

PART 4
MOC

THE AMERICAN BOARD *of* PEDIATRICS

The QI Guide

OCTOBER 2020

THE AMERICAN BOARD *of* PEDIATRICS

Table of Contents

Model for Improvement Overview	2
What Are We Trying to Accomplish with This Improvement Effort?	4
Using the Model for Improvement	5
Aim Statements.....	6
How Do We Know a Change Is an Improvement?	8
Choosing Measures.....	9
What Changes Can We Make That Will Result in Improvement?	14
Generate Test Ideas.....	14
QI Tools	21
Sustain.....	26
Resources and References	28

Model for Improvement

There are many methods or frameworks that can be used to improve clinical care. The guide uses The Model for Improvement based on QI principles developed by Associates in Process Improvement. The Model for Improvement is an approach to planning, testing ideas, and then implementing those ideas that result in improvement in processes and systems of care. It has been used extensively in health care and other settings and provides a robust approach to moving from ideas to actions that can improve the care provided to patients.

The Model for Improvement uses Plan-Do-Study-Act (PDSA) cycles to test small changes in a rapid fashion to increase your knowledge about the impact the changes have on the processes you are seeking to improve. You can use PDSA cycles to:

- Test changes you predict will help improve care
- Implement practice-wide the changes proven to improve care



The Model for Improvement provides clinicians and their teams with a framework to support QI activities. It has been tested across many health care settings (e.g., inpatient and outpatient, general and subspecialty clinics) and has proven to be an effective method for identifying, testing, and evaluating changes to improve health care processes and outcomes.

GAPS IN QUALITY OF CARE ARE WELL DOCUMENTED

Significant documented gaps exist between current performance and desired performance. For example, almost all children would benefit from influenza immunizations and yet children die each year because immunization rates are significantly lower than they should be.

Physicians always want to provide their patients with excellent care and work hard to do this. Unfortunately, complex systems and increasing demands on providers make it difficult to consistently provide ideal care, and, as a result, what is considered standard practice evolves. As demonstrated by [Mangione-Smith et al](#), actual pediatric care received falls far short of what is needed. Children in her study received 67.6% of indicated care for acute problems, 53.4% for chronic conditions, and 40.7% for preventive care. Furthermore, work by Dartmouth shows that care can vary widely based on zip code.

As illustrated by [Dartmouth Atlas](#) data, page 36, for example, the rate of lead screening in Medicaid-insured children under the age of 2 varies widely across New England from 8% in Dover-Foxcroft, Maine, to 89% in Berlin, New Hampshire. Even in the absence of external documentation of gaps in quality, most physicians are aware of the significant problems in their own systems of care. While it is difficult to read reports such as the Institute of Medicine's *Crossing the Quality Chasm* and *To Err is Human* and multiple other published articles that document significant gaps in quality and safety, it is the responsibility of all physicians to not just provide outstanding care, but work towards always improving the care they provide. This PIM is designed to help providers move in this direction and find joy in work that results in improved care to patients.

IMPROVING IS CHALLENGING

The reasons for improving are clear. The intrinsic motivation to improve is the professionalism that drives most physicians' behavior. The challenge is that we often do not know how to improve – especially in complex settings like hospitals and clinics. Anyone in medicine recognizes that thinking about improving patient care is often easy – actual improvement is far more challenging.

The Model for Improvement combines the best of two approaches to improvement: understanding

problems before trying to change them and then systematic testing of ideas or interventions (real-time science) to see what works. The Model for Improvement uses the concept of "trial-and-learn" throughout and allows you to apply knowledge about what works in your setting to improve care for your patients.

THE THREE KEY QUESTIONS FOR IMPROVEMENT

Before you change anything, you need to ask yourself three fundamental questions:



These questions will help you focus on implementing changes that will have the most impact on your practice. This is because you will learn by testing ideas specific to your setting on a small scale. What you learn from each small test will guide the next step of your improvement effort. Using the three questions will help you stay focused on improvement despite the many forces competing for your attention.

In order to conduct an improvement project, you will need to:

- Identify a gap/problem
- Form a team
- Raise awareness
- Develop an aim statement
- Define measures
- Identify and test changes or interventions
- Evaluate the impact of those changes for evidence of improvement
- Understand sustainability
- Recognize when to spread in your practice

The following sections will guide you through this process.

I. What Are We Trying to Accomplish with This Improvement Effort?

GETTING STARTED

A. Identify the Gap

To begin any Quality Improvement project, you need to establish the scope of your activities and/or identify the gap or problem. Often this begins by considering questions such as:

- What do we really care about improving as a health care team?
- What is the issue or concern at hand?
- Why is the status quo no longer good enough?
- Why should we improve?
- What will happen if we do not improve?
- What should the future look like?

As you begin to answer these questions, consider the six aims outlined in the Institute of Medicine's *Crossing the Quality Chasm* report to create the will for improvement (i.e., the sense of urgency that the care team must do something different).

- **Safe:** avoids injuries to patients from the care that is intended to help them
- **Effective:** matches care to science; avoids overuse of ineffective care and underuse of effective care
- **Patient-Centered:** honors the individual and respects choice
- **Timely:** reduces waiting for both patients and those who give care
- **Efficient:** reduces waste
- **Equitable:** closes racial and ethnic gaps in health status

B. Form Your Team

You will need a committed team with solid leadership to carry out and sustain your changes. Your team leader will need to have the authority to manage the team's work and institute changes. The best teams include both clinical and administrative staff. Patients and caregivers often add valuable input.

Some strategies for building a strong team:

- **Choose a team leader.** This person should be enthusiastic about improvement and have the power to facilitate change. If they are not a senior leader in the practice, then senior leadership must demonstrate that the team leader has the authority to act.
- **Include one representative from each area of your practice who are both motivated and respected.** In small practices, this may mean involving most (or all) of your clinical and administrative staff members. In large practices, choose at least one person from each area. Members may include:
 - Physicians
 - Nurse practitioners/Physician assistants
 - Nurses
 - Medical assistants
 - Practice managers (can often help with data)
 - Front office staff
 - Billing staff
- Keep the team's size manageable. It can be hard to make progress with more than eight team members.
- Key stakeholders and ad hoc members can be brought in as needed.
 - Support staff (e.g., social work, care coordinators)
 - Information services and/or data analyst who can pull data to support the changes and evaluation of the process

- Senior leader(s)
- Payer(s)
- Include patients and/or caregivers. They have a unique perspective, including vital first-hand insight on patient experience and opportunities for improvement, which can be very eye opening for the care team.
 - Ask staff which individuals are typical of your patient population.
 - Include this person on special projects as needed.
 - Consider offering a meal or a small gift of recognition for this member's contribution.

Schedule regular team meetings, with the first one designed to introduce the topic and educate your team. You may find you need to meet more frequently at first but can scale back once the project is in motion. Build report-out into the standard meeting process, as well as ongoing review of roles and responsibilities. Regular reporting to senior leadership is crucial for accountability and team engagement.

The team you put together will craft your aim statement.

C. Raise Awareness in the Practice, Unit, System in Which the Improvement Work Is Happening

Discuss the work needed to move the project forward at a variety of opportunities such as staff meetings, provider meetings, lunch-and-learns, etc.

Next, gather your team and continue ...

II. Using the Model for Improvement

What Are We Trying to Accomplish?

AIM STATEMENT DEFINED

It can be helpful to think in very specific terms about the changes you want to make in your practice. You can do this with an **aim statement**. An aim statement is a written description of the accomplishments expected from the improvement effort. In other words, this statement articulates the results you hope to see because of the changes you implement.

There are two types of aim statements:

1. **Global aim statement:** The more robust version described below (i.e., a paragraph, with a set of measurable goals). You may see it used in future collaborations, as this version is often used to tell the full story of the improvement work planned.
2. **SMART aim:** The narrower aim statement called the "SMART aim." While we will describe both types of aim statements below, for the purposes of this PIM, we will use the SMART aim framework.

GLOBAL AIM STATEMENTS

Global aim statements include:

- A general description of what you hope to accomplish from this effort
- The why bother/rationale
- A description of the specific patient population that is the focus of the improvement efforts, time
- Some guidance for carrying out the work (methodology)
- Usually four to six sentences and goals, includes:
 - Three to six goals that tell you have accomplished what you intended to do

This statement is based on the improvements you would like to see relevant to the performance gaps you identified through chart review or some other process of assessment of practice performance. An aim statement is a balance – not too easy, not too hard. An effective aim is not something that can be accomplished by making minor "tweaks" or adjustments to existing processes or systems of care – it should require intentional shift(s) or measurable, maintainable changes. Finding the balance between creating an aim statement that is neither too easy nor impossible to achieve can be challenging. This is often where senior leaders can help. They are well positioned to look at the larger systems of care and consider the impact of the improvement project.

EXAMPLE OF GLOBAL AIM: PICU/OR HANDOFF PROCESS

Communication failures are a threat to patient safety and quality of care. They account for nearly 70% of medical errors and adverse events in health care. A significant number of communication failures happen during patient handoffs between care teams that often result in treatment delays, incongruence in patient data, and increased patient length of stay. Some of the most common barriers to appropriate handoffs are associated with lack of a standard handoff system, and lack of handoff training for health care providers. **The aim of this project is to improve safety for patients being transferred from the OR to PICU and from PICU to the OR, through standardizing handoffs by July 2020.** For this QI project, we will use the Model for Improvement and rapid cycle PDSAs.

Goals:

- 50% reduction in safety incidents
- 90% of the time a standardized process checklist is followed
- 90% of the time both communication steps re: the rolling call are completed
- 80% of the time only 5 minutes elapse between arrival and OR team case ending
- 80% of the time all team members are present at patient arrival

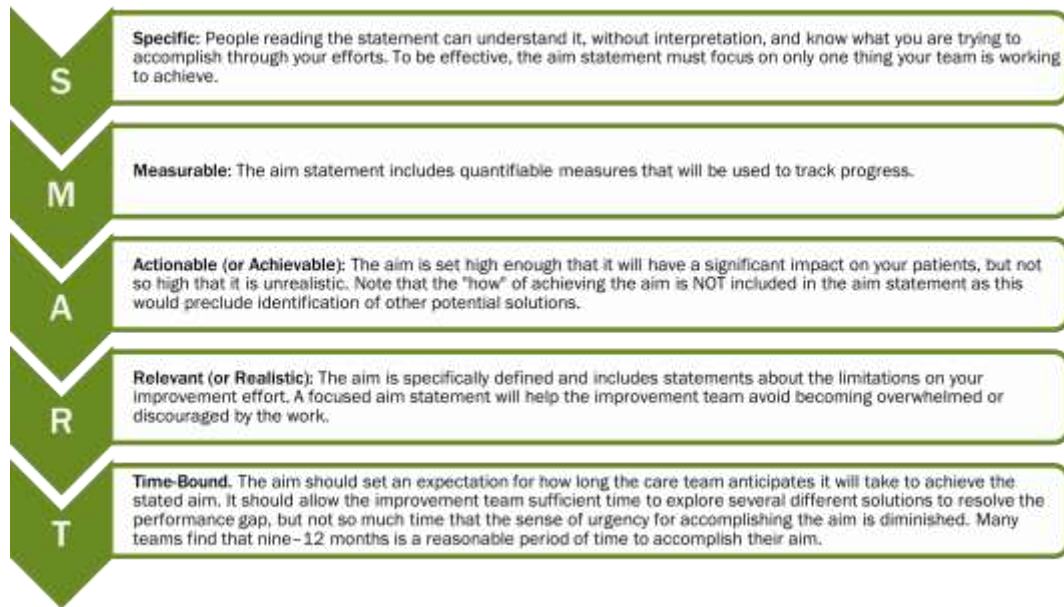
Measures:

- % reduction in safety incidents
- % of the time a standardized process checklist is followed
- % of the time both communication steps re: the rolling call are completed
- % of the time only five minutes elapse between arrival and OR team case ending
- % of the time all team members are present at patient arrival

USE THE SMART FRAMEWORK TO CLARIFY AND ESTABLISH AIM STATEMENTS

Many teams find the **S-M-A-R-T** framework helpful in clarifying and establishing their aim statement.

A SMART aim statement is:



TIP: Many organizations have published their aim statements on their websites along with their improvement stories. A quick internet search is often an effective place to start your process to create an aim statement to unify and describe your work.

EXAMPLES OF SMART AIM STATEMENTS

- Shadow Hospital will reduce adverse drug events (ADEs) in critical care by 75% within one year.
- Lake Forest Clinic will reduce average patient waiting time to see a physician to less than 15 minutes within nine months.
- Within nine months, 95% of children birth–3 years will receive appropriate developmental screening in the medical home using a validated screening tool.
- Essex Pediatrics will reduce patient no-show rates for health supervision visits by 80% within six months.

ANATOMY OF A WELL-CRAFTED AIM STATEMENT

Over time you will start to recognize that effective aim statements are formulaic in nature — they describe the five "Ws": Who, What, Where, When and Why in one succinct statement.

For example:

Clinicians will increase PH-Q depression screenings for adolescents at well visits to 75% in 6 months.



In this example, the team felt the aim was relevant because they had noted an increase in hospitalizations due to influenza last winter. In a review of their medical records they identified that less than 40% of their patients had received influenza immunizations during that period of time. The team did not feel it was necessary to answer the "why" explicitly in the aim statement because the "case" for immunization to prevent disease and/or death was so well known to them. A full aim statement includes the rationale and the why; as a team, you can decide which will be more useful to you.

PITFALLS IN CRAFTING AIM STATEMENTS

Watch out for these common pitfalls:

- The aim statement is **too big** to be compelling — An effective aim statement should create a sense of tension and a bit of uncertainty among team members, but the overall consensus of the group should be that it is achievable.
- The aim statement is **too broad or lacks focus** — One way to test this is to ask each team member to write down in his/her own words what the team is trying to accomplish. If the answers differ, this is a good sign that the aim statement needs to be refined and the focus clarified.
- The aim statement is **not understandable to anyone outside the team**. Ask someone outside the team to read the aim statement: What needs clarification? Can they understand what you are trying to accomplish?
- Don't set an aim that is **outside of the care team's ability to influence** — For example, if an outpatient clinic is trying to improve referral processes and follow up for a population of at-risk patients, the aim should focus on the processes within the clinic (i.e., identification of the population, tracking, timeliness of referrals) not on bottlenecks in the referral agencies which are outside the team's control. In this example, if the most significant barrier to improvement is an external bottleneck, this may not be an appropriate aim for this team. Perhaps a new intra-agency team is needed to address the issue or perhaps the care team needs to redefine what it is trying to accomplish.
- Even in the best systems, **achieving 100% (or 0%) may not be feasible (at least initially)** — Make sure to select a numeric goal that is a stretch, but is achievable. It is okay, and may be preferable, to set a goal at 80% or 90% and have the team accomplish the aim.

It is very easy for QI teams to lose focus and/or momentum over time, resulting in an unintentional shift away from the original aim. Thus, aim statements should be revisited on a regular basis, ideally at each team meeting, to ground team members in the specific purpose you are working to achieve together. They are key to the work.

III. How Do We Know a Change Is an Improvement?

MEASURING FOR IMPROVEMENT

Measures are one of the key features of the Model for Improvement. Measures help answer the second question in the Model: "How do I know a change in my practice is an improvement?" Measures are directly linked to the aim statement goals. Without measuring, teams have no idea if their changes are leading to improvement, which changes cause what results, and whether they are on track to achieve their aim.

There are many additional reasons and roles for measurement in improvement, such as:

- To identify gaps/needs for QI project(s)
- To monitor progress toward project goals/aim
 - This usually requires more than one measure.
 - A balanced set of measures helps assure that the system improved:
 - Linking measurable goals in the aim statement
 - Showing improvement quickly and including outcomes

Monitoring for unintended consequences:

- To generate ideas for improvement
- To evaluate rapid tests of change (PDSAs)
- To monitor for sustainability after improvement
- To collect data for outcome, process, and balancing measures

Baseline data is very helpful to see where your process was before the project started and is sometimes needed to make the case for change. For example, you may be able to motivate your colleagues to join you in the project when the group realizes that the baseline rate for HPV immunization is lower than anyone expected. That baseline measure serves as a starting point for improvement efforts.

It is important to note that all data will have inherent variation. Performance one month may differ from the next month based on the schedules of physicians, the differences in patients, and other factors that are simply part of running a practice or working in a hospital. Due to these day-to-day differences in delivering care to patients, your baseline data will have random or inherent variation when you look at it over different time periods. Acknowledging and understanding this variation prevents teams from attributing apparent improvement or worsening to what is just inherent random variation. For example, if you only looked at your baseline rate of HPV immunization in April, and were performing at 40%, you may be falsely reassured when May reveals a rate of 50%. If you understand that, for the last year, the month-to-month variation resulted in HPV immunization rates that ranged from 35% to 55% in no particular pattern, you have a better understanding of the degree of change needed to truly show improvement. There is more detail on this concept below.

There are several key features of good project measures. Of greatest importance, teams must be sure they are capturing meaningful information without creating too much of a data burden. Teams also need to consider how their data will tell the "story" of their project. The most successful data packages include the following considerations:

- Quantitative and qualitative data
- Format is meaningful and understandable to stakeholders, aligning with what stakeholders' value.
- Baseline levels are not too close to the goal (i.e., there is room for improvement).
- Data must be perceived as valid, especially among leaders.
 - Use measures that are based on, or are consistent with, nationally recognized guidelines or benchmarks when available.
 - If you must create new measures, share them with your stakeholders and test them using Plan, Do, Study, Act (PDSA) cycles to determine if the measures will be perceived as helpful/valid.
 - Make sure to clearly define the measures so that everyone has a clear understanding of "what to count" and "how to count it." Using a measurement table is a great way to define the measures.

There are three types of measures:

1. **Process:** What we do to achieve the outcome.
 - Examples: Number of forms to complete, number of steps the patient takes during their visit, number of steps in a process, number of patients asked about sexual history, etc.
2. **Outcome:** These are the ultimate results we are trying to achieve.
 - Examples: Overall wait time for visit, time to receive final septic tank permit, overall time to process an application, number of chlamydia tests ordered, etc.
3. **Balancing:** What we could "mess up" while trying to improve process and outcome; monitors for unintended consequences.
 - Examples: Satisfaction with the time spent with provider when increasing clinic efficiency; accuracy and completeness of a form when trying to streamline a process; number of unnecessary chlamydia tests ordered, etc.

Improvement Idea	Outcome Measure	Process Measure	Balancing Measure
Improve timely delivery of pain medication to children in the ED with obvious long bone fractures	Average pain score one hour after arrival to the Emergency Department	% of eligible patients receiving IV narcotic within 45 minutes of arrival to the ED	# of patients who left without being seen in the Emergency Department
Improve the application of fluoride varnish to eligible patients in a primary care clinic	% of eligible patients that receive fluoride varnish at well child visit	% of eligible patients with documented oral health risk assessment and dental exam	# of health care providers bitten during application

Qualitative data also plays a valuable role in measuring your improvement work. Both quantitative and qualitative data contribute to communication. Together, words and data enhance the impact of measurement. Stakeholders will have different preferences for data. Some like the "hard numbers" while others like to hear the stories.

Make sure your project includes both types because together they can enhance the impact of your measurement.

In this section, you will:

- Review the process of collecting data.
- Determine baseline performance when possible.
- Assess the impact of improvement strategies on the measures identified in each module.

This will allow you to appropriately assess the effectiveness of the changes you select to test through improvement cycles.

Once you have determined your numeric goals in your aim statement, you have your measures. For example:

- If the goal is: 80% of children will get X
- Then the measure is: % of children who received X

Using three to six measures will ensure your system is improved.

USE NATIONALLY DEVELOPED AND ENDORSED MEASURES

When determining your measures, you may choose to use measures that are nationally developed and endorsed by the National Quality Forum and other national bodies. Measures developed by these organizations will have well-defined specifications and instructions for when and how to collect the data to ensure that it can be compared to existing benchmarks and to others conducting similar improvement work.

KEEPING MEASURES USEFUL AND MEANINGFUL

To keep measures useful and meaningful it is helpful to:

- Use clear and specific definitions of your measures.
- Collect samples of data, rather than collecting large amounts of data (just enough).
- Collect both qualitative and quantitative data.
- Plot data over time.
- Display data on run charts to aid in analyzing the data and identifying trends.
- Integrate measurement into daily routines.
- Use existing data when possible.

COMMON MISTAKES WHEN SELECTING MEASURES

Common mistakes when selecting measures:

- Cannot easily collect data
- Data not related to the aim statement or the changes being tested
- Numerator and denominator not properly defined

To learn more about establishing measures, refer to [Tips for Effective Measurement](#) on the Institute for Healthcare Improvement website.

DATA COLLECTION, DISPLAY, AND ANALYSIS

Collecting data regularly will help you answer the question, "How do I know my change is an improvement?" It informs your process and helps you decide whether the changes you are testing should be more widely implemented, revised, or abandoned. It is important to note that not all changes result in improvement. In fact, some can have unintended negative consequences, so having a set of core measures and a measurement plan from the outset of your project helps you determine whether changes really are an improvement. You need only enough information to answer the question, "Has this change made an improvement?"

Data collection should be planned to assure high data quality with accuracy, completeness, and consistency. Prospective data collection is often preferable to retrospective chart review because of recognized variation in the quality and completeness of medical records. A sampling strategy should allow for a large enough sample size to assure that the data accurately represents the process being studied. Often this can be accomplished by collecting data on 10–30 encounters.

TIP: If the event you are trying to measure is rare, you will need to consider increasing the sample size or looking for other relevant measures. For example, as surgical site infections decrease, your measure may need to look at the days between infections or the number of cases between infections.

There are many ways to collect data to inform improvement activities such as:

- Encounter forms collected by clinic/hospital staff or patients during a visit
- Chart review
- Surveys
- Claims data

Further, many successful QI projects also collect informal data by soliciting observations and feedback from team members and others impacted by the system under review (e.g., administrative staff, patients, support staff). These data are often qualitative in nature and are used to help interpret the impact of the improvement strategy being tested as well as to identify any potential problems you may have encountered as a result of the change being tested.

Understanding how to collect and analyze data is essential for demonstrating competence in QI.

A measures table (similar to a checklist) is a useful tool to make sure each selected measure has all the necessary components:

EXAMPLE MEASURE TABLE:

Name	Type	Goal	Exclusions	Numerator/Denominator	Data Collection	Data Reporting
Measure A – Increase Screenings	Process	50% screening rate	N/A	# of patients screened/ # of patients seen	Visit template	Monthly run chart

ASSESSING BASELINE PERFORMANCE

Before you begin to try to improve quality of care, it is important to measure how well your practice is doing currently and whether your quality of care is getting better or worse.

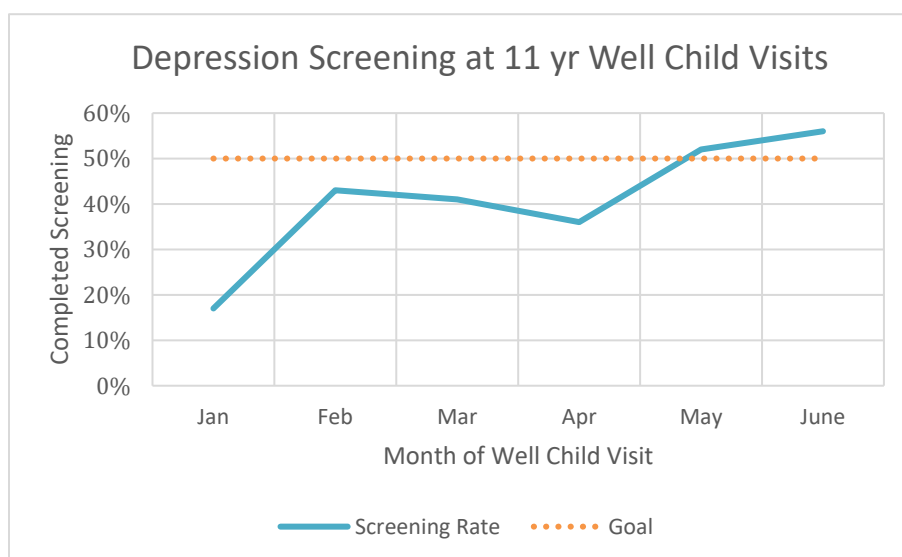
WHY IS IT IMPORTANT TO COLLECT BASELINE DATA FOR MORE THAN ONE POINT?

Data collected at one point in time allows you to assess whether there is a gap in the quality of your care, but processes vary over time. Before you begin to try to improve, it is important to know if your care is staying the same, getting better, or getting worse. This secular trend is essential in evaluating whether the changes you make to improve care produce real change that is different from what would occur regardless of the change you are testing. However, if you know your process is not in place, the first few months of data collection become your baseline. Do not let lack of baseline data prevent you from starting the improvement work.

QI DEPENDS ON ANALYSIS OF DATA OVER TIME

A distinguishing feature of QI is the analysis of data over time to determine whether a process is improving as changes are tested to reach an aim. For instance, data collected on a monthly basis over six months may indicate that nurses and physicians in a practice use appropriate hand hygiene on average only 40% of the time. One month the results may be 37%, the next 43%, the next 39%, and so on, with the average over six months being 40% (see Figure 1). We usually talk about the median rather than the average for run charts.

Figure 1: Run Chart



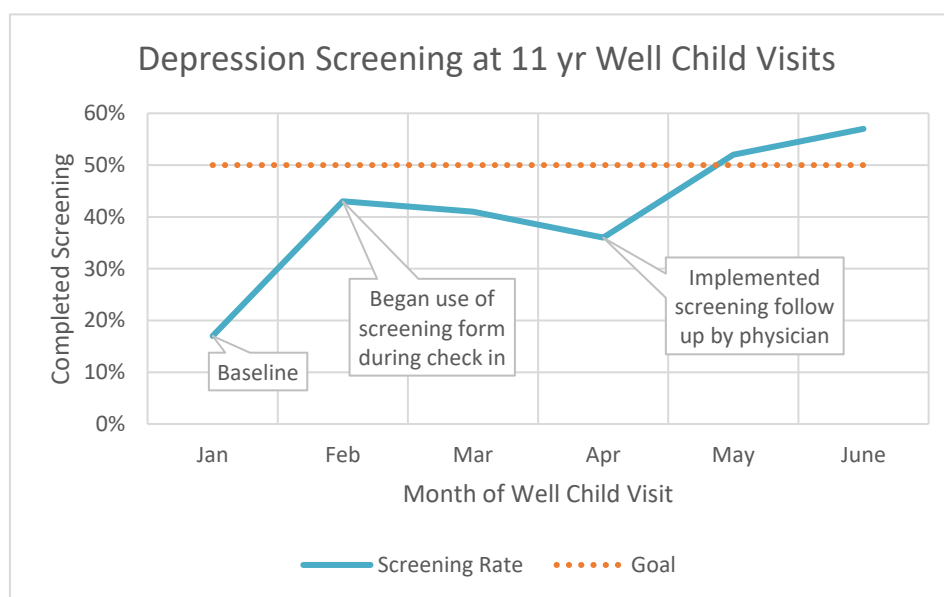
If the rate is neither increasing nor decreasing, assuming nothing changes, one can predict within a defined range that the rate for the next month will be around 40% as this has proven to be the typical, normal variation that occurs in the process.

MEASUREMENT TOOL: RUN CHART

Data plotted over time in a linear graph, such as Figure 1 above, is called a run chart. Time is plotted on the x-axis and the variable being measured is plotted on the y-axis. This visual display of data makes it easy to see if a process is changing over time and by how much. After five or so data points, a median should be plotted.

If comments are added to the chart indicating what changes have been made to the process and when (see Figure 2) the display of data is then called an "annotated" run chart. There are statistically based rules that allow one to determine when a change in the process is statistically significant and not just the normal variation that all processes display. Note that a median is required in order to apply these rules. For example, a shift of six consecutive points above or below the mean represents a statistically significant change. Additional rules can be found in textbooks or online sources on Quality Improvement. Key resources include Langley et al. *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance* (2nd ed) and Provost and Murray *The Health Care Data Guide: Learning from Data for Improvement*.

Figure 2: Annotated Run Chart



IV. What Changes Can We Make That Will Result in Improvement?

The third key question in The Model for Improvement is: "What changes can I test that will result in improvement?" To answer this question, start by generating a list of changes or ideas. It is important to begin with a literature search and an environmental scan to determine if there are ideas that have been already tested or that have a strong evidence base from research. Remember that even evidence-based guidelines need to be tested in local environments of care. Make sure to involve your staff in this process as they often have insights into aspects of the care process that are less familiar to you.

BRAINSTORM IDEAS WITH STAFF, PATIENTS, AND PARENTS

In addition to a literature search and environmental scan, it is helpful to use brainstorming as a technique to generate ideas and to involve everyone who is a part of the care process. You do not need to analyze or edit ideas initially. The first step is to consider the possibilities. Many ideas often come up while the team is writing the aim statement. These should be captured for possible tests of change.

USE A PROCESS FLOW CHART AND A SITE DIAGRAM

There are many useful tools that can help your team improve their understanding of what changes to make and where to make them — two of the most useful to clinicians are a process flow chart and a site diagram. A process flow chart can be used to map out the individual components of care in the process you are trying to change, while a site diagram can be a helpful tool to determine if the clinic workspace should be redesigned or altered to improve the care processes. These will be discussed further in the QI Tools section.

___/___/___

Model for Improvement:

Team Name:

PDSA Worksheet: Cycle _____

Project:



PLAN

Objective for this cycle:

Questions:

Predictions:

Plan for change or test: (*who, what, when, where*)

Plan for collection of data: (*who, what, when, where*)

DO

Carry out the change or test. Collect data and begin analysis. Describe observations, problems encountered, and special circumstances.

STUDY

Complete analysis of data. Summarize what was learned.

ACT

Are we ready to make a change? Plan for the next cycle.

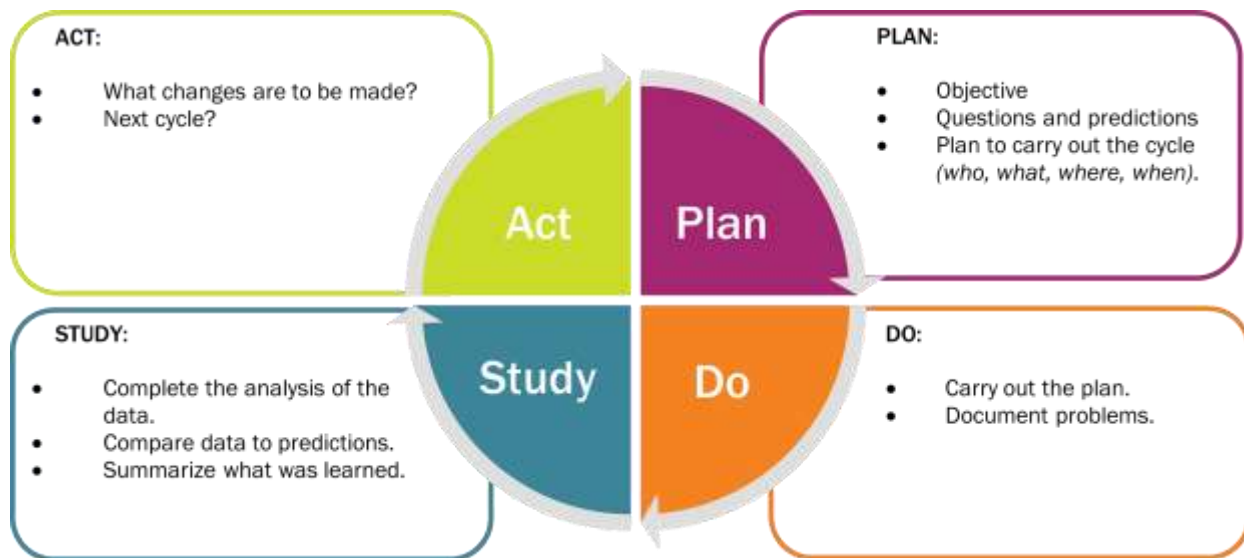
A great source to consult is the [Institute for Healthcare Improvement's Improvement Map](#) for ideas about the best knowledge available on key process improvements that led to optimal patient care.

[Here is a downloadable version of the PDSA form illustrated above.](#)

TESTING IDEAS USING PDSA CYCLES/TESTS OF CHANGE

The Plan, Do, Study, Act (PDSA) cycle is a technique for testing ideas that may result in improvement prior to implementation. PDSA cycles begin with ideas or theories and involve prediction about the impact of a change idea. Some have called the PDSA cycle the application of the scientific method to human systems. It is an iterative process for learning and improvement structured upon rapid, small scale "tests" of change that provide learners with a mechanism to build knowledge about what works (and what doesn't) so that after you complete the first cycle, the results inform the next cycle of tests, and so on. PDSA cycles force us to be methodical, clarify what we are trying to learn with this idea, make a prediction, and reflect on the learning from each cycle. They allow rapid adaptation and implementation of changes in busy health care settings.

PDSA Cycles typically have four steps: Plan, Do, Study, Act



Once these forms are completed, they document each step of each test of change, as illustrated below:

PDSA: STEP 1 – PLAN: DETERMINE THE PURPOSE OF YOUR PDSA CYCLE

When planning, ask the following questions:

- What are we testing?
- What are we trying to learn?
- On whom are we testing the change?
- When are we testing?
- Where are we testing?
- Who will carry out the test?
- What data or information will we collect during the test?
- What do we expect will happen? What is our prediction?

Most learning occurs when making a prediction and then reflecting on that prediction after the test is complete. If you can answer the above questions with some specificity, you are probably done planning!

For example: I predict that installing alcohol dispensers will improve our observed rate of appropriate hand hygiene. **What are we trying to learn?** Best location for alcohol dispenser: Should it be inside or outside the door? Should it be hands-free? I predict if we place a hands-free dispenser outside the door, people will use it. On Tuesday, we will place a dispenser outside Room 10 for two hours. Susie will count the number of times it gets used and ask people what they think of the location.

PDSA: STEP 2 – DO: CARRY OUT THE TEST OF THE IDEA

Carry out the test. Document observations, surprises, problems, and any data that results from the test. Seek opinions and informal feedback about the results (both favorable and unfavorable) of the test. Make note of any problems encountered or special circumstances that arose during the test.

Successful PDSA cycles test the change on a small scale by trying the change with just a few patients for a very limited period first. This minimizes the "cost" of the test in terms of time, resources, and need to obtain buy-in from a broader group. Another example: place reminder posters for good hand hygiene in one physician's exam rooms and survey that physician's patients for one day. If this test works and does not interrupt your office or practice flow, you can test it further under different conditions (different day, different team, etc.). Such linked tests will help build your confidence that your idea is a good one and worth implementing on a broader scale.

PDSA: STEP 3 – STUDY: REFLECT ON WHAT YOU HAVE LEARNED

- Did you complete the test of the idea as you planned to do?
- Compare the resulting data with your prediction.
- Review any quantitative and/or qualitative data collected. Remember, data collected in PDSA cycles is specific to the cycles, instead of not one of the project measures, and ends with the PDSA cycle.

If you did not complete the test of the idea as you had planned to do, then identify what did not work and plan a revised test. You will have the most impact when you take the time to reflect on what worked (or didn't) and why. Ask:

- What have we learned from this test?
- What could we do differently next time to make it an improvement over the current system?
- What additional information do we need for the next test?

Share your learnings with the rest of the team. Seek input from everyone in your setting.

PDSA: STEP 4 – ACT: USE WHAT YOU HAVE LEARNED TO PLAN YOUR NEXT STEP

Plan your next cycle (or series of cycles). If the first cycle was successful, you should plan to expand it, such as with more patients or with more staff involved. If the change was not successful or it needs further adaptation, either adjust it to work better and retest it, or try a different change to accomplish your goal.

The science of PDSA is in the act of reflection, learning from what one did. Those who want improvement to occur need to reserve specific times to ask, "What did we learn?" and "How can we build on it?"

KEY FEATURES OF PDSA CYCLES

- Small-scale tests are very small: one patient, one staff person, one small process change, one day, one visit.
- Results from one PDSA cycle are used to develop subsequent PDSA cycles.
- This technique is low-risk and involves few resources.
- "Failed" cycles are good learning opportunities when small. Ask:
 - Was the test conducted well?
 - Does the change tested need modification in our setting?
 - Was the prediction/theory wrong?
- When tests are "successful", test it further under as many conditions as possible.
- Special situations (e.g., busy days)

- Factors that could lead to breakdowns (e.g., different staff or physicians involved).
- Things "naysayers" worry about (e.g., "It will not work when Dr. Diehard is not here.").
- The "study" is specific to the PDSA cycle you are running.
- The data collected in a PDSA cycle:
- Usually not one of primary project measures, is specific to that PDSA cycle
- Usually ends with PDSA cycle
- Can be qualitative, not just quantitative

Use the PDSA cycle repeatedly to gain knowledge and confidence in the changes you are testing to achieve your aim. As you gain confidence in the change, expand the size of the PDSA cycles as you move toward implementation of the change, eventually making it the new way you do the work. Using the worksheet above, or something similar, helps teams to learn the steps until it becomes second nature.

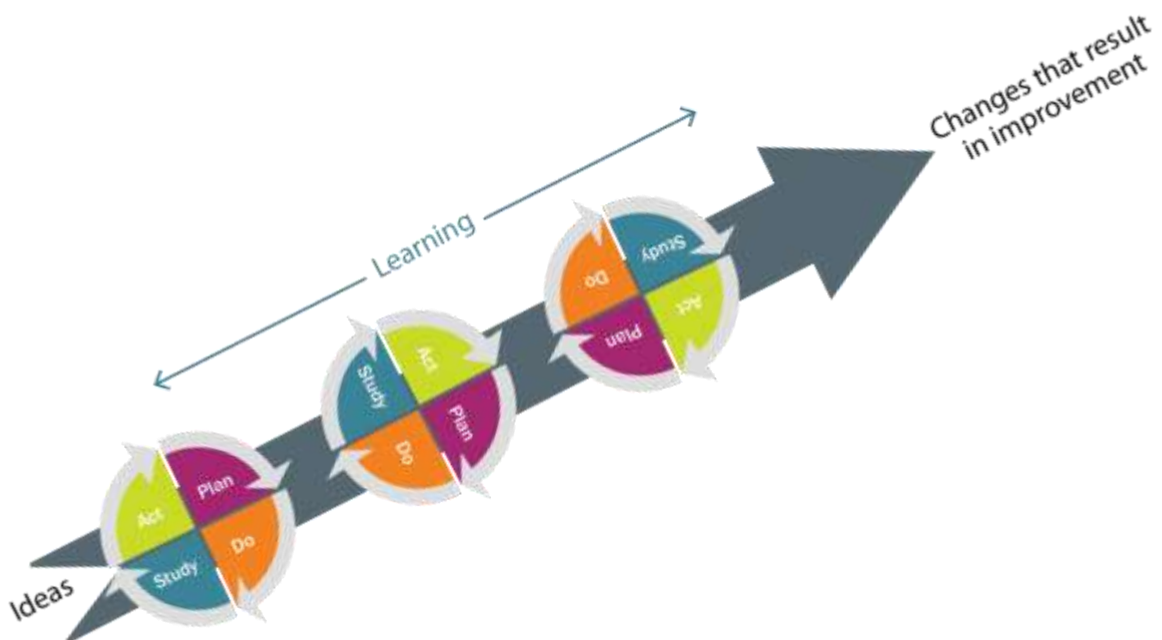
PDSA CYCLES – A "TEST" VERSUS A "TASK"

Clinicians who are new to quality improvement may get confused when trying to identify the steps needed to prepare to run a PDSA cycle (test of change) and end up focusing their time and energy on the tasks associated with the test rather than the test itself. The test is meant to gather quick feedback about a change to determine whether it should be adjusted, adopted, or abandoned. Once a team gains confidence in the idea being tested and moves toward implementation, there may be additional tasks that need to be identified and assigned to ensure full implementation of the change.

LEARNING THROUGH REPEATED PDSA CYCLES

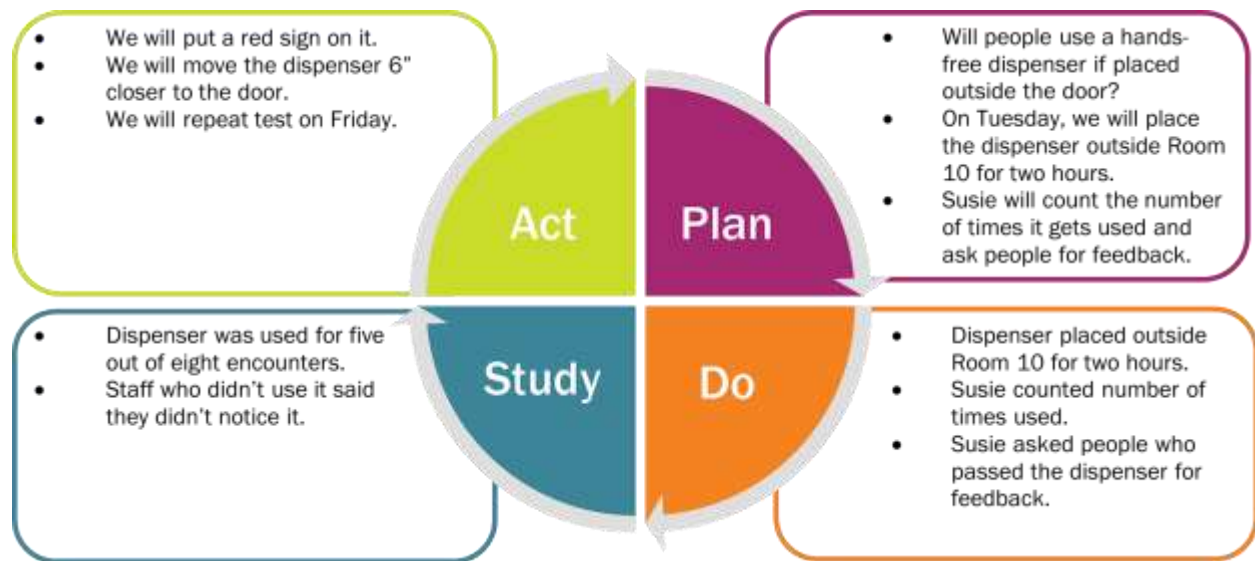
Rarely will the first test of a change idea result in immediate implementation of that idea. Repeated tests, done rapidly, will accelerate the learning process and ultimately result in a refined idea that can then be implemented. The graphic below demonstrates this concept.

TESTS OF CHANGE



PROJECT: IMPROVING HAND HYGIENE

PDSA: Testing Placement of Dispenser



Model for Improvement:

Team Name: Charlotte Pediatrics

PDSA Worksheet: Cycle 2

Project: Improving Hand Hygiene



PLAN

Objective for this cycle:

Test location for alcohol dispenser.

Questions:

Will people use a hands-free dispenser if placed outside the door?

Predictions:

It will be a visual reminder, and people will use it.

Plan for change or test: (*who, what, when, where*)

Who: QI team

What: Place dispensers outside room

When: Tuesday, 10:00 a.m.

Where: Room 10

Plan for collection of data: (*who, what, when, where*)

Who: QI team

What: Place dispensers outside room

When: Tuesday, 10:00 a.m.

Where: Room 10

DO

Carry out the change or test. Collect data and begin analysis. Describe observations, problems encountered, and special circumstances.

- Team placed dispenser as planned.
- Susie counted how frequently it was used and asked staff for feedback.

STUDY

Complete analysis of data. Summarize what was learned.

- Result was dispenser used five out of eight encounters.
- Staff who did not use it said they did not notice it was there.

ACT

Are we ready to make a change? Plan for the next cycle.

- Team will put a red sign on the dispenser and move it six inches closer to the door.
- Repeat test on Friday and 10:00 a.m.

V. QI Tools

IMPROVEMENT TOOLS FOR TEAMS

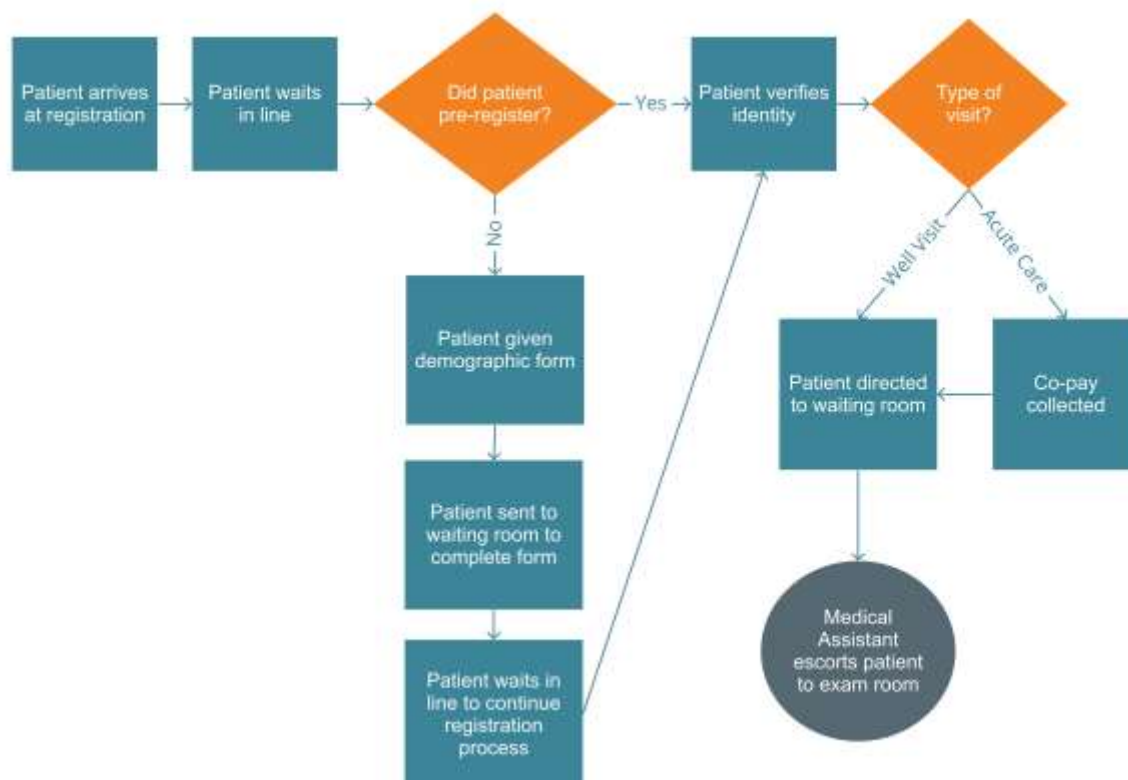
Many improvement tools exist to help teams conduct the various aspects of successful QI projects (e.g., setting aims, forming teams, identifying change ideas, prioritizing techniques, collecting data, measuring progress, testing, and sustaining changes, and spreading improvements). However, several key tools have proven so useful across quality initiatives that they warrant special mention here: process flow chart, site diagrams, and key driver diagrams.

PROCESS FLOW CHART

This is a useful tool for understanding what changes to make and where to make them. A process flow chart can be used to map out the individual components of care and identify gaps, bottlenecks, and redundant steps in the process. It can also help uncover variations in a clinical practice.

In order to create an effective process flow chart, you will need to gather input from multiple people on the care team. Each may have unique knowledge and perspectives on particular steps in the process. One easy-to-use technique to translate a process into a flow chart is to use sticky notes to detail each step and post them all on an empty wall, shifting them around until you have captured all of the necessary steps and decision points in the process. Next, take a picture of the wall to document the flow before transferring it into a more permanent format by computer or pen/paper. Take time to identify and understand the barriers that prevent change. This will help you plan initiatives that anticipate and overcome these barriers.

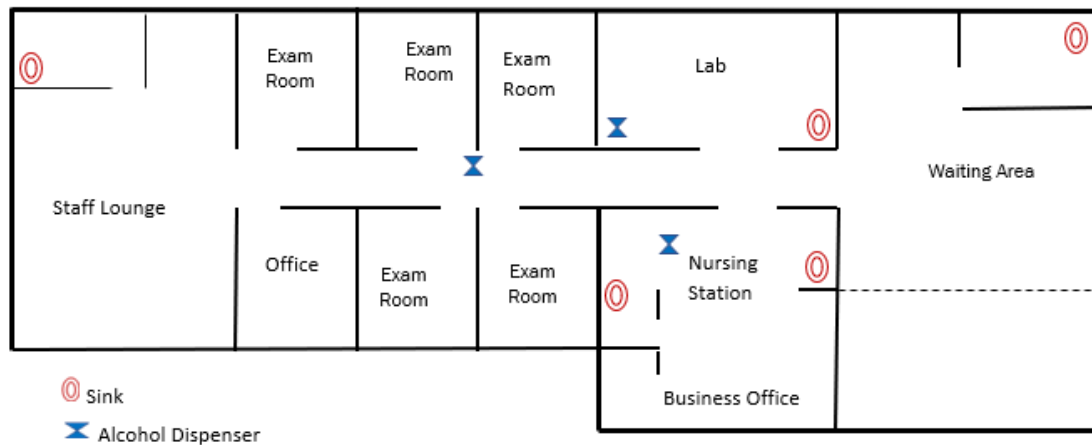
EXAMPLE PROCESS FLOW CHART



CLINICAL SITE DIAGRAM

A clinical site diagram can be particularly helpful for improvement projects that need to address spatial relationships and flow between settings, or when considering where to place equipment and supplies.

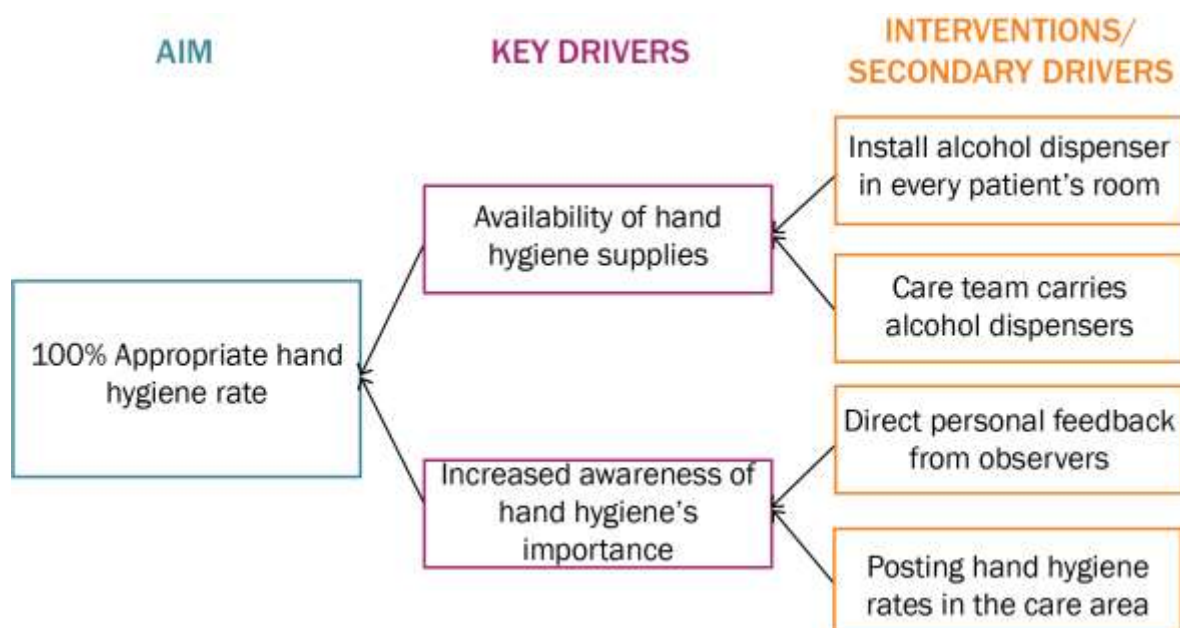
For example, in a hand hygiene improvement project, a site diagram could be used to determine if the clinic workspace should be redesigned and/or where, specifically, to place hand sanitizer containers.



KEY DRIVER DIAGRAM

Finally, a very useful tool for synthesizing the planning and implementation for a QI project is a key driver diagram or a logic diagram that explains the reasoning behind the proposed changes. The aim or goal of the improvement effort is listed on the left. The key drivers, or changes that the team feels would have the biggest impact on outcomes, are listed in the middle and the specific interventions or changes that will be tested are listed on the right.

Example Key Driver Diagram



PARETO

Pareto charts support data collection and analysis by displaying information as a bar graph. This tool can help to determine the prevalence of a problem, identify the most significant issue out of several problems, or drill down from broad causes to specific pieces. Key benefits of Pareto charts are that they relate cause and effect, facilitate communication, and illustrate which situations are more significant (arranged in order from left to right).

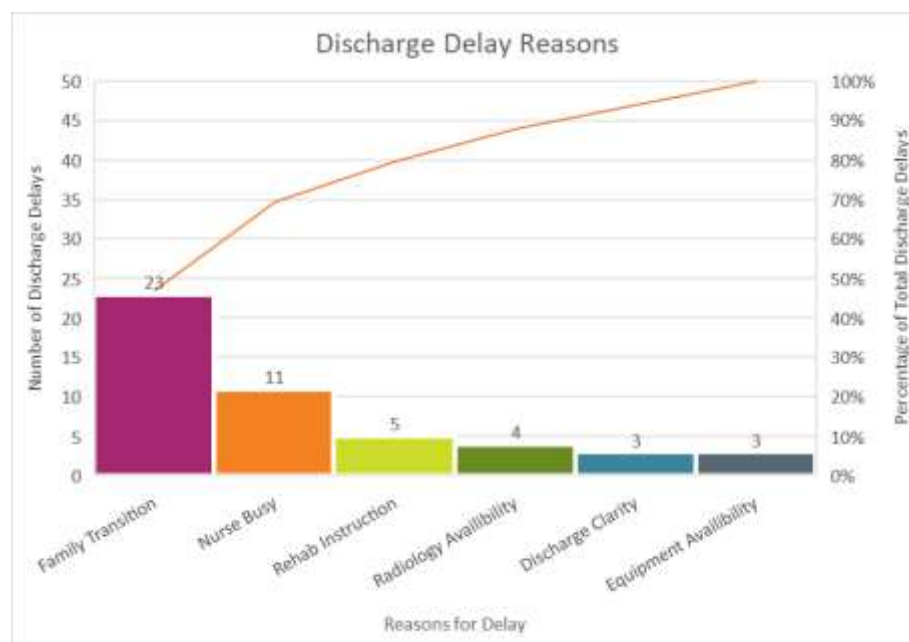
When creating a Pareto chart, first decide on the data to be used, timeframe under review, and measures. Collect your data and set the numeric scale for the chart. Then make a bar chart with the length of each labeled bar signifying cost or frequency (highest to lowest).

Example:

The team on the pediatric surgery floor wants to improve the hand hygiene process.

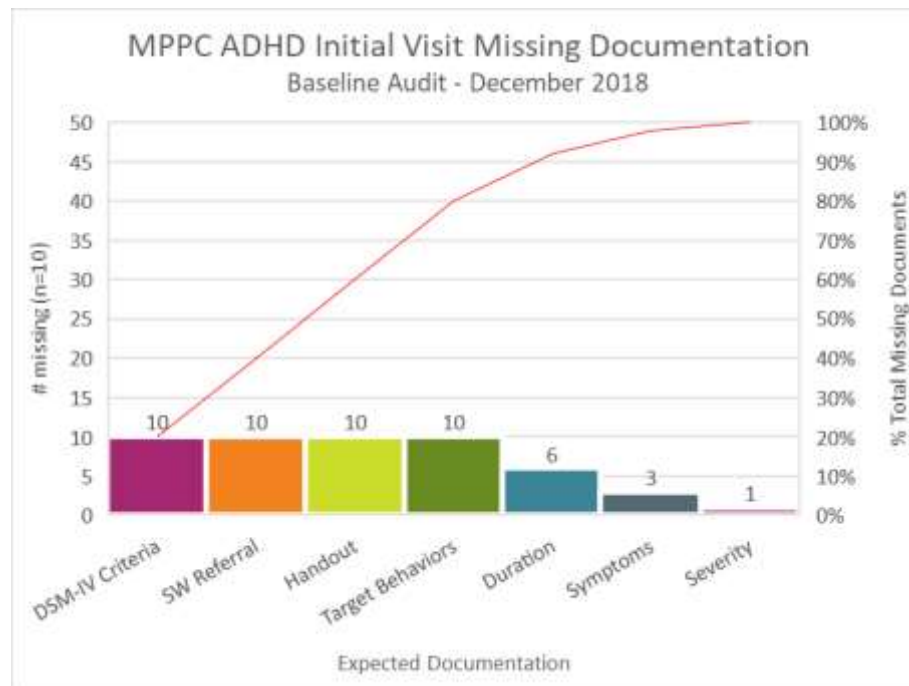
1. Team brainstormed and voted on what they believed were causes of providers not washing hands.
2. Team collected data to assess hypothesis and identify the greatest improvement opportunity.
3. Team created a Pareto chart to display what they learned about leading causes of failure to wash hands.

The Pareto chart below illustrates a similar project addressing discharge delays:



Example:

This Pareto chart shows what was missing from a sample of 10 ADHD initial visit records. All 10 charts were missing documentation of the first four categories, which represent 80% of the problem, and should be addressed first if possible.

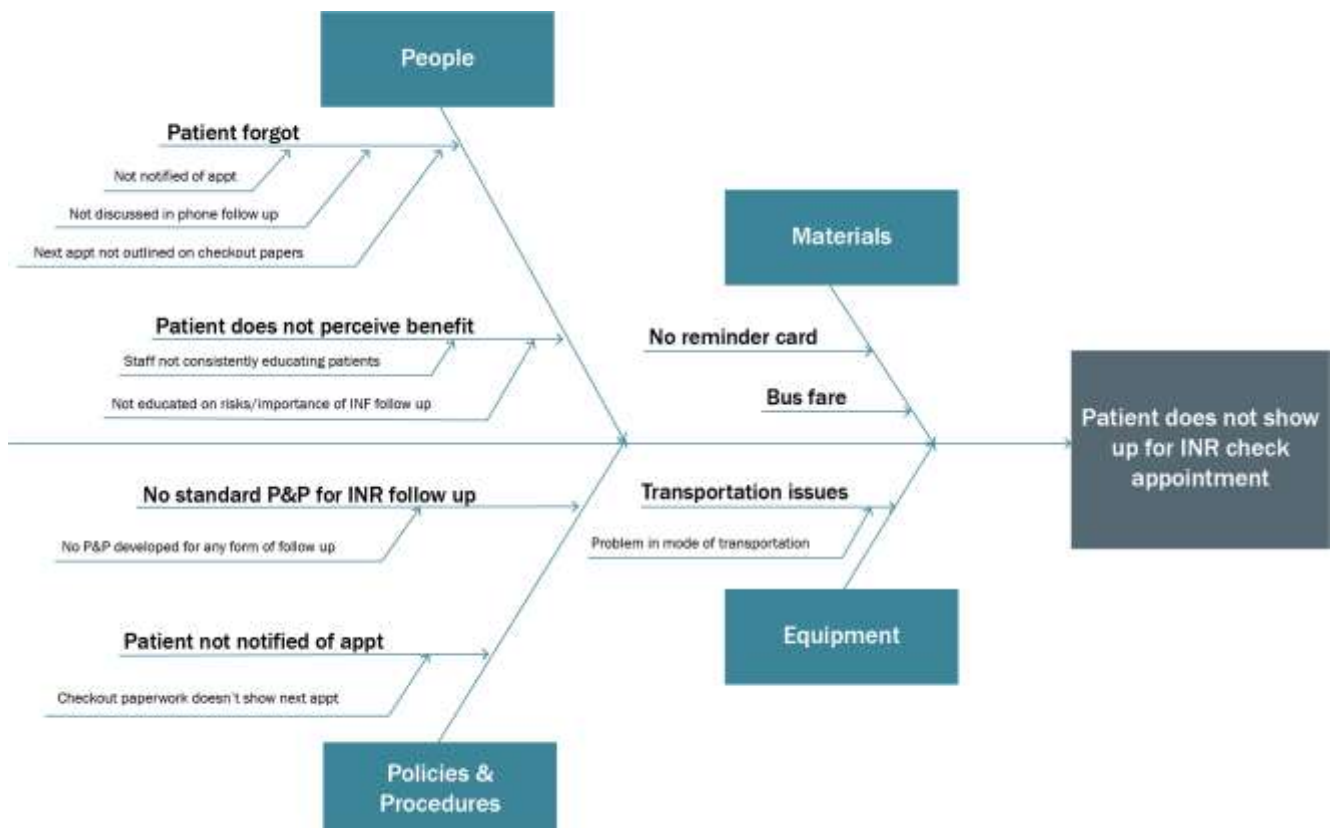
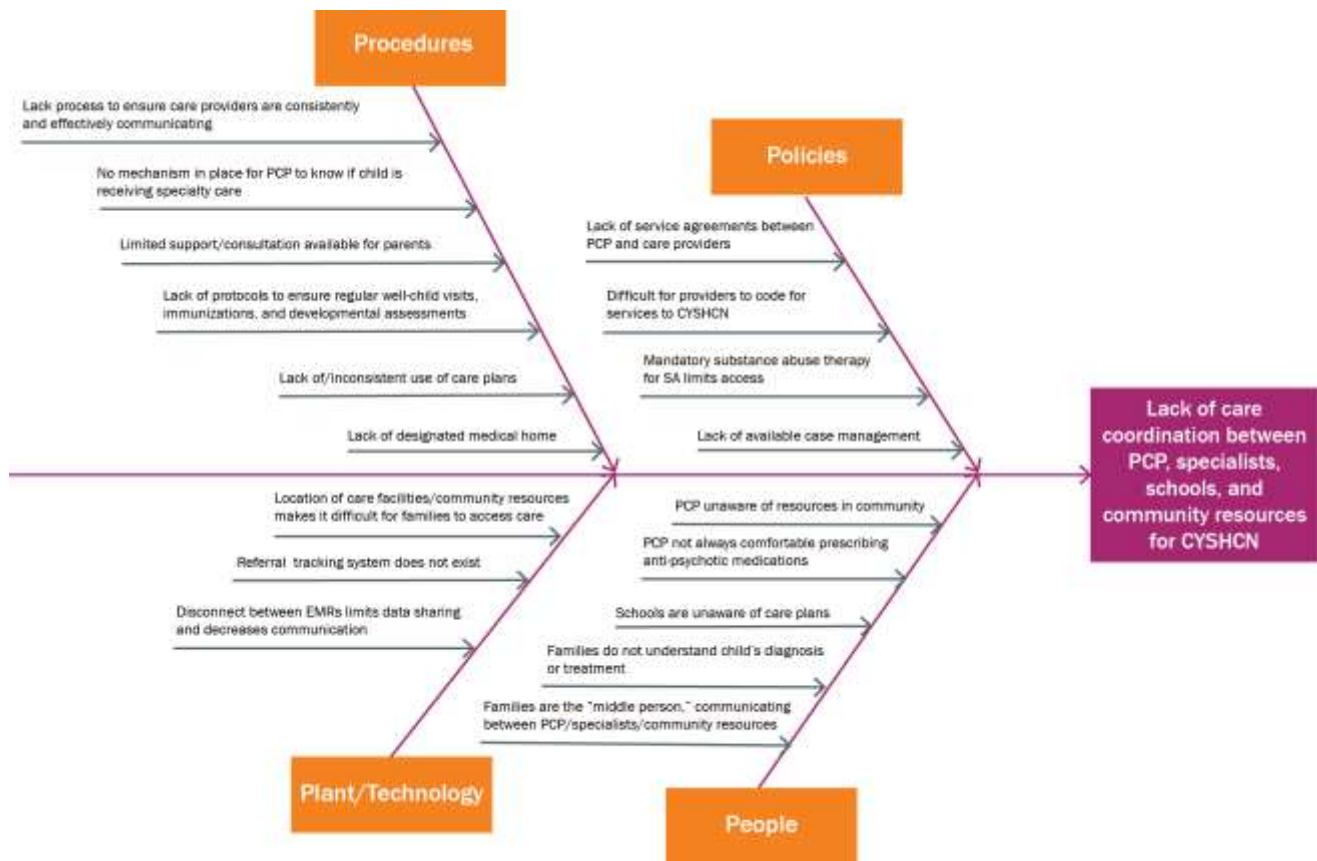


FISHBONE

A fishbone diagram helps teams better understand a problem. It may also be called an Ishikawa or cause-and-effect diagram. It requires broad thinking to identify possible causes and can help a team generate improvement ideas or actions.

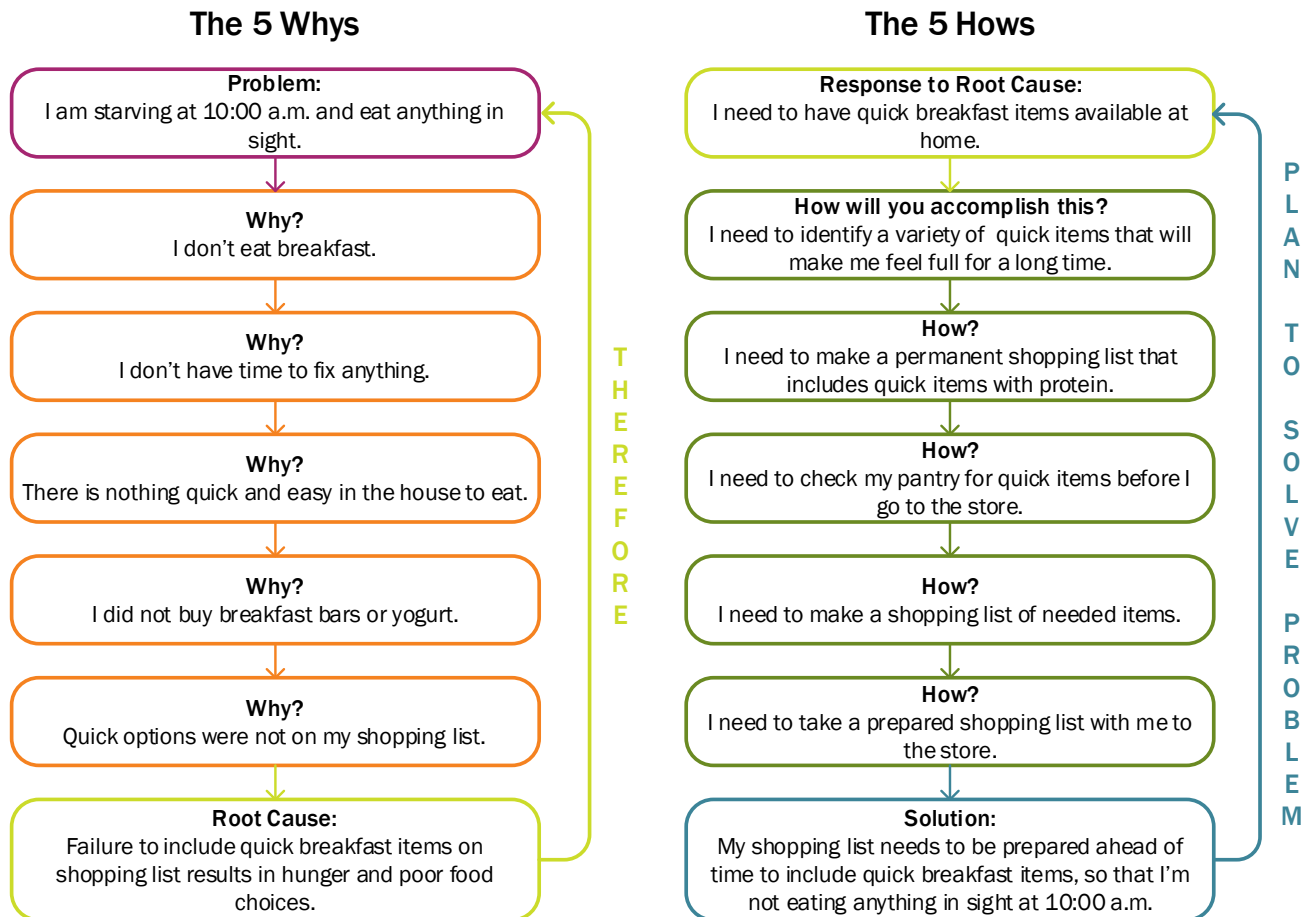
Fishbone diagrams provide structure for brainstorming, corral the team's collective knowledge, and help the team cast a wide net with their brainstorming. This is especially useful when there are multiple causes for a problem. In addition, it breaks a problem into smaller pieces so teams can identify possible causes and prioritize attention on which causes should be tackled first.

As with other planning tools, teams need to first agree on the problem (the "effect") and then brainstorm causes. Causes are then grouped into categories, which are sometimes labeled generically as the "4 Ps" and/or the "5 Ms": People, Equipment, Policies, and Practices; Machines, Manpower, Materials, Methods, and Measurement. (You will often find variations and combinations of these labels.) Draw a "fishbone" of the ideas, with the problem at the "head." "Bones" link cause and effect, with ideas placed on the branch of the appropriate category (ideas can appear in multiple places).



5 WHYS

The 5 Whys and 5 Hows are a series of detailed questions that help teams describe a problem, drill down to the root cause, and identify a solution to test. They are helpful when teams are having difficulty digging deeper into a problem. Both sets of questions help clarify the problem and develop a detailed solution. They pair well with the fishbone diagram. The 5 Whys identify the root cause of a problem and the 5 Hows identify an effective solution for the original problem.



[Here is a brief video highlighting this process as applied to the Jefferson Memorial.](#)

VI. Sustain

Once you have progressed through the planning, testing, and implementation of changes that lead to improvement as indicated by the data, it is now time to think about sustaining and spreading the work. If you have achieved or surpassed your goal for six or more months, you can consider shifting into sustainability. Failure to devote sufficient time to this phase of the work often results in erosion of the improvement within months. Therefore, it deserves an equal amount of effort.

Many crucial steps underpin sustainability, such as assigning ownership, building the change into the system (rather than relying on individuals), continuing to measure the change's impact, and seeking senior leader support.

You need to choose an individual to “own” the sustainment. As the process owner, they will provide status reports to senior leaders, resume team meetings as needed, watch the data for regression, and manage ongoing improvement. This person will keep the necessary staff informed and engaged, including repeating training and sharing the project's successes.

You can help hardwire change by incorporating the new process into job descriptions and including improvement discussions in recruitment, performance evaluations, and merit increases. Anticipate potential disruptions, such as staff turnover and absences, by cross-training staff on changes and new processes. Providing new staff with QI training and initiating frequent discussions about improvement will help build a culture of QI to support changes. Your efforts will be most successful if these strategies are employed across the system or practice, not on an individual basis. Remember to involve patients and families when planning for sustainability.

Continued measurement is crucial for sustainability, although you can begin to measure less frequently. Gradually scale back to alternating months, then quarterly, and eventually annual measurement. Without data, the changes you have instituted will erode and entropy will take over — but you must reduce the data burden to enable your team to move on to other improvement work. Choose one or two measures from your balanced set, which will indicate early on when the process starts to slip. Share this data at staff meetings and have a plan ready in case your data does start to reveal loss of reliability.

Senior leaders remain important in the sustainability period. Create a clear, succinct report and share regularly to keep them informed. Continue to keep your work visible through posters and presentations and request senior leader support in removing barriers and providing resources, such as sufficient training time for new staff.

Use one of the sample sustainability checklists provided in the links below to manage this portion of the improvement work.

- [Sustainability Checklist Short Version](#)
- [Sustainability Checklist Long Version](#)

VII. Spread

Teams can start to consider spread when there's enough data to show the change is an improvement, the team is confident that the change idea is ready for spread, the team has a well-defined plan for spread, and the next location for the spread appears open to change. Spread teams must continue consistent measurement, but the volume can often be reduced. Sometimes spread leads to new improvements to the change idea, and these should be captured for further learning. A **spread checklist** helps ensure all the pieces are in place for successful spread and should be completed before you start to spread.

- [Spread Checklist](#)

References

GENERAL

- Committee on Quality of Health Care in America, Institute of Medicine. Crossing the Quality Chasm: A New Health System for the 21st Century. The National Academies Press.
[\[https://www.nap.edu/login.php?record_id=100271\]](https://www.nap.edu/login.php?record_id=100271). Accessed September 28, 2020.
This landmark report makes an urgent call for fundamental change to close the quality gap in health care. It offers a set of performance expectations for the health care system: 10 rules to guide patient-clinician relationships; an organizing framework to better align incentives inherent in payment and accountability with improvement in quality; and key steps to promote evidence-based practice and strengthen clinical information systems.
- Improving Chronic Illness Care. Group Health Research Institute.
[\[http://www.improvingchroniccare.org/\]](http://www.improvingchroniccare.org/). Accessed September 28, 2020.
This national program of the Robert Wood Johnson Foundation aims to improve the health of chronically ill patients by helping health systems, especially those that serve low-income populations, to improve their care through implementation of the Chronic Care Model, a coordinated program of quality improvement, research, and dissemination.
- Improving Performance in Practice. American Board of Medical Specialties, Research and Education Foundation. [\[http://www.abms.org/initiatives/committing-to-physician-quality-improvement/improving-performance-in-practice/\]](http://www.abms.org/initiatives/committing-to-physician-quality-improvement/improving-performance-in-practice/). Accessed September 28, 2020.
This state-based, nationally led quality improvement initiative is designed to improve outcomes for patients with diabetes, asthma, and other chronic conditions.
- Institute for Healthcare Improvement. [\[http://www.ihl.org/\]](http://www.ihl.org/). Accessed September 28, 2020.
These comprehensive programs aim to improve the lives of patients, the health of communities, and the joy of the healthcare workforce.
- Langley GJ. The Improvement Guide: A Practical Approach to Enhancing Organizational Performance, 2nd Edition. San Francisco, CA. Jossey-Bass; 2009.
This guide offers an integrated approach to process improvement that delivers quick and substantial results in quality and productivity in diverse settings.
 - Mangione-Smith R, De Cristofaro AH, Setodji CM, et al. The quality of ambulatory care delivered to children in the United States. *N Engl J Med*. 2007; 357:1515-1523.
[\[https://www.nejm.org/doi/full/10.1056/NEJMsa0646371\]](https://www.nejm.org/doi/full/10.1056/NEJMsa0646371)
This article assessed the extent to which care processes recommended for pediatric outpatients were delivered.
- National Committee for Quality Assurance (NCQA). [\[http://www.ncqa.org/\]](http://www.ncqa.org/). Accessed September 28, 2020.
NCQA exists to improve the quality of health care by developing standards and performance measures for a broad range of health care entities and certifies, accredits, and recognizes health care organizations and programs.
- National Quality Forum. [\[http://www.qualityforum.org/\]](http://www.qualityforum.org/). Accessed September 28, 2020.
This forum sets national priorities and goals for performance improvement, endorses national consensus standards for measuring and publicly reporting performance, and promotes attainment of national goals through education and outreach programs.
- Nelson EC, Batalden PB, Lazar JS. Practice-Based Learning and Improvement: A Clinical Improvement Action Guide, 2nd Edition. Joint Commission Resources. 2007.
This guide contains a conceptual framework and practical tools to challenge the reader to identify local resources and opportunities, to define improvement tasks more precisely, and to act, so that positive and meaningful change becomes synonymous with clinical work itself.
- Ogrinc GS, Headrick LA, Barton AJ, et al. *Fundamentals of Health Care Improvement: A Guide to Improving Your Patient's Care*. Joint Commission Resources. Oak Brook Terrace, IL; 2008.
This guide will help students of the health care professions diagnose, measure, analyze, change, and lead systems improvement in health care.

- Physician Consortium for Performance Improvement. [\[https://www.thepcpi.org/page/AboutUs\]](https://www.thepcpi.org/page/AboutUs). Accessed September 28, 2020.
This consortium, convened by the American Medical Association, developed performance measures to address a significant gap in the measurement landscape.
- Splaine ME, Dolansky MA, Estrada CA, Patrician PA. Practice-Based Learning and Improvement: A Clinical Improvement Action Guide, 3rd Edition. Joint Commission on Accreditation of Healthcare Organizations; Oak Brook Terrace, IL; 2012.
[\[https://store.jointcommissioninternational.org/assets/1/14/ebag12sample.pdf\]](https://store.jointcommissioninternational.org/assets/1/14/ebag12sample.pdf). Accessed September 28, 2020.
This practical workbook shows clinicians how to use quality improvement methods to provide high-quality and cost-effective care.
- The Healthcare Improvement Skills Center v3.0. [\[http://www.improvementskills.org/\]](http://www.improvementskills.org/). Accessed September 28, 2020.
This resource is an introduction for those new to quality improvement (QI) and a refresher for those with QI experience.

AIM STATEMENTS

- Assessing Readiness and Developing Project Aims. Health Resources and Service Administration. [\[https://www.hrsa.gov/sites/default/files/quality/toolbox/508pdfs/readinessassessment.pdf\]](https://www.hrsa.gov/sites/default/files/quality/toolbox/508pdfs/readinessassessment.pdf). Accessed September 28, 2020.
This resource contains tools and guidance to support the creation of aim statements with examples from several health care communities.
- Moran J, Duffy Grace. The Key Components of a Quality Improvement Project: A Step by Step Process. Public Health Foundation. [\[http://www.phf.org/resourcestools/Documents/Rapid_Cycle_PDCA.pdf\]](http://www.phf.org/resourcestools/Documents/Rapid_Cycle_PDCA.pdf). Published November 7, 2008. Accessed September 28, 2020.
This resource contains a step by step process to implementing a rapid cycle PDCA.
- Moran J, Riley B. Making Aim Statements More Robust. Public Health Foundation. [\[http://www.phf.org/resourcestools/Pages/Making_AIM_Statements_More_Robust.aspx\]](http://www.phf.org/resourcestools/Pages/Making_AIM_Statements_More_Robust.aspx). Published April 16, 2012. Accessed September 28, 2020.
This resource examines the importance of describing and accounting for tangible and intangible benefits resulting from aim statements and provides tools and examples for creating effective aim statements.
- Sample Aim Statement and Worksheet for Developing a Spread Aim. Robert Wood Johnson Foundation. [\[http://www.rwjf.org/en/research-publications/find-rwjf-research/2009/11/sample-aim-statement-and-worksheet-for-developing-a-spread-aim.html\]](http://www.rwjf.org/en/research-publications/find-rwjf-research/2009/11/sample-aim-statement-and-worksheet-for-developing-a-spread-aim.html). Published November 12, 2009. Accessed September 28, 2020.
This worksheet developed by the Robert Wood Johnson Foundation lists questions that providers should consider when writing spread aims.
- Science of Improvement. Tips for Setting Aims. Institute for Healthcare Improvement. [\[http://www.ihl.org/resources/Pages/HowtoImprove/ScienceofImprovementTipsforSettingAims.aspx\]](http://www.ihl.org/resources/Pages/HowtoImprove/ScienceofImprovementTipsforSettingAims.aspx). Accessed September 28, 2020.
This resource contains quick tips to consider when building aim statements.

MEASURES

- Measures. Institute for Healthcare Improvement. [\[http://www.ihl.org/resources/Pages/Measures/default.aspx\]](http://www.ihl.org/resources/Pages/Measures/default.aspx). Accessed September 28, 2020.
This resource describes how measurement is a critical part of testing and implementing changes.

PDSA TESTING & CYCLES

- PDSA Cycle. Institute for Healthcare Improvement.
[\[http://www.ihi.org/resources/Pages/HowtoImprove/ScienceofImprovementTipsforSettingAims.aspx\]](http://www.ihi.org/resources/Pages/HowtoImprove/ScienceofImprovementTipsforSettingAims.aspx). Accessed September 28, 2020.
This resource describes how the PDSA cycle is a critical part of testing and implementing changes.
- Health Resources and Service Administration. U.S. Department of Health and Human Services.
[\[https://www.hrsa.gov/sites/default/files/quality/toolbox/508pdfs/qualityimprovement.pdf\]](https://www.hrsa.gov/sites/default/files/quality/toolbox/508pdfs/qualityimprovement.pdf). Published April 2011. Accessed September 28, 2020.
The purpose of this module is to provide a foundation and an introduction to quality improvement (QI) concepts and key topics for developing or improving a QI program within an organization.
- Moen R, Nolan T, Provost L. Quality Improvement through Planned Experimentation. McGraw-Hill; 1999.
The purpose of this book is to provide the philosophy, principles, and methodologies to plan and conduct experiments to understand what changes will best lead to the improvement of a product, process, or system.

PATIENT SURVEYS

- Consumer Assessment of Healthcare Providers and Systems. Agency for Healthcare, Research and Quality. [\[https://cahps.ahrq.gov\]](https://cahps.ahrq.gov). Accessed September 28, 2020.
This resource contains detailed information about patient surveys that examines the experience with health care. It includes example surveys, a bibliography, and other resources.
- Clinical Microsystems. Excellence in Health and Social Systems.
[\[http://clinicalmicrosystem.org/uploads/documents/outpatient-primary-care-workbook.doc\]](http://clinicalmicrosystem.org/uploads/documents/outpatient-primary-care-workbook.doc)
Accessed September 28, 2020.
This is an example of a patient survey for use in outpatient primary care settings.

PROCESS FLOW CHART

- Abubakker HT. A Practical Guide to Creating Better Looking Process Maps. iSixSigma.
[\[http://www.isixsigma.com/tools-templates/process-mapping/practical-guide-creating-better-looking-process-maps/\]](http://www.isixsigma.com/tools-templates/process-mapping/practical-guide-creating-better-looking-process-maps/). Published February 26, 2010. Accessed September 28, 2020.
This site provides the common rules for symbols in process maps and provides tips for developing your process map in Microsoft PowerPoint or Visio.

DRIVER DIAGRAMS

- Lloyd R. The Science of Improvement: Driver Diagrams. YouTube.
[\[https://www.youtube.com/watch?v=A2491BJcyXA\]](https://www.youtube.com/watch?v=A2491BJcyXA). Accessed September 28, 2020.
This video covers the use of driver diagrams in the science of improvement.