installed, queries the server periodically for tasks to be executed and launches a processor if new tasks are identified;(b) a processor that executes tasks and pushes aggregated and de-identified data to the server; and (c) a client mini repository that stores all the translated data from the EHR. The software system includes processes to select specific tables and fields in the EHR databases to extract the required data to calculate the eight Beacon measures. The mappings are conducted using input from IT staff and providers at every clinic. Certain clinic-mappings also require input from the EHR vendors.

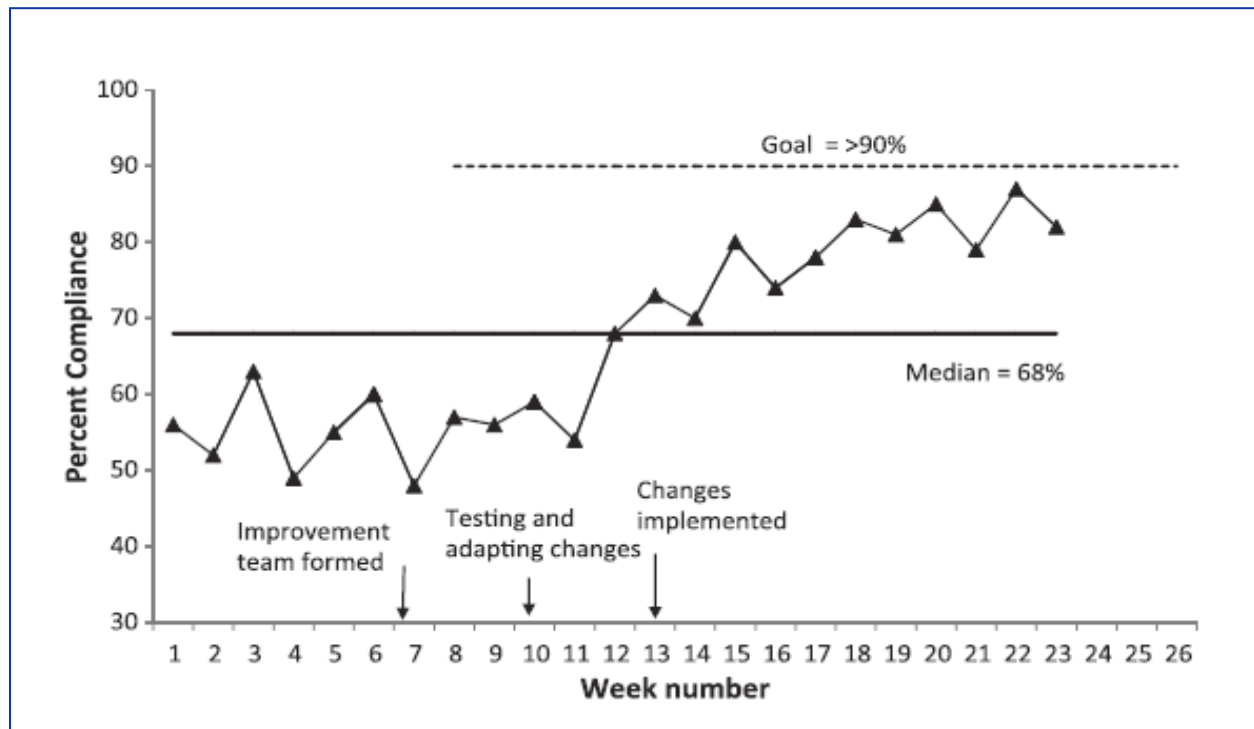
Discussion: *HealthInsight* shares the data generated from the system in the form of custom reports with each clinic, and the clinics use the reports in their out-reach efforts to improve care provided to patients with diabetes. The system is currently implemented in 13 Beacon clinics and extracts data from 11 different EHR systems. *HealthInsight* plans to expand the implementation of the software system to selected clinics over the next six months. Although, the Primary Use Case has been the calculation of the Beacon measures to improve the health of patients with diabetes, there are several initiatives to use the software system for additional Use Cases, such as identifying eligible participants in the Care4Life patient self-management program, validate other data sources, and for Quality Improvement projects that are data-reliant. We found that the complexity of data extraction and mapping from an EHR depended on several characteristics that

include the technical expertise available at each clinic, a highly motivated provider champion, access to the EHR database, and collaboration between EHR vendors and clinics.

Acknowledgements: IC3 Beacon Community, Grant #90BC00006.

Appendix I: Using Run Charts to Drive and Assess Performance Improvement

The example run chart below shows percentage compliance with a sample procedure over time aligned with the different stages of process improvement activities.



Above figure from: Perla, R., Provost, L., & Murray, S. (2011). *BMJ Quality & Safety*, 20(1), 46-51.

There is considerable published material describing the use of run charts in detail, including how to construct, use, and interpret run charts in health care. Those interested in learning more might consider the following resources:

- Perla, R., Provost, L., & Murray, S. (2011). The run chart: a simple analytical tool for learning from variation in healthcare processes. *BMJ Quality & Safety*, 20(1), 46-51. doi: 10.1136/bmjqs.2009.037895.
- Institute for Healthcare Improvement's Run Chart Tool: <http://www.ihl.org/knowledge/Pages/Tools/RunChart.aspx>
- A Health Resources and Services Administration (HRSA) resource on Managing Data for Performance Improvement: <http://www.hrsa.gov/quality/toolbox/methodology/performanceimprovement/part2.html>

Appendix J: Acronyms and Key Definitions

Exhibit J-1: Acronyms

Acronyms	
ACA	Affordable Care Act
ACO	accountable care organization
AHRQ	Agency for Health Research and Quality
AMA	American Medical Association
BP	blood pressure
CCR	continuity of care record
CCSQ	Center for Clinical Standards and Quality
CDS	Clinical Decision Support
CMS	Center for Medicare and Medical Services
CPC	Comprehensive Primary Care Initiative
CPT	common procedural terminology
EHR	electronic health record
HHS	Department of Health and Human Services
HIE	health information exchange
HIO	health information organization
HIPAA	Health Information Portability and Accountability Act
HITECH	Health Information Technology for Economic and Clinical Health
ICD	International Classification of Diseases
IPA	Independent Physician Association
LOE	level of effort
LOINC	Logical Observation Identifiers Names and Codes
MA	medical assistant
MSSP	Medicare Shared Savings Program
MU	Meaningful Use
NCQA	National Committee for Quality Assurance
NIH	National Institutes of Health
NQF	National Quality Forum
ONC	Office of the National Coordinator for Health IT
PCMH	Patient-Centered Medical Home
PGHD	patient-generated health data

PQRS	Physician Quality Reporting System
QIO	Quality Improvement Organization
REC	Regional Extension Center
SNOMED	Systematized Nomenclature of Human Medicine Clinical Terms

Exhibit J-2: Terms and Definitions

Terms	Definitions
Clinical Decision Support (CDS)	An interactive decision support system designed to assist physicians and other health professionals with decision-making tasks, such as determining diagnosis of patient data. CDS systems link health observations with health knowledge to influence health choices by clinicians for improved health care.
Continuity of Care Record (CCR)	The CCR is a patient health summary standard. It is a way to create flexible documents that contain core health information about a patient and send this information electronically from one caregiver to another. Its contents include patient demographics, insurance information, diagnoses and a problem list, medications, allergies, and a care plan. These represent a snapshot of a patient’s health data that can be used at the time of clinical encounter.
Health Information Organization (HIO)	An HIO is a multi-stakeholder organization created to facilitate the transfer of health care information electronically across organizations. The larger the stakeholder group, the more complex the engagement and consensus-building process.
Systematized Nomenclature of Medicine - Clinical Terms (SNOMED)	A systematically organized computer collection of medical terms providing codes, terms, synonyms, and definitions used in clinical documentation and reporting. The primary purpose of SNOMED is to encode the meanings that are used in health information and to support the effective clinical recording of data with the aim of improving patient care. SNOMED provides the core general terminology EHRs and includes clinical findings, symptoms, diagnoses, procedures, body structures, organisms and other etiologies, substances, pharmaceuticals, devices, and specimen.

Appendix K. References

Endnotes

¹ Hillestad, R., Bigelow, J., Bower, A., Girosi, F., Meili, R., Scoville, R., & Taylor, R. (2005). Can electronic medical record systems transform health care? Potential health benefits, savings, and costs. *Health Affairs*, 24(5), 1103-1117.

² Weiskopf, N.G., & Weng, C. (2012). Methods and dimensions of electronic health record data quality assessment: enabling reuse for clinical research. *J Am Med Inform Assoc*, 20(1), 144-151. doi:10.1136/amianjnl-2011-00681

³ Centers for Medicare & Medicaid Services. <http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/DataAndReports.html>.

⁴ Chan, K., Fowles, J., & Weiner, J. (2010). Electronic health records and the reliability and validity of quality measures: a review of the literature. *Med Care Res Rev*, 67(5), 503-527.

⁵ Galanter, W.L., Hier, D.B., Jao, C., & Sarne, D. (2010). Computerized physician order entry of medications and clinical decision support can improve problem list documentation compliance. *Int J Med Inform*, 79(5), 332-338. doi: 10.1016/j.ijmedinf.2008.05.005

⁶ Parsons, A., McCullough, C., Wang, J., & Shih, S. (2012). Validity of electronic health record-derived quality measurement for performance monitoring. *J Am Med Inform Assoc*, 19(4), 604-609. doi: 10.1136/amiajnl-2011-000557

⁷ National Quality Forum (NQF). http://www.qualityforum.org/Projects/e-g/eMeasures/Electronic_Quality_Measures.aspx.

⁸ http://www.qualityforum.org/Projects/e-g/eMeasures/Electronic_Quality_Measures.aspx

⁹ Parsons, A., McCullough, C., Wang, J., & Shih, S. (2012). Validity of electronic health record-derived quality measurement for performance monitoring. *J Am Med Inform Assoc*, 19(4), 604-609. doi: 10.1136/amiajnl-2011-000557

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¹¹ Ibid.

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¹⁶ Agency for Healthcare Research and Quality, February 2002.

¹⁷ Botsis, T., Hartvigsen, G., Chen, F., & Weng, C. (2010). Secondary use of EHR: Data quality issues and informatics opportunities. *AMIA Summits Transl Sci Proc*, 1–5.

Appendix L. Other Resources

- National Quality Forum. Electronic quality measures (eMeasures). Retrieved from http://www.qualityforum.org/Projects/e-g/eMeasures/Electronic_Quality_Measures.aspx
- National Learning Consortium. Health Information Technology Research Center. *Primer: Continuous quality improvement (CQI) strategies to optimize your practice*. Retrieved from http://www.healthit.gov/sites/default/files/tools/nlc_continuousqualityimprovementprimer.pdf
- Qualis Health, Safety Net Medical Home Initiative. *Implementation guide: Optimizing health information technology for patient-centered medical homes: Quality improvement strategy PT 2*. Retrieved from <http://www.safetynetmedicalhome.org/sites/default/files/Implementation-Guide-QI-Strategy-2.pdf>
- Qualis Health, Safety Net Medical Home Initiative. *Implementation guide. Improving patient care through teams: Continuous and team-based healing relationships*. Retrieved from <http://www.safetynetmedicalhome.org/sites/default/files/Implementation-Guide-Team-Based-Care.pdf>