



Implementing Closing the Loop Safe Practices for Diagnostic Results

Convened by

ECRI Institute

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PARTNERSHIP *for*
HEALTH IT PATIENT SAFETY
a national collaborative

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Acknowledgments

The ECRI Institute *Partnership for Health IT Patient Safety* thanks the organizations that participated in the Closing the Loop Implementation Workgroup. We also thank those who presented and shared with the workgroup valuable information and those who provided the expertise that assisted with the development of the work plans. The workgroup participants and contributors are listed below.

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Implementing Closing the Loop Recommendations

The National Academies of Sciences, Engineering, and Medicine report *Improving Diagnosis in Health Care* highlighted the significance of diagnostic errors, defining them as “the failure to establish an accurate and timely explanation of the patient’s health problem(s) or communicate that explanation to the patient.”¹ One insidious diagnostic error is based on the failure to respond in an appropriate manner to new, actionable information about the patient’s condition. Regardless of the means of communication, tracking of test results and referrals has long been a challenge in all practice settings. Health information technology (IT) holds the promise of improving this process. In 2017, the *Partnership for Health IT Patient Safety* (see “ECRI Institute, the *Partnership*, and a Mission for Safety”) put forth three high-level safe practice recommendations to mitigate delayed, missed, and incorrect diagnoses related to diagnostic testing and medication changes using health IT:

1. Develop and apply IT solutions to communicate the right information (including data needed for interpretation) to the right people, at the right time, in the right format
2. Implement IT solutions to track key areas
3. Use health IT to link and acknowledge the review of information and documentation of the action taken

This white paper details recent work conducted on implementing these safe practices for diagnostic testing and specialty referrals. The work focuses on solutions for tracking the status of test results at various points in the process of obtaining diagnostic information.

Introduction

After the *Partnership for Health IT Patient Safety* developed safe practices and tools to facilitate their implementation, the *Partnership* developed a new workgroup structure. This structure included the traditional virtual meetings and stakeholder participation but now added activities to focus on implementing the practices. The objective was to identify where health IT can be used more successfully to close the loop for safety and to mitigate the risk of delayed, missed, or incorrect diagnoses. For this implementation workgroup, interested sites were identified, strategies and approaches were set forth, and a regular meeting schedule was established.

The *Partnership* invited volunteers from seven ambulatory care sites to commit to implementing recommendations for closing the loop on diagnostic testing and specialty referrals. Three sites began the process, two followed the project to completion.

The Closing the Loop Implementation Workgroup expanded upon the *Health IT Safe Practices for Closing the Loop: Mitigating Delayed, Missed, and Incorrect Diagnoses Related to Diagnostic Testing and Medication Changes Using Health IT*. The workgroup focused on implementing the selected recommendations using the strategies and tools that the *Partnership*’s topic-focused multi-stakeholder group identified. Diagnostic testing and specialty referral processes—specifically the tracking of results—are often a challenge for ambulatory care practices. This project takes the closing the loop safe practice recommendations and applies them to diagnostic testing and specialty referral tracking in the ambulatory care setting.

Envisioning and Approaching the Project

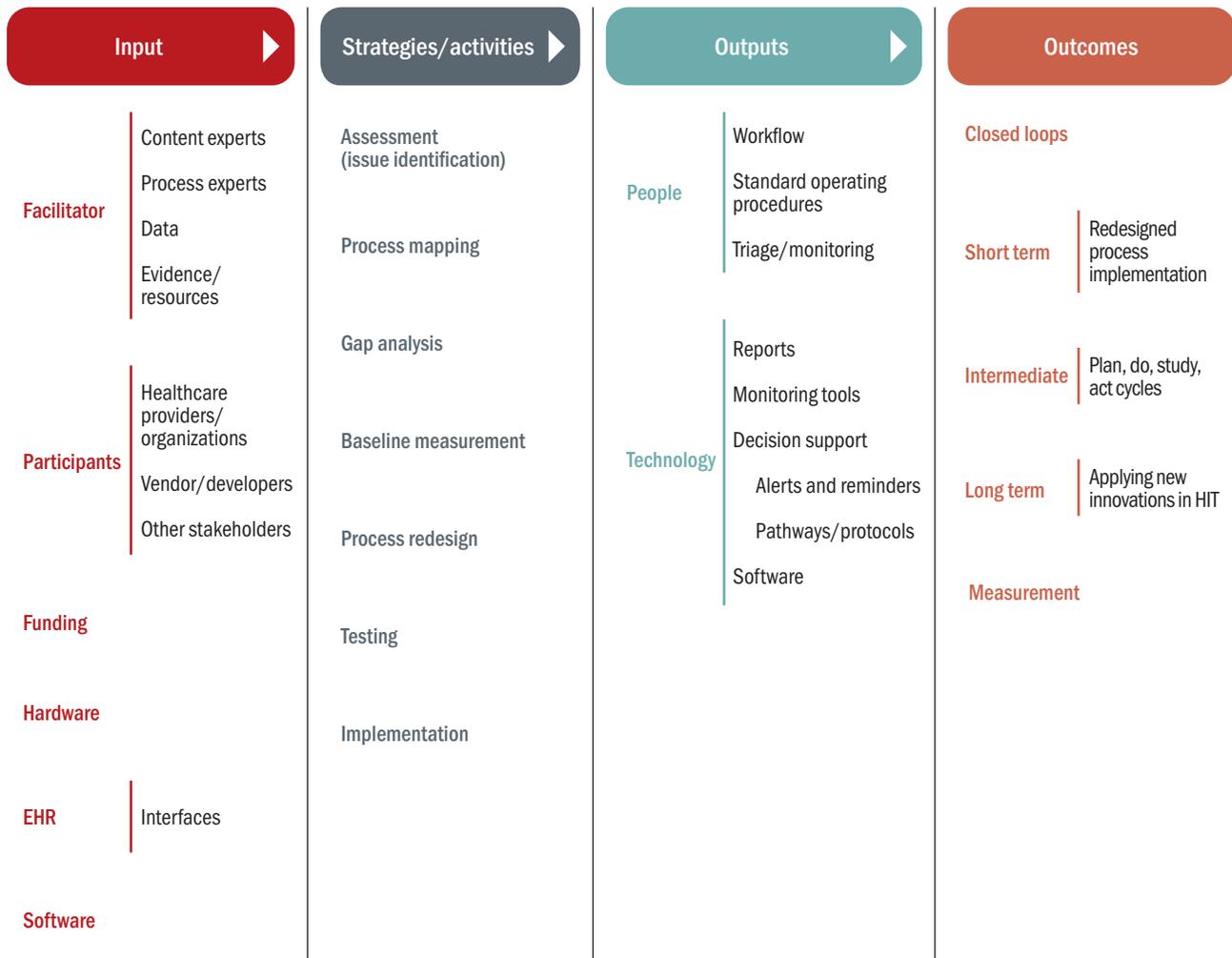
The overall strategic approach for this project included first developing a logic map (Figure 1) to help guide and inform the process. Once clarified, the process took a stepwise approach, beginning with recruiting and onboarding the participating organizations, gathering the necessary resources, and conducting a series of structured interviews, identifying the health information systems and the testing and referral processes each site used. Each site used a different electronic health record (EHR), and the practices had varying levels of IT and vendor support.

The next step was to identify the issues. For this purpose, each organization chose from a variety of strategies and

assessments that the *Partnership* provided to the sites. Using tools for process mapping and **gap analysis**, it was possible to identify issues for baseline measurement. It was not until the issues were clearly understood that the steps for process redesign, testing of solutions before deployment, and finally broader implementation of solutions could occur.

The anticipated outcomes of the project addressed processes focused on both people and technology. To achieve these outcomes, processes were subdivided into smaller units, with focused outputs from each. Improvements to the workflow and procedures, as well as triage and monitoring of the processes, were identified as output goals. In examining how best to leverage technology for improvement, the reports, monitoring tools, clinical decision support, and any additional software

Figure 1. Implementation Project Logic Map for Closing the Loop



the sites used were all areas of focused inquiry. Achieving such outcomes often is best divided into short-, intermediate-, and long-term goals. The time to accomplish these goals may vary, and processes for improvements may need to be repeated as they are refined after initial testing. In order to determine success of any solutions implemented, monitoring and evaluation, including measurement, must be ongoing.

Goals and Objectives for the Closing the Loop Implementation Workgroup

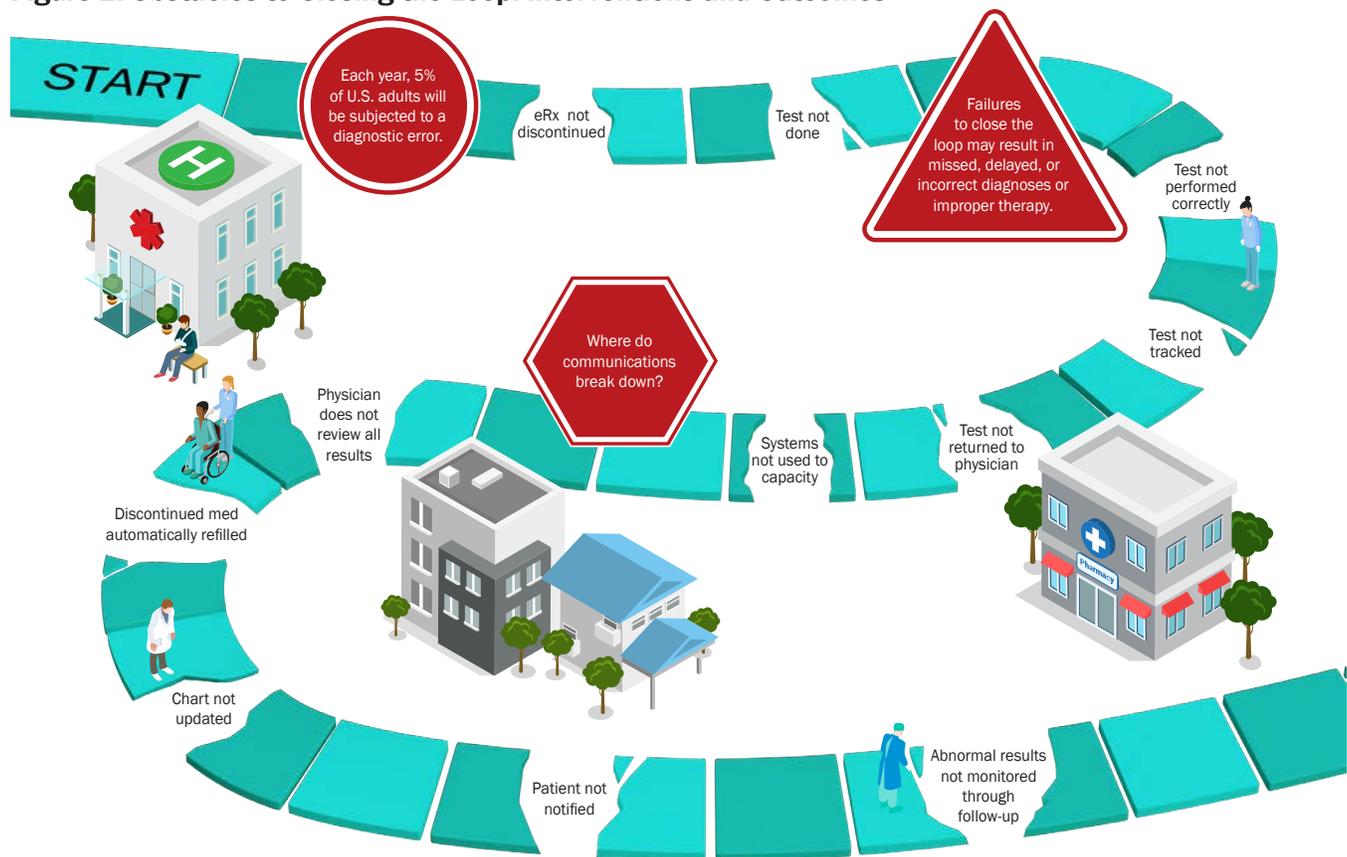
The overarching goal for implementing the safe practices at the participating sites was to improve results tracking using the technologies at hand, ultimately improving timely and accurate diagnoses by improving processes to close the loop. The project identified the safe practice recommendations (develop and apply IT solutions to communicate, to track key areas, and to link and acknowledge review of information and documentation of actions taken) that were in line with issues the two

ambulatory care groups identified. The workgroup objectives include the following:

- Identify gaps, cracks, failure points, or breaks in the process for improvements for diagnostic testing and specialty referrals (see Figure 2).
- Evaluate the current processes using tools identified, including process mapping and the steps identified in the Agency for Healthcare Research and Quality's (AHRQ) *Improving Your Office Testing Process*.²
- Identify where technology might facilitate improvement.
- Implement changes and monitor and measure their effectiveness.

While the *Partnership* identified three safe practice recommendations, the workgroup found, after evaluation and analysis of the issues and processes, that **tracking key areas** was the appropriate area of focus. The workgroup therefore emphasized

Figure 2. Obstacles to Closing the Loop: Interventions and Outcomes



Sources: Balogh EP, et al. Improving diagnosis in health care. Washington (DC): National Academies Press; Diagnostic errors: technical series on safer primary care. Geneva: World Health Organization, 2016; Singh H. Types and origins of diagnostic errors in primary care settings. JAMA Intern Med. 2013;173(6):418-25.

exploring opportunities for tracking, including assigning accountability for, and ensuring oversight of, tracking tools and processes; improving tracking by implementing standard workflows and processes; and improving tracking by ensuring bidirectional communication.

Taking a Stepwise Approach

The *Partnership* team acted as facilitators for the project, providing evidence and the following resources to the sites to support the project:

- [Health IT Safe Practices for Closing the Loop: Mitigating Delayed, Missed, and Incorrect Diagnoses Related to Diagnostic Testing and Medication Changes Using Health IT](#)
- [Closing the Loop: Recommendations & Implementation Strategies](#)

Sites provided their current policies and procedures as well as details about all phases of their processes to the facilitators.

Getting Started: Recruitment

The *Partnership* team contacted members of a nationwide network of organizations developed through ECRI Institute’s membership and consulting programs, through *Partnership* collaborators, and through ECRI Institute’s patient safety organization (PSO) and its members. Ambulatory care practices were the focus, because these sites often identify tracking as a challenge, although hospital practices were not excluded in recruitment. Ambulatory care organizations, each with multiple practice sites, were selected to participate in the project.

Following initial site selection, the workgroup process was reviewed (see [Figure 3](#)). The *Partnership* facilitated group

meetings from April through August 2019. One-on-one interactions with each of the sites occurred throughout this period, and then for an additional three months. Facilitators arranged for subject matter expert presentations to the workgroup and also met with vendors and developers to discuss technology solutions.

Participating Sites

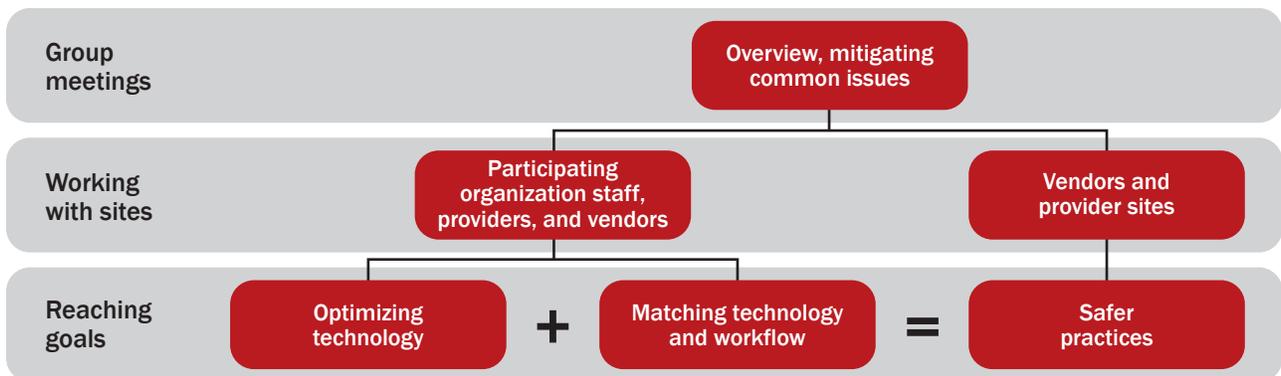
Site #1

Site #1 is a community-based provider with two locations specializing in family medicine. The practice serves a multi-lingual population that incorporates a number of diverse ethnicities and cultures. The site has technology support through the customer services offered through their technology vendor. The staff at site #1 receive IT recommendations for best practices through user groups that meet at scheduled intervals. One identified problem was that user groups at one time met monthly, but the group has met only twice over the past 12 months. Internally, the site has a user specialist with more than seven years of experience with the system in place. The practice exchanges information with a collaborative of hospitals, physicians, laboratories, and health plans to facilitate patient care. Site #1 identified diagnostic testing referrals, including radiography, computed tomography, and magnetic resonance imaging, as the most difficult orders to complete.

Site #2

Site #2 is an ambulatory care organization that provides services to 75,000 patients at various locations. A total of 80,000 diagnostic testing and specialty referral requests are obtained annually. Site #2 obtains technology support through both internal staff and via a technology-controlled network.

Figure 3. Implementation Approach to Closing the Loop



The technology-controlled network allows participating sites to leverage a common infrastructure and share recommendations to address issues, achieving a sophistication otherwise available only at very large health systems. Site #2 used process mapping and gap analysis to identify multiple opportunities for improving tracking.

Initial Steps

Each site determined which individuals at their organization should participate in the workgroup discussions. Some groups chose to include their leadership, which shed new light on the issues identified. In one instance, executive leadership participation led to the organization pulling back and reevaluating the extent of the issue and exactly how it might be better managed. The remaining sites brought together quality improvement and patient safety leaders, an EHR implementation specialist and informaticist, a clinical analyst, radiology and laboratory services personnel, and physicians and nurses. These subject matter experts, with their wide and varied knowledge and experience, assisted the sites in identifying the areas in their processes that posed the greatest risks for diagnostic errors related to the failure to close the loop.

After the initial recruitment, structured interviews were conducted to identify the site's EHR vendor, determine the extent of IT support, identify potential overlapping projects, and—most important—obtain detailed information about each essential area of the organization's testing process. These interviews made it readily apparent that tracking was a shared issue. Additional interviews then focused on tracking (e.g., how the organization currently tracks test results). It was also important to identify the challenges and barriers the organizations faced with tracking, any improvements they had already attempted, and their own goals for improving tracking.

Providing Information

Participants shared important information such as common strategies and challenges at the group meetings. In addition, facilitators arranged for opportunities to hear from subject matter experts as well as those who had successfully implemented changes within their organizations. Sites had the opportunity to hear from Jennifer Fabre, DNP, APRN, ANP/FNP-C, CDE, director of quality and risk management at Teche Action Clinic, who presented her work on a successful project called "Closing the Loop on Electronic Referrals: A Quality

Improvement Initiative Using the Care Coordination Model."² Fabre's research grew from a finding that one in four referrals were never completed.³ The reasons for incomplete referrals were multifactorial, and the result was often a cascade of effects including delays in treatment, gaps in care, and waste and inefficiencies as well as increased patient harm and increased costs. Fabre described her approaches to realistically determining timelines, obtaining leadership support, and obtaining the needed resources (e.g., additional staff to support the project).

Hardeep Singh, MD, MPH, chief of health policy, quality and informatics at the VA Center of Innovation at Baylor College of Medicine, shared his research on "Closing the Loop on Test Results in the EHR Era" with the group. According to Singh's research, 7% of abnormal laboratory results and 8% of abnormal imaging studies lacked timely follow-up.⁴ Here too, Singh said, causes are varied; multiple sociotechnical issues may be at play in the failure to close the loop. He stressed the importance of teamwork and shared responsibility.

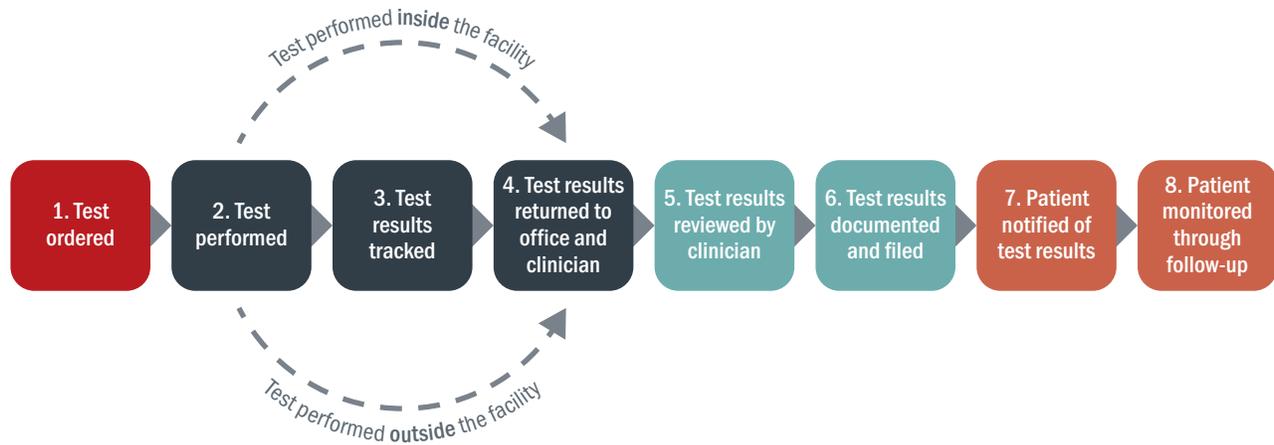
Obtaining Information

In addition to providing the information from [Health IT Safe Practices for Closing the Loop: Mitigating Delayed, Missed, and Incorrect Diagnoses Related to Diagnostic Testing and Medication Changes Using Health IT](#), resources for studying laboratory and referral processes were needed. ARHQ's [Improving Your Office Testing Process](#) was used to help clarify these processes (see [Figure 4](#)).

Each of the sites began by providing details about their test tracking process using the eight steps in the "Planning for Improvements" tool from the ARHQ publication *Improving Your Office Testing Process* ([Figure 4](#)) as a guide.⁵ The participating sites completed the process mapping work offline. The results were discussed and clarified with the project lead and the project facilitators.

Once these processes were outlined and the information from the sites consolidated, diagnostic and referral tracking processes were identified as the processes that held the greatest risk for failure to close the loop. Analysis of this information made it possible to identify common areas of concern: the ability to track whether the test was performed; whether the results were received; whether the provider reviewed the results; and whether the patient was notified about the results (see [Table 1](#)). These areas of concern were also apparent in

Figure 4. Example of an Office Testing Process



Modified from: Eder M, Smith SG, Cappelman J, Elder N, Singh G. Improving your office testing process: a toolkit for rapid-cycle patient safety and quality improvement. Publication no. 13-0035. Rockville (MD): Agency for Healthcare Research and Quality; 2013 Aug.

comments participating sites submitted:

- Referrals and imaging are the most difficult to get done and to make certain that patient follows up due to language barrier, insurance, and scheduling issues.
- Available tracking reports are not usable or actionable.
- Reminder lists are created separately from the order. It is an additional step for the user.
- Orders remain open for one year—this is a default set by the site.
- Results and reports that are scanned in are not always attached to the patient order.
- Order does not automatically complete.

The ability to track orders is essential to ensure that tests are ordered and performed and results are returned, reviewed, and communicated to the patient. Once this area was identified for focus, further questions addressed what processes were occurring.

Analyzing Issues

Before beginning a quality improvement initiative, it is necessary to understand current processes as they are being performed. Using process mapping and gap analysis, the participating sites were able to identify what steps may not have been fully executed, what solutions had been set in place, and what role technology might be able to play in the process.

The chosen model not only helped to facilitate process mapping but also was useful in conducting a gap analysis (Table 1). Once the sites understood the current state, they began looking at gaps in their processes and how they were using the existing technology. Only through this analysis could possibilities be identified for leveraging technology to improve the tracking process.

The participating practices found process mapping and gap analysis to be valuable tools in assessing their diagnostic testing and specialty referral workflow processes. The gap analysis revealed problematic areas in the tracking of diagnostic and specialty referrals. This analysis allowed comparison of actual with potential or desired performance. A gap analysis can identify the following elements:

- Performance of current process
- Workflow for tracking diagnostic testing and specialty referrals
- How the process and workflow should be performed
- Where gaps occur

In completing a gap analysis, the group was able to identify where improvement activities could or should happen.

Examining Findings

The process mapping and gap analysis found many commonalities at the participating sites (see Table 1). The sites focused on the results management process, honing in on areas where

Table 1. Test Tracking Process-Tracking Gaps

Testing Process	Tracking Gaps		
	Site #1	Site #2	Site #3
1. Test ordered			
Test done at point of service			
Test ordered outside the system	✓	✓	✓
Test ordered with the EHR system			
2. Test performed			
Test performed	✓	✓	✓
Test performed correctly	✓	✓	✓
3. Test results tracked			
EHR functionality available for tracking	✓	✓	
EHR functionality used for tracking	✓	✓	✓
Results received electronically	✓	✓	✓
Results received by fax	✓	✓	✓
Results associated with the wrong patient	✓	✓	✓
Criticality defined	✓	✓	✓
4. Test results returned to office and clinician			
One-way interface	✓		
Bidirectional interface	✓	✓	✓
Test results matched to order	✓	✓	✓
Paper results scanned in	✓	✓	✓
5. Test results reviewed by clinician			
Time frame in place for review and sign off			
Triage system in place for critical, abnormal, normal	✓	✓	✓
6. Test results documented and filed			
Automated filing	✓	✓	
Manual filing	✓	✓	
Error queue	✓	✓	
7. Patient notified of test results			
Standardized notification process for critical, abnormal, normal	✓	✓	✓
Portal available		✓	
Results sent to portal		✓	
Results called in to patient			
Results mailed to patient			
8. Patient monitored through follow-up			
Treatment plan documented			
Follow-up appointment scheduled		✓	✓

Bold checkmarks indicate areas of commonality.



technology can improve tracking. While there are many loops to close in the process of tracking, sites found that problems often began with “completing” the order. When an order was finished, it was not necessarily “complete.” Manual efforts were required to “complete” an order in the system—that is, a separate step was required to mark the order complete. As they reviewed their processes, sites discovered that in order to “complete” requests, users adopted workarounds and alternative workflows to close the loop. This concern was addressed with the system vendor at site #2. The vendor explained the process that was required for “completion.” Orders are assigned a status of “completed” not when the provider signs results or consultation reports, but only after the provider clicks “complete.”

Identified Impediments to Closing the Loop

- Diagnostic testing or specialty referral was not completed
 - Prior authorization was not completed
 - Prior authorization was denied
 - Patient never received the prior authorization to schedule
 - Patient received all necessary paperwork but did not schedule
- Diagnostic testing or specialty referral was completed, but not in the EHR
 - Workflow was not performed as intended
- Diagnostic testing or specialty referral was not tracked
 - Referral status report was unmanageable
 - A large backlog existed
 - Necessary data elements required for follow-up were not captured
- Diagnostic testing or specialty referral patient was not notified
 - Standardized triage process was lacking
 - Patient notification process was determined by individual clinician
- Monitoring and evaluation of the diagnostic testing and specialty referral tracking process are lacking
 - Clinicians and staff receive no feedback on their performance

Gap analysis also revealed multiple reasons the process might not be marked complete, in particular EHR or process workflows that did not align with clinical workflows or were not followed through to completion, including staff turnover, practice growth, or insufficient training. Additional examples of failure to close these various loops were identified (see “Identified Impediments to Closing the Loop”).

A Context for Solutions

The safe practice recommendations were developed with consideration for the eight dimensions of the sociotechnical model (workflow and communication; organizational policies, procedures, and culture; content; hardware and software; user interface; personnel; measurement and monitoring; and external rules and regulations).⁶ These dimensions must also be considered in implementing the recommendations, remembering that technology is only one part of the socio-technical model. According to Menon et al.,⁶ sociotechnical issues that should be considered include the software, the content, usability (user interface), workflow and communication, providers (people), and organizational issues (e.g., policies and procedures). Sociotechnical commonalities among the participating sites were seen in the areas of software, usability, people, and organizations:

- For software and hardware: the functionality for tracking was not fully implemented or was not being used as intended, or it did not offer a safe and effective means of communication for the receipt and acknowledgment of the information
- For content: clinical and electronic workflows were not aligned
- For user interface: the functionality was burdensome
- For providers: high rates of staff turnover created a lack of process knowledge and created challenges for training
- For organizations: policies, procedures, and culture did not align with clinical and electronic workflows

EHRs are only one part of the complex sociotechnical system. Solutions, however, must address all relevant parts of the model.

Identifying Solutions

Possible solutions were identified through scheduled calls with vendor and developers, in-house IT department personnel, and others as deemed necessary. To achieve the identified objectives, emphasis was on exploring existing functionality of the technology and its availability for tracking, assigning accountability for and ensuring oversight of tracking, and improving tracking. Although each of the participating sites used a different EHR, this framework helped to broaden the base of understanding. The workgroup identified commonalities at the different sites; however, each site's concerns with their processes were slightly different. Therefore, the action and implementation plans were customized for the participating organizations, depending on the priority of the gaps identified.

Often technology is not the first solution for closing the loop. The process mapping and gap analysis may indicate a need to alter workflows, align the clinical and electronic workflows, and centralize the process.

Solutions may be focused on people, on technologies (i.e., hardware and software, clinical content, human-computer interface), or on both. Focusing on people (i.e., individuals, workflow, and communication) includes examining the actions of all those who interact with the EHR (e.g., clinical and nonclinical users, software developers, in-house IT, implementation specialists and system trainers, patients). Regarding users, the first thought often turns to training. Although user training on new implementations and updates to the system is important, training should not be the only focus; the design, implementation, and usability of the EHR are equally important. New or improved processes should be a collaborative effort between end users and the vendor or developer and should be tested before full deployment.

Focusing on hardware also includes optimization of the interfaces, display, and communication tools. Technology solutions involve multiple sociotechnical dimensions, all of which should be considered when optimizing existing technologies or implementing future software changes (e.g., decision support enhancements).

The measuring and monitoring dimensions may be one of the most significant dimensions as any improvement efforts are made to the EHR or to the processes themselves.⁷

Tracking of diagnostic test results and specialty referrals is a time-consuming, burdensome task, but it is necessary to ensure

that the loop is closed, the patient is notified, and a treatment plan is set in place. Failure to monitor all phases of the process can lead to missed or delayed diagnoses. It is necessary to have well-articulated policies and procedures for tracking of diagnostic and specialty referrals that promote alignment of the clinical and electronic workflows.

A final meeting was held with each site. Considerations were given to identifying and implementing standards and improving tracking through bidirectional communication. The sites also considered improving existing functionalities and adding new functionalities to help close the loop. EHRs have the potential to automate the procedure to close the loop, improving both timeliness and completeness. Participants' plans were summarized, and participants prioritized their solutions.

The final step was to implement the solutions identified. A [Step by Step Guide for Implementing the Closing the Loop Safe Practices](#) was created to facilitate broader implementation. Included are recommendations for roles of staff participants, resources needed, discussions and tools for process mapping and gap analysis, suggestions for measures sites can utilize, and suggested strategies for interventions by other stakeholders. The hope is that other sites will use the guide to implement the safe practices within their organizations.

Take-Away Lessons

The lessons the participating organizations learned revealed multiple opportunities to improve tracking processes using health IT and addressing how systems are used, such as the following:

- Avoid workarounds by ensuring that providers and staff are consistently using the EHR system to track key areas as intended. Address the issues that lead to workarounds:
 - Workarounds can be fostered by an EHR design or configuration that incorporates too many active alerts, leading users to override or decline the alert.
 - Workarounds can occur because of the absence of a formal training or ongoing training when new implementations, upgrades, or fixes for bugs are set in place.
 - Workarounds can occur when a policy or procedure does not align the clinical and electronic workflows.
- Prohibit circumventing the automated functions built into the systems to track orders. For example, staff should



not use a paper tickler system as a workaround. This creates additional work for staff and creates the potential for an error.

- Collaborate with vendors and healthcare organizations on solutions to guarantee that tracking of all functionality is fully implemented.
- Work with the EHR vendor to automate as many tracking and audit functions as possible.
- Work with the vendor to automate a system to generate a daily task list that flags certain situations that could lead to risk exposure. Circumstances that should be flagged as reportable when a diagnostic test or specialty referral is ordered are:
 - Diagnostic test or referral not performed
 - Test results or consults not received
 - Test results or consults not viewed by the healthcare provider
 - Test results or consults not acknowledged by the healthcare provider
 - Results received but not communicated to the patient
- EHR systems have the potential and the capacity to generate a range of reports that can help practices audit the effectiveness and efficiency of their processes.
 - Each site is unique and may require the inclusion of different data elements to generate reports that are useful to track referrals in their particular patient population.
 - Identifying actionable reports may require trial and error, ongoing tweaking, and assigned oversight of the report to ensure that the necessary data elements are being captured.
- Create efficient, usable open-orders reports that include the necessary data elements to track key areas in the results management process.
- Clean up the backlog on the open-orders report by closing out-of-date orders.
 - To facilitate timely tracking, do not allow orders to remain open for an extended period.

- Consider changing the default to a more reasonable time frame. For example, if there is often a five- to six-month wait to see a specialist, set the default expiration date on specialty referrals to reflect this.

- Consider the frequency of running open-order reports. It may be more efficient to:
 - Run more frequent reports or status updates
 - Run actionable reports less frequently so that the issues can be addressed

By using the EHR system to better track and manage test results, the practice can aim to ensure that no result goes missing or unnoticed.

Discussion

The *Partnership for Health IT Patient Safety* developed three safe practice recommendations for communication, tracking, and linking and acknowledgment of test results, along with strategies and tools to facilitate these recommendations to prevent missed or delayed diagnoses. The materials are publicly available in [Health IT Safe Practices for Closing the Loop: Mitigating Delayed, Missed, and Incorrect Diagnoses Related to Diagnostic Testing and Medication Changes Using Health IT](#).⁹ Often, multiple loops need to be closed, and failure to close them can impact patient safety, delay diagnosis and treatment, or result in missed or incorrect diagnoses. What is evident is that the process of closing the loop begins and ends with the patient.

While health-IT-focused recommendations for closing the loop are increasing, few have been implemented. In an effort to increase the application of the safe practices identified, the Closing the Loop Implementation Workgroup was convened to conduct a proof of concept to determine whether the recommendations could be more broadly implemented. The workgroup, in conjunction with participating sites, examined the current situation, determined where improvements were needed, identified the barriers participants faced, and determined the resources required to execute the anticipated changes. The group then worked with the vendors and the participants to implement those changes.

Participants encountered several barriers in executing this workgroup. Most evident were the competing priorities

participants faced. Lack of staff, funding, and leadership-buy in were also challenges. These challenges emphasized the importance of involving the right mix of organizational stakeholders (e.g., those able to allocate resources and prioritize projects). Once the project was initiated, comprehending the depth and extent of the issues caused at least one organization to pull back to further evaluate their processes. Finally, knowing how and when to involve the vendor was a barrier that could be addressed with the aid of the *Partnership*.

The Closing the Loop Implementation Workgroup found that providers were not the only ones facing challenges with closing the loop; patients also faced unique obstacles. Challenges on the patient's end often included knowing whether all results or only abnormal results would be communicated; knowing when to follow up on an incomplete result; understanding precertification requirements; locating specialists who accepted their current insurance coverage; and understanding what was being asked of them (e.g., why a test was ordered, what impact a referral might have on their care). All patients face such challenges, but they are especially daunting if language or cultural barriers also impede understanding.

Communication, especially bidirectional communication (e.g., provider to testing site, provider to provider, provider to health information exchange, and the reverse of all of these), remains a challenge. Often connections are limited or standards are nonexistent, impeding the ability to timely communicate results. For example, if a laboratory uses a different identifier format than the provider uses (e.g., the laboratory uses last name/first name, while the provider uses first name/last name), those results may not file directly into that individual's record. Results then file to an error or problem queue that must be manually addressed. While management of the error queue is something that sites themselves can address, addressing standards across sites requires broader intervention.

Using the available tools, organizations were able to identify improvements to processes for diagnostic studies. First, the tools made it readily apparent what processes occurred. Discussing and explaining these steps with staff and with others illuminated what was thought to be occurring versus

what was actually occurring. Next, the tools enabled the identification of gaps (areas for further evaluation), including issues with whether testing was performed, whether results were received, whether results once received were viewed or acted upon, and whether results were communicated to the patient. Finally, the tools enabled sites to examine possible solutions. The solutions for closing the loop focused variably on the individuals working at the sites, on the processes those individuals followed, on the technology they used, and on the reports they used to track the various stages of the process. While technology can facilitate improvements, it is not the only solution.

The project timeline allowed for a six-month implementation. During that time it was possible to achieve short-term successes and to identify opportunities for longer-term strategies. The project remains ongoing. As the team continues to monitor this project, additional tools and metrics may be needed, as well as further usability studies for the existing tools and metrics.

Conclusion

The *Partnership* sought to more broadly implement the safe practices for "closing the loop" in tracking of diagnostic testing and referrals. Given that diagnostic processes begin in the ambulatory care setting, such sites were challenged to participate. The participating sites were motivated and fully engaged in the project, contributing their time, expertise, and knowledge to drive the search for solutions. The workgroup also successfully obtained input from subject matter experts and from the vendor/developer community to maximize available resources and implement change. Subject matter experts shared their research, knowledge, and experience with closing the loop using health IT. The vendors and developers provided clarification on functionality and workflow issues and were receptive to future innovations in closing the loop.

The pilot project was successful in achieving the goals identified and in addressing the barriers encountered. It is now time to implement the safe practices to ensure that the multiple loops associated with diagnostic studies are closed.



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ECRI Institute, the *Partnership*, and a Mission for Safety

ECRI Institute is an independent, nonprofit organization dedicated to improving the safety, quality, and cost effectiveness of care across all healthcare settings. The combination of evidence-based research, medical device testing, and knowledge of patient safety makes ECRI Institute uniquely respected by healthcare leaders and agencies worldwide. For more than 50 years, ECRI Institute has maintained an unwavering dedication to transparency and strict conflict-of-interest policies. The organization has earned a reputation as the trusted voice of unbiased, research-based assurance for tens of thousands of members around the world using its solutions to minimize risk and improve patient care.

ECRI Institute has the only medical device testing labs in North America and Asia Pacific, where engineers conduct hands-on independent device testing for safety and human factors usability. ECRI Institute is designated an Evidence-based Practice Center by the U.S. Agency for Healthcare Research and Quality. ECRI Institute PSO is listed as a federally certified patient safety organization by the U.S. Department of Health and Human Services. Visit <https://www.ecri.org> and follow @ECRI_Institute on Twitter to learn more.

In 2013, ECRI Institute convened the *Partnership for Health IT Patient Safety* in part because of the organization's long history of cutting-edge patient safety initiatives, and also in response to the growing recognition that action was needed not only to fully realize the benefits of health IT but also to involve the appropriate parties in the identification, classification, aggregation, analysis, and development of solutions to the ever-increasing concerns surrounding health IT. The *Partnership* is a multi-stakeholder collaborative convened and operated by ECRI Institute and funded in part by the Gordon and Betty Moore Foundation. The collaborative is comprised of healthcare providers, health IT vendor and developers, academic researchers, patient safety organizations, patient advocates, and professional societies. The *Partnership* has worked to identify health IT safety issues and identifies ways to implement safe technology practices by bringing together multi-stakeholder subject matter experts, evaluating data, looking at evidence, and assimilating all of this information to identify safe practices. Once safe practices are identified, it is essential that stakeholders take ownership and identify ways to implement these practices for safety. The *Partnership* was established to make healthcare safer by understanding and mitigating health IT hazards and safety events. For more information on the *Partnership*, please visit our website.



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