CASE REPORT

IMPROVING YOUR LABORATORY TESTING PROCESS

Agency for Healthcare Research and Quality

PATIENT SAFETY

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Prepared for: Adapting and Implementing Patient Safety Practices in Ambulatory Care: Workflows to Improve Safety and Efficiency in Laboratory Testing (WISE-LT)

University of Colorado: Colorado ACTION Partnership

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Executive Summary

The purpose of this project was to evaluate and improve the usability, practicality, and usefulness of a previously published AHRQ toolkit, "Improving Your Office Testing Process," (Toolkit Version 1, see https://www.ahrq.gov/professionals/quality-patient-safety/quality-resources/tools/office-testing-toolkit/index.html) designed to systematize laboratory testing processes in primary care practices. We are a team of clinicians and scientists with experience in patient safety, quality improvement (QI), and implementation science from the University of Colorado.

Methods:

We first **improved toolkit usability using stakeholder engagement and iterative design methods.** Based on written feedback and qualitative interviews with six patients and community members, seven clinicians or practice staff, and five patient safety experts, we revised the toolkit (Toolkit Version 2) as a step-by-step guide by more clearly indicating the purpose of each component of the toolkit, removing unnecessary or redundant content, and simplifying the language in the assessment tools. Then we **pilot tested the revised toolkit and evaluated its implementation in two primary care practices.** One small internal medicine practice and one large family medicine residency practice implemented the revised toolkit over 6 to 8 weeks. We conducted site visits and qualitative interviews with implementation teams (3-4 clinicians and staff) at baseline, mid-point, and follow-up. We used thematic analysis to identify themes about how practices used the toolkit for improving lab testing processes, as well as suggestions for further improving the usefulness and usability of the toolkit.

Findings:

Look (at the data) before you leap! The QI team in a **large family medicine residency practice** initially thought they would work on test ordering, previously identified as a problem for their clinic. However, when they administered the Assessing your Testing Process tool to the full practice, the results showed that inconsistent communication of results to patients was rated as more harmful to patients than were problems with the test ordering process. Using the new data, they shifted the focus of their lab process improvement activities.

Engage your patients! A **small general internal medicine (GIM) practice's** use of the Patient Experience Survey in the toolkit helped them explore their patients' understanding about the lab tests that were ordered. While most patients indicated on the survey that they did know why a test was ordered, the care teams observed that patients started asking more questions after completing the survey. This led the QI team to re-institute systematic use of patient education handouts for commonly ordered lab tests, and encourage care team members to engage patients in conversations about the reason for their tests, what results they should expect to receive, and when. Use of the Toolkit Version 2 helped the practice identify ways to better engage patients in their care. Additional findings:

- Version 2 was useful for prioritizing and planning quality improvement around lab testing.
- Practices can use just the tools most relevant to their purposes and even adapt them as needed.
- The expected 6-8 week implementation period was adequate for the small GIM practice, but too short for the larger FM residency practice.
- The title should be a "step-by-step guide" not a toolkit.
- The guide should be arranged like the steps in improvement (assess, plan, implement, reassess).

- The guide needs brief case examples showing how practices can follow each step in the guide.
- The guide needs to provide more detailed guidance on how to implement a change.

Project Overview

Background

Primary care practice clinicians order laboratory tests for nearly one-third of patient encounters in an average week; not surprisingly, among medical errors in primary care, an estimated 15% to 54% are attributed to laboratory testing processes.[1-3] As noted in the AHRQ Technical Brief "Patient Safety in Ambulatory Care" Matrix of Key Informant Themes,[4] the lack of systematic testing processes in primary care is an established patient safety concern. Evidence shows small- and medium-sized primary care practices frequently lack formal, standardized, and efficient procedures in the overall testing process.[5,6] In response to these findings, AHRQ and the Centers for Disease Control and Prevention (CDC) funded recent work to develop laboratory testing process improvement toolkits to help ambulatory practices use whole-office, team-based, step-wise approaches to improve the quality and safety of laboratory testing processes.

The AHRQ "Improving Your Office Testing Process"[7] toolkit was developed to be a comprehensive, evidence-based set of quality improvement tools for standardizing and systematizing lab testing processes known to improve patient safety. This includes processes such as results tracking and communication of results to patients. To increase the potential for toolkit use in real-world practices, there was a need to evaluate and enhance the toolkit's practicality, usability, and usefulness.

Purpose

The purpose of this project was to:

- Revise the existing AHRQ "Improving Your Office Testing Process" toolkit (Toolkit Version 1) through iterative review and input from experts, clinicians, staff, and patients.
- Produce a revised toolkit (Toolkit Version 2).
- Pilot test and evaluate the usability, practicality, and usefulness of the revised toolkit in two primary care practices.

The toolkit review and revision process is detailed below in the section, "Development of the New Evidence-Based Intervention." The pilot test findings are described under "Implementation: Pilot Test of the Revised Toolkit," beginning on page 6.

Development of the Revised "Improving Your Office Testing Process" Toolkit

Prior to pilot testing, the University of Colorado (CU) team conducted a review of evidence-based approaches for lab process improvement and interviewed experts, clinicians, staff, and patients to identify opportunities for improving the usability and usefulness of the original AHRQ toolkit "Improving

Your Office Testing Process" toolkit (Toolkit Version 1). This input was used to produce a revised Toolkit (Version 2) for use in pilot testing and evaluation.

Summary of Existing Patient Safety Tools and Techniques

We conducted a limited review of ambulatory care patient safety documents on laboratory testing processes to ensure that the current AHRQ toolkit, "Improving Your Office Testing Process," reflects up-to-date practice improvement and safety recommendations, techniques, and tools before testing in practices. We reviewed our team's own related toolkits in practice improvement and laboratory testing processes, our library of patient safety citations, and Web-based resources to summarize core patient safety practice content and improvement principles. We also reviewed related patient safety practices that rely on team approaches and standardization techniques for inclusion in our adaptation, including TeamSTEPPS® and hospital safety protocols and recommendations.

Overarching principles of safety and improvement identified

We identified several key safety and improvement principles in our review that should be embedded in safety improvement activities as part of a larger effort to create a culture of safety in medium or large primary care practices. These safety improvement principles include:

- Teamwork: a team-based approach is required.
- Fix systems: focus on improving systems, rather than blaming individuals.
- Small steps: start small and use a step-by-step approach to achieve realistic goals.
- Standardization: standardize systems or protocols where possible.
- Make safety a priority: get leadership buy-in, set aside sufficient time, and follow through.
- Establish context: position specific improvements in larger context of promoting organizational learning, fostering a culture of safety, and improving patient care and the patient experience.

Our review also identified three common components for effective change processes and tools/toolkits in laboratory testing patient safety: (1) a stepped, sequence of improvement activities (either enumerated or implied), (2) common content or recommendations at each point in the process, and (3) embedded tools, aids, suggestions, examples, or templates in most steps, or as needed. Although sequential in layout, some steps or process points may need to be revisited, revised, or repeated.

Considerations for revising the toolkit

Based on the review and collective reflection by our team, we made the following recommendations for revision of the toolkit:

- Ensure the content of the toolkit addresses the overarching principles, either directly in the text or by completing steps in the toolkit.
- Ensure the toolkit provides a concise overview of all of the steps involved, including clear enumeration of each step.
- Identify any steps that may be missing and recommend possible remedies where possible.

- Identify any additional tools (e.g., checklists, surveys, templates) that may be required for missing steps or to provide in place of existing tools.
- Reduce the overall length of the toolkit wherever possible, including eliminating non-essential text, tools, content; shortening existing narrative (e.g., using bullets instead of complete sentences or paragraphs); or moving content to an appendix.
- Compare the existing toolkit to other tools or toolkits to further streamline and trim existing content or to fill any gaps in existing content.
- Recommend systematization or standardization of protocols as a promising intervention approach.

Stakeholder and Expert Review of the Original Toolkit

Refinements to the extant AHRQ toolkit ("Your Office Testing Process") aimed to build on the established theory and tools identified in our review of existing patient safety tools and techniques while seeking additional stakeholder input from three stakeholder groups: 1) patients and community members, 2) patient safety experts, and 3) primary care clinicians and staff. Participants in each stakeholder group were provided with a copy of the toolkit, a structured review form, and detailed instructions for reviewing and commenting on the draft toolkit. Follow-up group and individual interviews were conducted with each stakeholder using a structured interview guide.

Qualitative analyses

All stakeholders were sent electronic copies of the unrevised toolkit along with a structured review form designed to elicit input about their overall impressions of the toolkit, clarity of each section, plus critical changes they would recommend for each section of the toolkit. For the patient stakeholders, special emphasis was placed on the patient engagement sections of the toolkit. Following their review of the toolkit, stakeholders participated in either a group or individual interview designed to elicit additional information about their impressions and recommendations, and to clarify their written comments. Different interview guides and review forms were used for each of the stakeholder groups to elicit focused feedback in addition to their general impressions. Data collection included:

- Interviews and written comments from six patients and community members who are standing members of the CaReNet Patient Advisory Council and the High Plains Research Network Community Advisory Council.
- Interviews and written comments from seven providers and staff from primary care clinics from two practice-based research networks.
- Interviews and written comments from five patient safety expert consultants, including several authors of the original toolkit.

We kept detailed notes during all interviews, then thoroughly reviewed all notes and written feedback using a matrix-based approach[8] to summarize key recommendations, which were organized by the sections of the toolkit. Audio recordings were used to verify notes, if needed. Based on the stakeholder feedback, we identified key stakeholder recommendations and comments and used them to revise the toolkit while aligning with the overarching principles identified in our review.

Revision of the Toolkit

We revised the toolkit based on the design principles identified in our review and recommended changes that were similar or the same across multiple stakeholders and respondents. The revisions were limited to those recommendations that did not require a complete re-write of the existing toolkit, but rather changes that required minor revisions or reorganization of the existing content. Primary changes to the final intervention element (the revised toolkit) included:

- Re-ordering existing material sequentially .
- Clearer labeling and sequencing of chapters and sub-headings.
- Streamlining of content: removing excessive blank pages, combining or condensing text, simplifying instructions.
- More consistent, logical chapter content structure: purpose, when to use the tool, why the tool is important, the tool itself, scoring and interpretation.
- Wording changes for more consistent terminology throughout the toolkit.

The overall style (i.e., color palette, font, and design elements) of the document did not change. A final electronic version of the revised toolkit was prepared for use in the pilot test described below (Implementation).

Implementation: Pilot Test of the Revised Toolkit

Pilot Test Overview

We tested the toolkit in two practices, a large (>10 clinicians) Family Medicine residency practice and a small (<5 clinicians) General Internal Medicine practice. The primary eligibility criteria were ability to prioritize participation during the project period and interest in improving office testing processes. We used qualitative methods to answer the questions:

1) To what extent was the toolkit usable or practical for use in real-world clinical settings? In other words, what were practice experiences with implementation of the toolkit, including barriers and facilitators to implementation and practice readiness for change?

2) To what extent was the toolkit useful for guiding lab testing process improvements? In other words, what changes to lab testing processes were made based on toolkit guidance?

Finally, we report practice suggestions for further revisions to the toolkit. We conducted baseline, mid-point (3-4 weeks), and follow-up interviews (7-8 weeks) with the implementation teams. See Appendix A through C for interview guides. The interviews were transcribed and analyzed for themes using methods described above in the toolkit revision section.

Recruitment of Practices

Practices were recruited from the Building InvestiGative practices for better Health Outcomes Research Network (BIGHORN) and the American Academy of Family Physicians National Research Network (AAFP NRN). See Appendix D for the practice recruitment letter. Interested practices were provided with a 1-pager describing the project goals, expectations, and timeline; we had an introductory telephone call

with interested practices to further explain the project and answer questions. Practices were then asked to sign an Agreement to Participate (see Appendix E). As recognition for participation in this project and to partially offset the cost of practice staff participating in two site visits, both practices received $2,500 at the completion of the implementation period.

Settings for Pilot Testing the Revised Toolkit

Small General Internal Medicine Practice

A General Internal Medicine (GIM) practice located in Boulder, Colorado, with four full-time clinicians was recruited from BIGHORN . This former private practice joined a local integrated health system about 2 years prior to this project. The practice serves on average 160 patients per week, mostly private payer population (70 percent) with an additional 17 percent Medicare, 9 percent Medicaid, and 4 percent self-pay. Seventy-seven percent of their patients are female and 79 percent are adults between the ages of 18 and 65. The practice uses a widely used electronic health record (EHR) and maintains registries for patients with diabetes and hypertension. The practice is recognized as a Level III Patient-Centered Medical Home (PCMH), and is actively involved in multiple advanced primary care practice initiatives, including the Comprehensive Primary Care initiative (CPC), Comprehensive Primary Care Plus initiative (CPC+), and the Colorado State Innovation Model (SIM). The toolkit project fits with their overall approach and drive to improve quality and patient safety. The lead clinician has been recognized for her work in the community and the practice's quality improvement (QI) efforts.

The practice has a highly engaged practice manager, extensive QI experience, and a history of success with laboratory process improvement projects. The practice holds regular monthly QI team meetings, with representation from all job titles in the practice and two patients, plus the head of population health/ambulatory care for the affiliated hospital. Recent improved stability in medical assistant (MA) staffing has increased the practice's ability to successfully carry out QI activities. There is good teamwork between the MAs and appropriate prompting and insistence on QI from the physicians. Staff appear very comfortable speaking up and talking openly about things that work and don't work, which indicates a supportive climate and culture for quality improvements. Data systems for monitoring patient experience are in place. The practice looks at patient feedback quarterly and more frequently when feedback is less positive.

Large Family Medicine Residency Practice

A university-affiliated Family Medicine (FM) residency practice located in St. Paul, Minnesota, with 10 part-time FM faculty and 24 FM residents was recruited from the AAFP NRN. The practice serves all ages, with 5 percent of patients under age 2 years, 23 percent age 2-12, 8 percent age 13-17, 56 percent age 18-64, and 8 percent over age 65. Most (71 percent) of patients are covered by Medicaid, with 14 percent Medicare, 13 percent commercial insurance, and 1 percent self-pay. The practice provides a full range of services and serves a mostly urban core population, including a large refugee community. The practice uses one of the most widely used electronic health record (EHR) systems.

This practice has good experience with and established processes for doing QI, including a monthly QI meeting. The medical director runs or oversees all of the QI projects. Their clinic manager is very well trained in QI. They keep the projects on the huddle board, indicating which projects are ongoing, so if other people are interested in something they can join the effort. They periodically do plan-do-study-act

exercises (PDSAs) and Kaizen (rapid improvement) events. Residents go through a practice management rotation where they gain exposure to QI. The clinic has good teamwork and communication between the physicians, residents, and the staff. Stable MA staffing is a recent development and it has helped the clinic.

Preparation

In preparation for this project, the pilot practices identified a project leader and a small implementation team. At initial site visits, practice staff and clinicians were introduced to the project goals and were given a brief overview of the toolkit itself and the evaluation plans. All practice staff and clinicians attended the overview presentation at the small GIM practice, while only the implementation team from the large FM residency practice attended. After distributing the revised toolkit, we conducted baseline interviews with the implementation teams and practice observations to assess motivation to participate, anticipated barriers and facilitators to toolkit implementation, observed current lab testing processes, and identified potential starting points for improvement. We prepared process maps depicting baseline lab testing process workflows and provided these to the practices for verification of accuracy.

Implementation Processes and Steps

Implementation Teams

The toolkit implementation teams from each practice were comprised of the following:

Small GIM Practice	Large FM Residency Practice
1 Practice Manager (Project Leader) 1 Clinician 3 Medical Assistants	1 Faculty Clinician (Project Leader) 1 Lab Manager 2 Residents 2 Lab Staff Members

Implementation Steps

The implementation teams in each practice followed a similar process of assessment, planning, implementation, and re-assessment, as outlined in the toolkit. The teams met approximately weekly during the implementation period to select relevant portions of the toolkit and brainstorm solutions based on data generated from baseline assessments.

Implementation Timing

After the initial kick-off meeting, practices were self-directed in use of the toolkit to guide process improvement. To implement the toolkit, each practice convened meetings with their defined implementation team, reviewed the toolkit and selected assessments to use, collected data, then reconvened to interpret the data and brainstorm possible solutions. The toolkit implementation period was originally expected to last 6-8 weeks. The small GIM practice found this timeline to be adequate, while the large FM residency practice required an additional 4 weeks to implement planned changes. Thus, about 8-12 weeks of active effort is a reasonable timeline to expect for this project, although more or less time may be required depending on the scope of changes to be made. Note, this timeline does not include time for re-assessments, as neither practice had had changes in place long enough to expect to observe the impact of a change.

Resources Required

The primary resource requirements beyond the toolkit itself were an implementation team representing multiple practice roles (clinicians and staff) with the time, skills, and motivation to complete the project. Other helpful resources included a committed team leader to keep the process moving, an established QI infrastructure (e.g., QI meetings, patient experience surveys, huddle boards), access to someone in the practice with formal training and previous experience in quality and process improvement methods (e.g., PDSA), and support from higher level practice and organizational leadership to sanction use of administrative time for the project.

In general, pilot practices did not require additional outside resources to use the toolkit, probably because the practices prioritized improvements they could implement without needing to collaborate or receive assistance from other hospital resources. For example, the FM residency practice avoided focusing on improvements requiring changes to electronic health record templates, since this would have required information technology support staff.

Findings

The findings for the pilot test relate to the toolkit's perceived usability (practice experiences with toolkit implementation) and usefulness (changes made as a result of following the steps in the toolkit). Additionally, we report practice suggestions for further revisions to the toolkit.

Toolkit Usability: Practice Experiences with Implementation

Overall, both practices had a positive experience with the toolkit, which they viewed as a helpful step-by-step guide for QI. Participants believed that breaking down the lab testing process into multiple steps as depicted in the Improvement Process section of the toolkit was important for making the project feel manageable. As the practice manager in the small GIM practice said, "Making improvements in that bubble is sort of an insurmountable task. So breaking it down by the steps and identifying potential gaps in a particular step is great."

Both practices appreciated that they could use the toolkit in a piecemeal manner, selecting only those components most relevant to their practice. For instance, both practices skipped the Assessing Office Readiness section, noting that their established QI infrastructure and known frustrations with the lab testing process made them fairly confident that this project was right for them.

The toolkit was seen as providing a starting point for assessment and planning materials, which helps expedite the QI process. As a faculty clinician from the large FM residency put it, "It's been nice, for the most part, the provider survey, things like that, to just make copies of something and not have to worry about recreating the wheel." In addition, the toolkit was also adaptable, and could be modified to fit individual practice needs and context. Both practices needed to make modifications to at least one component of the toolkit to fit their practice, but this was not perceived as overly burdensome.

The toolkit was especially appropriate for team members (such as residents) who had less QI experience. "It's been nice because—I think I told you this before—we've got people at different comfort levels with quality improvement process. This is nice for all-comers. Someone like <the lab manager> who's done a lot of QI stuff here, this is probably nothing that's news to her." (Faculty clinician, large FM residency

practice) Those with mature QI skills tend to quickly scan the toolkit and pick out the pieces perceived as relevant, rather than following the guide in order.

Implementation Facilitators:

The project was perceived as high priority by one practice, partly due to having common goals with other practice initiatives (e.g., a practice-wide emphasis on improving patient experience). Further, both practices experienced regular inefficiencies and frustrations with testing, from confusing interfaces for ordering tests to trouble communicating effectively with patients and other providers regarding timing and results. Leadership and management support was critical. Even if leaders did not directly participate, they could allocate administrative time for an implementation team to meet as a group, gather assessment data, and design and implement changes, as well as grant time for the group to present their work at all-hands meetings.

Implementation Barriers:

Practices felt it was hard to maintain momentum on this project with all the other things going on. Both practices experienced periodic delays due to unexpected medical leave and team turnover, as well as normal staffing challenges due to limited availability of medical assistants. It can be especially challenging to keep a QI project top of mind in a residency practice, given annual resident turnover and cycling through rotations. Finally, the anticipated project timeline was too short. While the project was expected to take 6-8 weeks, in both practices this was only enough time to conduct baseline assessments, brainstorm improvements, and begin to plan to implement improvements.

Toolkit Usefulness: Lab Testing Process Improvements Informed by the Toolkit

The most useful components of the toolkit were the patient assessments and handouts, the provider survey, and the brainstorming tools to aid in selecting aspects of a process to target for improvement. Beyond this, the practices felt the toolkit fell short in guiding design and implementation of practice changes.

Large Family Medicine Residency Practice Improvements

Use of the revised AHRQ Laboratory Testing Safety toolkit (Version 2) provided the practice with the data necessary to identify the step in their lab testing process in greatest need of improvement. When the FM residency practice implementation team was first introduced to the toolkit, they had ideas about what they wanted to improve in their laboratory testing process. The implementation team initially thought they would work on test ordering, previously identified as a problem for their clinic through team discussions. However, when they met with the full practice and administered the “Assessing your Testing Process” tool to 15-20 clinicians, the results showed that inconsistent communication of results to patients was rated as more harmful to patients than were problems with the test ordering process. This was contrary to their initial opinions about which part of the testing process needed improvement.

Using the new data, they shifted the focus of their lab process improvement activities to focus on patient communication, specifically the process of ensuring all patients have received their results. They developed a “dot phrase” for the EHR to document patient preferences for receiving normal results by letter or another method. Dot phrases are shorthand codes that pre-populate common phrases into documentation for an encounter, e.g., typing “.results” automatically adds the phrase “Patient would

like normal results returned via mail." Some MAs have started using the dot phrases. They also developed a dot phrase for clinicians regarding their orders for communicating next steps to the patient pending lab results, so that the patient care staff to know what action needs to be taken. The practice is piloting this in the clinic group and will then disseminate it more broadly in the clinic. The practice also plans to make results letters in different languages, especially for the Somali refugee patients, but that plan has been harder to implement given the many dialects and the cost of translation services.

Small General Internal Medicine Practice Improvements

The GIM practice used the Patient Experience Survey in the toolkit to assess their patients' level of understanding and knowledge about the lab tests that were ordered. While most patients indicated on the survey that they did know why a test was ordered, the care teams observed that due to the project more patients were asking questions about what their lab test is or what the results mean. One MA said about this change from before the project to after the project finished: "It's maybe the realization that we are trying to make sure that they understand what's going on. Now that they know that, it's like, 'Okay, well I can ask them questions. They don't mind if I ask questions.'" This led the QI team to reinstitute systematic use of patient education handouts for commonly ordered lab tests, and encourage care team members to engage patients in conversations about the reason for their tests and what results they should expect to receive and when. In consultation with the hospital, the practice created a handout on common blood tests (Appendix F) to educate their patients about the test that was ordered and the reason why it was ordered. Thus, use of the revised toolkit helped the practice identify ways to better engage patients in their care.

Suggestions for Further Revisions to the Toolkit

The toolkit could be further improved with the addition of examples and case studies describing how practices have applied each component of the toolkit. The pilot practices felt there was a need for additional guidelines for measurement and tools for designing and implementing process changes. For example, the clinic manager pointed out page 6, with the 8 boxes which go through the steps in the lab testing process. She said that it would help if the toolkit then gave references to tools and guides so that clinics could work on improving each of those 8 steps. A related suggestion was to add a tool for clinics to create their own process maps, as the maps created by our team for this project were seen as useful for highlighting where inefficiencies or gaps in the process may be occurring. As noted by the FM Residency Faculty Clinician, "[We] didn't see how many times things were crossing lanes. When you're looking at communication, that's where things can fall through. [There are] so many different lanes of people, and opportunities for error. When mapped out, you visualize that a lot better."

Setting appropriate expectations for timelines was also seen as important. Recommendations included providing a range of timelines for following each step in the toolkit. Creating some expectation around reasonable time frames would be helpful. A faculty clinician from the large FM practice suggested saying something like "a small scale project might test over 4 weeks, and a larger scale project might test 3 months." The practice manager from the small GIM practice said, "With the 'Patient Experience Assessment,' for example, if your goal is to get 20 responses, the office can pretty easily estimate how long it will take them to see 20 patients who need lab work, but how long would it take them to get 20 responses?"

The practices recommended providing the following pieces of advice to others who may choose to use the toolkit:

- "It will take longer than you think. [It is] good to set an ambitious timeline but don't be surprised [when it takes longer]." (FM Residency Faculty Clinician)
- "Keep it simple. We made it very clear at the start, 'this is what we are going to do!' and 'this person is taking care of this!' Try not to make it too overwhelming." (Practice manager, small GIM practice)
- "You have to be open to changing what you work on over the course of the project, not so committed to work on only what you thought you would work on." (FM residency faculty clinician)

Although the revised toolkit had been re-titled "Improving your *Diagnostic* Testing Process," the practices did not like the term "Diagnostic Testing," and preferred "Office Testing." Finally, the title should include the concept that it is a "Step by Step Guide" rather than a "Toolkit" given that the primary use of the toolkit is to break a QI project down into manageable pieces.

Summary

The revised toolkit was found to be useful and usable by the two practices that tested it. Some further changes may increase the usability and usefulness of the toolkit. The pilot practices demonstrated that not all components of the toolkit need to be used by every practice to make meaningful changes; rather, practices can select tools most relevant to their purposes and even adapt them as needed. Both practices implemented the toolkit with very little assistance from our team, who were there mainly to offer encouragement and observe their process, rather than to advise or direct. While the expected 6-8 week implementation period was adequate for the small GIM practice, the FM residency practice required an additional 4 weeks due to unexpected staff turnover.

Four key themes for improving the toolkit emerged from our interviews with both stakeholders and practice implementation teams:

1) Refer to the toolkit as a "step-by-step guide" rather than a toolkit.

2) Arrange the guide so that it flows through the steps in improvement (assess, plan, implement, reassess).

3) Include brief case examples describing how practices have followed each step in the guide.

4) Provide more detailed guidance on how to implement a change.

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Appendices

See the following pages for all appendices.

Appendix A: Kickoff Meeting Interview Guide

LAB TESTING PROCESS IMPROVEMENT GROUP INTERVIEW GUIDE

I. Introduction

Thank you for participating. We are interviewing two to four clinicians and staff in your clinic about plans to participate in a project evaluating implementation of the AHRQ office testing process improvement toolkit. We want to hear about your practice motivations to participate and existing capacity for quality improvement efforts.

II. Motivations and Priorities

1) How did your practice get involved with this project? Probes: how are people here feeling about it? Who decided? How was that decision communicated?

2) What are you hoping to get out of participating in this project? Probes: effect on your role personally as well as effect on the practice members (staff morale, etc.) or patients? Hard outcomes? Learning about processes in general? Other?

3) Considering other priorities right now, how does this project fit in? Where does it line up in the priority list? Why is that? To what extent is improving lab testing in general a priority for this practice? What factors influence this prioritization?

4) What potential challenges do you foresee with using the AHRQ toolkit to guide lab testing process improvement in this practice?

    a. Personnel

    b. Resources

    c. Timeline

    d. Other issues

III. Current processes and capacity

1) Next, can you please take me step-by-step through your practice's current lab testing process? Please share along the way:

a. Who is involved?

b. What tools, equipment, space are used?

c. How are tasks passed from one person to the next?

d. Are there “out of step” processes?

e. How do you know when lab testing is working well?

f. How do you know when a “ball gets dropped” or “something falls through the cracks?”

g. What is your overall evaluation of how well this process works? What could be improved if you had the opportunity to do so?

2) How does this practice typically do quality and process improvement?

a. Who is involved in QI in this practice? What are their roles?

b. Do you have a set process for QI? What QI frameworks, procedures, or tools do you use? (e.g., PDSA cycles)

c. What is your practice’s typical experience with QI efforts? What factors contribute to success? What challenges do you experience?

Thank you very much for your time today, we appreciate your help with this project.

ON-SITE LAB TESTING PROCESS MAPPING GUIDE

Overview

A focus of the on-site visit will be to observe processes for your laboratory testing process. Details to be obtained include:

Practice Process

General Laboratory Testing Process Information

- Is there a written process description of the testing process?
- Are clinic personnel trained on this process?
    - How are they trained?
    - New employees or new processes?
- What resources does the process use (paper, staff, technology)
    -
    - Who typically is involved in the process
    - Is there a lead staff person that is responsible for the process?
    - What happens when the lead person in unavailable?
    - What exceptions are there?
    - What happens if a problem occurs?
- Where does the process typically occur?
    - Where does each step occur?
    - Who is involved in each step?

        - Are there any exceptions to this?
        - Does notation need to occur?
    - What technology is used in the process?
        - What happens if there is a failure?
        - Training required for the technology?
        - Data flow involved with the technology?
    - Patient involvement in the process?
        - Which steps are patients involved in?
        - How do staff communicate with them? (who is responsible)
        -

- List of sub processes within the process
    - Sub maps for each sub process should be produced

- List of external agencies involved in the process
    - Include external agencies at each point in the process
    - What happens if there is a failure?
    - How does communication occur between practice and external agency?
    - What is the actual time frame from start to finish of the process?
        - What is the time frame for each step of the process?
        - What exceptions exist to the time frames?
    - How do staff communicate about this process?
        - Lead staff member that disseminates information

        - Teams
        - Face-to-face office meetings
        - Electronically
        - Notation in patient charts or labs
        - White board with messages
        - Log books

o Does this process require documentation and/or follow-up? (test ordered, results given to clinician, patient called, etc.)

        - Log book
        - Chart notation
        - Cross checks?

    - How do you know the process has been completed successfully?
        - Notation?
    - How can the process be improved?
    - Have you tried to improve this process in the past?
    - What techniques did you use?

Thank you for this information. As a next step, we'll create a visual process map that will show all of the steps you have described here. We'd like to have you review this when we're done to correct mistakes, add new information, or change something that doesn't look quite right.

OBSERVATIONAL TOOL

Overview

The major focus of the on-site visit will be to map the complete process for how your practice does laboratory testing. This Observational Tool provides a table-structured format for documenting qualitative observations to supplement the Process Mapping. Below are instructions for documenting data within the table.

Observation

- Data entered in this column include a general name or listing of the observation

Patients Tasks

- List patient tasks identified by practice staff.

Staff Involved

- List all staff involved with the specific observation
    - Is this a typical task for the individual to be involved in?
    - Is the staff listed appropriate for this task?
    - Could this task be done by a subordinate staff member?
        - How/why is this person qualified to do this task?
    - Where is this task occurring and is it located in an area easily accessible to the staff involved (lots of walking)

Clinician Involved

List clinician tasks.

- Does it differ by clinician?

Technology/Resources Involved

- List all technology and resources involved in the observation
- o What resources does the process use (paper, staff, technology, space, equipment, etc.)
- o Could technical failures or training issues affect performance?

Time Involved/Recurring?

- Lists the approximate time involved with the observation
- o Are there exceptions to this time?
- o How much, if any, down time occurs?

Description

- Provide a detailed description of the observation using terminology appropriate for mixed model analysis. Document only direct observations and not opinions or personal interpretation.

Laboratory Testing Process Observation Documentation Tool

Observation	Patient Tasks	Staff Involved	Clinician Involved	Technology/ Resources Involved	Time Involved/How often during the day	Description

Observation	Patient Tasks	Staff Involved	Clinician Involved	Technology/ Resources Involved	Time Involved/How often during the day	Description

III. Practice Demographics (to be completed by one person per practice)

We would like some basic information about your practice. This will help describe your practice for the evaluation report.

1) Please tell us about your practice's employees by job title in the questions below:

a) How many physicians (MD or DO) are in your practice? _____

i) How many practice…

(1) Family Medicine? _____

(2) General Internal Medicine? _____

(3) Other Specialties? _____

(a) Specify_____

b) How many non-physician providers are in your practice?

i) Nurse Practitioners or other advance practice nurses_____

ii) Physician Assistants

c) How many nurses (RN/CRN) are in your practice? _____

d) How many medical assistants (MA) are in your practice?_____

e) How many non-clinical employees are in your practice? _____

i) Master's degree level professionals (e.g., medical records administrators, accountants)?

_____

ii) Administrative staff (management, clerical)? _____ f) Other?

Specify_____

2) How many exam rooms are in your practice? _____

3) Who is the majority owner of your practice?: (Circle one)

a) Government

b) Integrated delivery system (IDS/Hospital)

c) Insurance company or HMO

d) Physicians

e) University or Medical School

f) Other? Specify_____

4) What is the population designation that best describes the county, town, or city surrounding your practice? (Circle one)

a) Nonmetropolitan (<50,000 people)

b) Small Metropolitan (50,000 to 250,000 people)

c) Medium Metropolitan (250,001 to 1,000,000 people)

d) Large Metropolitan (> 1,000,000 people)

5) Estimate the percentage distribution of your patients' ages for your practice.

Infant (under 2 years of age)……._____

Pediatric (between 2 and 12 years of age)……._____

Adolescent (between 13 and 17 years of age)……_____

Adult (between 18 and 64 years of age)……_____

Geriatric (between 65 and 79 years of age)……_____

Aged (80 years of age and older)……_____

TOTAL 100%

6) Estimate the percentage of your practice's “total gross charges" by type of payer.

Medicare……_____

Medicaid…………………………………_____

Commercial fee-for-service…………………_____

Commercial capitated………………………_____

Workers' compensation……………………._____

Charity and uncompensated care …………..._____

Self-pay…………………………………..._____

Other……………………………………..._____

TOTAL 100%

7) Does your practice use an electronic health record (EHR)?

    a. No.

    b. Yes.

        i. If YES, what is the name of your EHR or EHR vendor?

        ____

8) How are laboratory test orders transmitted to your clinical reference labs? (check all that apply) a)

    Electronically via our EHR

    b) Electronically via a separate portal or website

    c) Electronically via fax

    d) By paper requisition sent with the specimen

    e) By paper requisition sent with the patient

    f) Other: ___________________

9) How are most specimens for blood and urine tests collected?

    a) In the exam room by our medical staff

    b) In a room separate from the exam room by our medical staff

    c) In the exam room by a laboratory employee/phlebotomist

d) In a separate room by a laboratory

e) Other: _____

10) How many external clinical reference labs does your practice work with routinely? a) 1

b) 2

c) 3 or more

11) How are ***most*** laboratory test results (blood and urine tests) usually delivered to your practice from your clinical reference lab? (select the <u>one</u> most common)

a) Delivered directly into our EHR electronically

b) Sent by fax to our office

c) Sent electronically to a website or portal outside of our EHR

12) Which blood or urine tests are performed routinely in your office (and not sent out)?

a) _____

13) Does your practice have one or more quality improvement teams?

a) No

b) Yes→ If, Yes, how often does the team meet?

i) Weekly ii)

ii) 1-2x/month iii)

iii) Monthly

iv) iv) Quarterly

v) Other _____

Appendix B: Mid-Point Interview Guide

MID-POINT STAFF AND CLINICIAN INTERVIEW GUIDE

I. Introduction

Thank you for participating. We are interviewing two to four clinicians and staff in your clinic about your experience so far using the AHRQ office testing process improvement toolkit. We first want to hear about your overall experience—what you have worked on, how you have proceeded, who has been involved, and your use of the toolkit. We then would like to hear about your specific comments about the toolkit itself.

II. What you have done

1) First, can you please describe what your practice (or practice team) has done so far (since [start date]) to improve lab testing processes?

    a. What specific part(s) of the process was selected for improvement? How did you decide that? How did the toolkit help with or guide your decision?

    b. Which sections have you chosen to use, refer to, or follow in the toolkit?

    c. What changes have been made to your lab testing processes? Please take me through specifically what is different than what you did before. Probe: For each change, how did you use the toolkit to help with or guide that change? Please explain how you used the toolkit for each specific change and/or the overall change process.

2) What has been your experience with implementing the toolkit?

    a. What has helped with or facilitated implementation so far? What has not been helpful or detracted from implementation?

b. What changes to the QI process as described in the toolkit have you made as you have done your lab testing QI work? How have these changes affected implementation or the QI process as described in the toolkit?

c. Anything else that has helped? Probes: Have you needed to rely upon knowledge, expertise or resources not provided in the toolkit? Have you needed outside expertise or help?

d. Any challenges in using the toolkit? What helped overcome the challenge?

e. How helpful was the toolkit in working through a challenge?

3) Once the practice got started trying to implement the toolkit to improve lab testing, what has been the reaction?

a. How have *providers* reacted?

b. How have the *staff* reacted?

c. How have *patients* reacted?

d. Any other important groups?

Thank you very much for your time today, we appreciate your help with this project.

Appendix C: Follow-Up Site Visit Interview Guide

LAB TESTING PROCESS IMPROVEMENT GROUP INTERVIEW GUIDE

I. Introduction

Thank you for participating. We are interviewing two to four clinicians and staff in your clinic about your experience using the AHRQ office testing process improvement toolkit. We first want to hear about your overall experience—what you have worked on, how you have proceeded, who has been involved, your use of the toolkit, and any barriers and facilitators. We then would like to hear about your specific comments about each section of the toolkit itself.

II. What you have done

1) First, can you please describe what your practice (or practice team) has done (since [start date]) to improve lab testing processes?

    a. To recap what we heard at the mid-point interviews, we heard that this practice focused on [specific process selected for improvement]. Is this correct? Have there been any changes in the process?

    b. Which steps did you choose to follow in the toolkit?

    c. What changes have been made to your lab testing processes? Please take me through specifically what is different than what you did before. Probe: For each change, how did you use the toolkit to help with or guide that change? Please explain how you used the toolkit for each specific change and/or the overall change process.

2) What has been the reaction to this project?

    a. How have *providers* reacted?

    b. How have the *staff* reacted?

    c. How have *patients* reacted?

d. Any other important groups?

3) What has been your overall experience with implementing the toolkit?

   a. What has been helpful? What has not been as helpful?

   b. Have you needed to rely upon knowledge, expertise, or resources not provided in the toolkit? Have you needed outside expertise or help?

4) Now, we'd like to go through each section of the toolkit, and get your feedback.

   a. *For each section, pass out the relevant page to participants.*

      i. General impressions

      ii. How relevant was this section to your practice?

      iii. How usable? Was it easy to read and understand, was information laid out in a logical order, did it explain exactly what to do for each step? Any missing information?

      iv. How efficient was this section? Any pieces you chose not to use?

      v. How feasible was it to implement the steps described in this section, using existing staff and resources? Barriers and facilitators?

      vi. In what ways did you adapt this section of the toolkit to meet your needs?

Thank you very much for your time today, we appreciate your help with this project.

ON-SITE LAB TESTING PROCESS MAPPING GUIDE

Overview

A focus of the on-site visit will be to observe processes for your laboratory testing process. Details to be obtained include:

Practice Process

General Laboratory Testing Process Information

- Is there a written process description of the testing process?
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    - How are they trained?
    - New employees or new processes?
- What resources does the process use (paper, staff, technology)
    - Who typically is involved in the process?
    - Is there a lead staff person that is responsible for the process?
    - What happens when the lead person in unavailable?
    - What exceptions are there?
    - What happens if a problem occurs?
- Where does the process typically occur?
    - Where does each step occur?
    - Who is involved in each step?
    - Are there any exceptions to this?

        - Does notation need to occur?
    - What technology is used in the process?
        - What happens if there is a failure?
        - Training required for the technology?
        - Data flow involved with the technology?
    - Patient involvement in the process?
        - Which steps are patients involved in?
        - How do staff communicate with them? (who is responsible)
- List of sub processes within the process
    - Sub maps for each sub process should be produced
- List of external agencies involved in the process
    - Include external agencies at each point in the process
    - What happens if there is a failure?
    - How does communication occur between practice and external agency?
    - What is the actual time frame from start to finish of the process?
        - What is the time frame for each step of the process?
        - What exceptions exist to the time frames?
    - How do staff communicate about this process?
        - Lead staff member that disseminates information
        - Teams
        - Face-to-face office meetings
        - Electronically

        - Notation in patient charts or labs
        - White board with messages
        - Log books

○ Does this process require documentation and/or follow-up? (test ordered, results given to clinician, patient called, etc.)

        - Log book
        - Chart notation
        - Cross checks?

    - How do you know the process has been completed successfully?
        - Notation?
    - How can the process be improved?
    - Have you tried to improve this process in the past?
    - What techniques did you use?

Thank you for this information. As a next step, we'll create a visual process map that will show all of the steps you have described here. We'd like to have you review this when we're done to correct mistakes, add new information, or change something that doesn't look quite right.

OBSERVATIONAL TOOL

Overview

The major focus of the on-site visit will be to map the complete process for how your practice does Laboratory Testing. This Observational Tool provides a table-structured format for documenting qualitative observations to supplement the Process Mapping. Below are instructions for documenting data within the table.

Observation

- Data entered in this column include a general name or listing of the observation

Patients Tasks

- List patient tasks identified by practice staff.

Staff Involved

- List all staff involved with the specific observation

  - Is this a typical task for the individual to be involved in?

  - Is the staff listed appropriate for this task

  - Could this task be done by a subordinate staff member?

    - How/why is this person qualified to do this task?

Where is this task occurring and is located in an area easily accessible to the staff involved (lots of walking)

Clinician Involved

List clinician tasks.

- Does it differ by clinician?

Technology/Resources Involved

- List all technology and resources involved in the observation

  - What resources does the process use (paper, staff, technology, space, equipment, etc.)

  - Could technical failures or training issues affect performance?

Time Involved/Recurring?

- Lists the approximate time involved with the observation

- Are there exceptions to this time?

- How much, if any, down time occurs?

Description

- Provide a detailed description of the observation using terminology appropriate for mixed model analysis. Document only direct observations and not opinions or personal interpretation.

37 **Laboratory Testing Process Observation Documentation Tool**

Observation	**Patient Tasks**	**Staff Involved**	**Clinician Involved**	**Technology/ Resources Involved**	**Time Involved/How often during the day**	**Description**

Observation	Patient Tasks	Staff Involved	Clinician Involved	Technology/ Resources Involved	Time Involved/How often during the day	Description

Appendix D: Practice Recruitment Letter

Patient Safety in Primary Care: Evaluating Tools for Improving Laboratory Testing

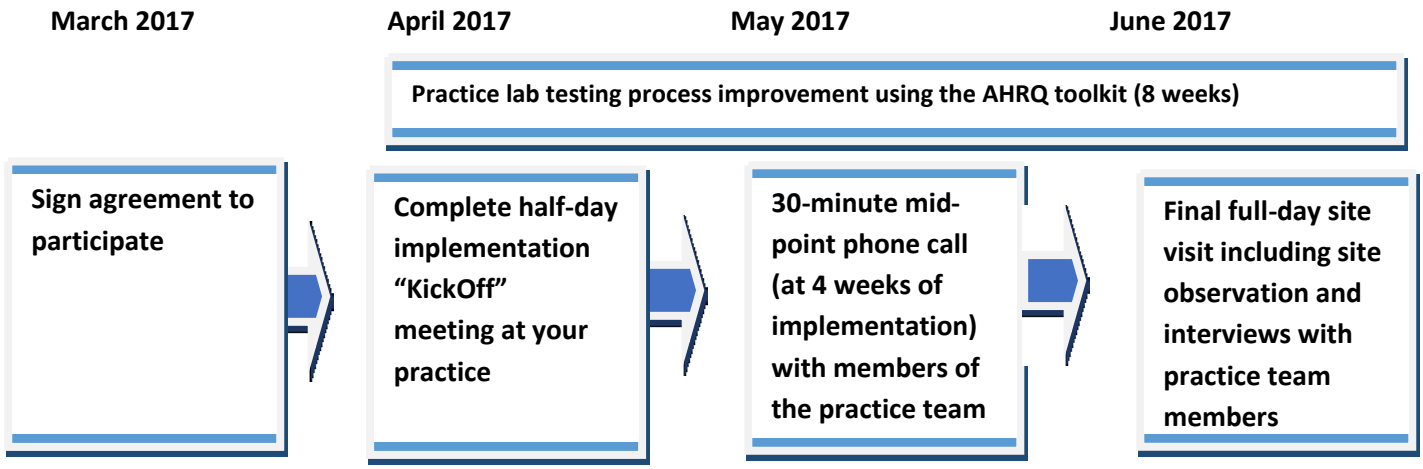
Is improving patient safety for lab testing a priority for your practice?
If so, help test the usefulness of an AHRQ toolkit for improving office testing processes

Over two billion lab tests are performed annually in the U.S., predominantly in ambulatory care settings. Errors occur in more than 20% of all tests, often related to communication breakdowns. Process improvement around laboratory testing processes can help reduce these communication breakdowns and improve patient safety. The purpose of this project is to evaluate the usefulness of a toolkit developed by the Agency for Healthcare Research and Quality (AHRQ) called "Improving Your Office Testing Process." Participating practices will attempt to use the toolkit to improve an office testing process of their choice, without assistance from the project team.

Practice Eligibility Checklist:

- ☐ Primary care practice with 11 or more full-time providers
- ☐ Level 2 or 3 Patient-Centered Medical Home recognized
- ☐ Established quality improvement team
- ☐ Improving laboratory testing processes is a current priority
- ☐ Able to commit personnel time to toolkit implementation and 15 hours with evaluation team

Practice Activities and Timeline



Practices will receive $2,500 for participation in this project, to be paid at the end of implementation

University of Colorado Project Team

Appendix E: Agreement to Participate

Patient Safety in Primary Care: Evaluating Tools for Improving Laboratory Safety

Agreement to Participate

This letter explains the expectations held by the Department of Family Medicine at the University of Colorado for the Patient Safety in Primary Care Laboratory Safety project. Please read this letter carefully and return in-person, electronically, or by mail to the project manager:

Peter Ferrarone
University of Colorado, Denver
13199 E. Montview Blvd. Suite 400 Aurora,
Colorado 80045
peter.ferrarone@ucdenver.edu

We, the clinical providers and staff of the *Spruce Street Internal Medicine Clinic* wish to:

Participate in a three-month project designed to test the usefulness of an AHRQ toolkit for improving office testing processes. By participating in the project we understand that:

1. The clinic's point of contact (office manager or lead clinician) will be the main contact for this project, including scheduling on-site observation, data collection, and follow-up phone calls and visits.

2. The contact person will assist the research team in developing an agenda and itinerary for two on-site visits to the practice at the beginning and end of the project.

3. The contact person will assist in assembling a local practice team consisting of a lead clinician, an administrator, and one or more office staff deemed appropriate by the practice leadership.

4. The practice will be expected to use the "Improving Your Office Testing Process" toolkit to guide practice improvement for an office testing process of your choice, over the course of 6-8 weeks.

5. During the on-site visits the project team will engage in data collection through observation of practice workflows and brief interviews with members of the practice improvement team to evaluate changes in testing processes and use of the toolkit (6-8 hour visit; up to 15 hours total contact with project staff).

6. The project team will develop a case report on use of the toolkit. Towards the end of the project period, this will be provided to the lead clinician and business manager to review for accuracy.

7. The project team will:

    - Respond to practice questions promptly
    - Provide the practice point of contact with a detailed agenda for the site visits
    - Develop a case report that limits identifiable information about the clinic, and does not expose the practice to business or professional risks
    - Assist the practice in developing an invoice, so that the clinic will receive a payment of $2,500 for project-related services.

_____	_____
Clinic Contact Person	John Westfall, UC Denver
_____	_____
Date	Date

Appendix F: GIM practice patient handout

Blood Tests

PATIENT EDUCATION

Below is a brief explanation of common lab tests that you may have had done. If you are not able to find a test that you had done, please take a look at this website for more test information: **www.labtestsonline.org.**

	Blood Test	Details
◯	**Complete Blood Count (CBC)**	
	White Blood Cells (WBC)	White blood cells are part of your immune system, which fights infections and diseases. Abnormal white blood cell levels may be a sign of infection, blood cancer, or an immune system disorder.
	Red Blood Cells (RBC)	Red blood cells carry oxygen from your lungs to the rest of your body. Abnormal red blood cell levels may be a sign of anemia, dehydration (too little fluid in the body), bleeding, or another disorder.
	Hemoglobin (HGB)	Hemoglobin is an iron-rich protein in red blood cells that carries oxygen. Abnormal hemoglobin levels may be a sign of anemia other blood disorders.
	Hematocrit (HCT)	Hematocrit is a measure of how much space red blood cells take up in your blood. A high hematocrit level might mean you're dehydrated. A low hematocrit level might mean you have anemia. Abnormal hematocrit levels also may be a sign of a blood or bone marrow disorder.
	MCV, MCH, MCHC, RDW	These tests measure size and makeup of the red blood cells. They can help to determine the cause of anemia.
	Platelets	Platelets help your blood to clot. Abnormal platelet levels may be a sign of a bleeding disorder (not enough clotting) or a thrombotic disorder (too much clotting).

	Lymphocytes, Monocytes, Neutrophils, Eosinophils	Different types of white blood cells. Their levels may be used to evaluate allergic reactions or determine if an infection is caused by a bacteria, virus, or parasite.
◯	**Lipid Panel**	
	Cholesterol & Triglycerides	These are the two main groups of fat in the blood. Increased levels of either may lead to arteriosclerosis (hardening of the arteries), diabetes, thyroid, liver, or pancreatic disease.
	High Density Lipoprotein (HDL)	This is the "good" cholesterol. The higher the value, the lower the risk of developing heart disease.
	Low Density Lipoprotein (LDL)	This is the "bad" cholesterol. The higher the value, the higher the risk of developing heart disease.
	Very Low Density Lipoprotein (VLDL)	This is the "bad" triglyceride. The higher the value, the higher the risk of developing heart disease and/or pancreatitis.
◯	C – Reactive Protein (CRP)	A protein present in the blood when certain inflammatory processes are occurring, it can help to predict heart disease. Recent illness or tissue injury, and chronic inflammation from arthritis can increase CRP levels and falsely influence the risk rating for heart disease from this test.
◯	**Metabolic panel**	
	Sodium, Potassium, Chloride	These are electrolytes, which are minerals in the body. Abnormal electrolyte levels may be a sign of dehydration, kidney disease, liver disease, heart failure, high blood pressure, or other disorders.
	Carbon Dioxide	Helps to detect, evaluate, and monitor electrolyte imbalances.

	Glucose	Glucose is a type of sugar that the body uses for energy. Abnormal glucose levels in your blood may be a sign of diabetes.
	Urea Nitrogen (BUN)	A waste product of the liver excreted by the kidneys. High values may indicate kidney malfunction and/or dehydration.
	Creatinine	This is a waste product of muscle metabolism that is excreted by the kidneys. It is elevated in kidney disease, muscle wasting disease, and sometimes the day after strenuous physical exercise.
	BUN/Creatinine Ratio	This ratio helps determine the type of kidney failure.
	Calcium	Abnormal calcium levels in the blood may be a sign of kidney problems, bone disease, thyroid disease, cancer, malnutrition, or another disorder
	Albumin, Globulin, & Total Protein	Abnormal results are an indicator of under nutrition, liver or kidney disease, cirrhosis, multiple myeloma, sarcoidosis, amyloidosis, lupus, and/or major infections.
	AST & ALT	Injury to cells releases these enzymes into the blood. Liver disease and heart attacks, as well as serious physical injury can cause elevation of these values.
	Alkaline Phosphatase	A bone and liver enzyme. High values are associated with liver and gall-bladder disease.
	Bilirubin	The primary pigment in bile, it builds up when the liver is functioning poorly or when some other disorder reduces the normal flow of bile. It can also be increased when there has been destruction of red blood cells.

◯	**Prostatic Specific Antigen (PSA)**	PSA is released into a man's blood by his prostate gland. Healthy men usually have low amounts of PSA in the blood. Levels can be elevated with age, as a result of injury, sexual activity (ejaculation), inflammation of the prostate gland, or prostate cancer.

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◯	**Thyroid Stimulating Hormone (TSH)**	This is the test of choice for evaluating thyroid function and/or symptoms of hyper or hypothyroidism.
◯	**Hemoglobin A1c**	This is a blood test that provides information about a person’s average levels of blood glucose, also called blood sugar, over the past three months. The result provides information to help manage diabetes.

Source: National Institutes of Health, 2012; American Association for Clinical Chemistry, 2017