# How to Perform Quality Improvement Projects

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## EDUCATION GAP

Lack of a shared understanding of a systematic approach to quality improvement initiatives can inhibit the ability to understand whether true improvements have been made in a system. Understanding how to plan, execute, and study a quality improvement project can lead to measurable and sustained process optimization.

## OBJECTIVES *After completing this article, readers should be able to:*

1. Identify the 5 guiding principles of a quality improvement project.
2. Understand how to plan and execute a quality improvement project using the Model for Improvement as a guiding framework.
3. Analyze improvement results and synthesize project details into a format acceptable for publication.

## ABSTRACT

Safety and efficiency remain salient concerns for the US health-care system, especially in the face of growing health-care costs and morbidity from low-quality care. Current estimates suggest that more than 20% of health-care costs in the United States represent waste and low-value care, presenting numerous improvement opportunities. Although current guidelines and standards aim to address these problems, system processes and clinician behavior must also change to fill care gaps in the health-care system. Quality improvement (QI) is a systematic approach to safety or value gaps in care that uses data measured over time and then makes sequential, small changes to achieve a measurable aim. The Model for Improvement provides a general framework for approaching QI. In this review article, we describe the general approach to conducting QI studies in the health-care setting using the Model for Improvement as a guide, including identifying a problem, performing testing, measuring change, and implementing successful ideas. We also summarize common issues that QI teams face and should consider if sharing their QI work through publication. By following

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**ABBREVIATIONS**

| | |
|---|---|
| PDSA | Plan-Do-Study-Act |
| QI | Quality Improvement |
| sFMEA | simplified Failure Mode Effects Analysis |
| SMART | specific, measurable, attainable, relevant, time-bound |
| SPC | statistical process control |

a systematic approach, QI teams can develop and implement interventions aimed at addressing gaps in care, thereby improving overall health-care value and safety for their patients.

## INTRODUCTION

You are the attending physician on a resident hospital medicine service when you notice that your patient with bronchiolitis, who was clinically ready for discharge on rounds, is still admitted in the late afternoon. You contact the resident physicians and the bedside nurse to discuss the patient and note a lack of shared understanding of the patient's discharge goals. You clarify that the patient is drinking well, is off oxygen, and is safe to go home; the infant is discharged soon afterward. Unfortunately, during the past few months, you have noticed similar delays in discharge and want to improve the discharge process. What should you do?

The need for improved system efficiency is a common theme in health-care settings even if the details of the previous example may not translate into every health-care environment. The Institute of Medicine's second and updated report, "Crossing the Quality Chasm: A New Health System for the 21st Century" discussed the need for systematic health-care improvement. Six fundamental "aims for improvement" for health-care were outlined in the 2001 report: safe, effective, patient-centered, timely, efficient, and equitable. (1) How can we approach the above challenge regarding discharge efficiency? How do we implement meaningful change? How do we identify sustainable solutions? QI methods provide an approach to answer these questions and lead to process optimization that benefits patients in our complex health-care system.

QI, as defined by the US Department of Health and Human Services, is "the systematic and continuous actions that lead to measurable improvement in health care services and the health status of targeted patient groups." (2) Problems for which there is clear consensus and/or evidence for best practice, such as implementation of a new national guideline recommendation or hospital policy, fit best into QI methods. Similarly, in these instances, the multifaceted aspects of QI strategies work well to target complex patients, health-care providers, and health-care systems. (3) QI teams should proceed with caution when addressing problems that lack consensus or evidence for best practice. QI methods may still be used in this instance, but there should be further consideration of the risks and benefits of project aims and interventions. QI initiatives may also be ill-advised to pursue when health-care systems require urgent clinical changes. For example, early in the global coronavirus disease 2019 (COVID-19) pandemic, hospitals quickly implemented broad COVID-19 testing procedures and policies. In this example, recommendations and processes were changing too rapidly for organized QI interventions. Although data tracking in these instances remains useful, waiting for the urgency to subside is most appropriate. Once a more stable state develops, using available data and QI methods to achieve best practice may allow QI teams to further adapt and optimize current process(es).

Contrasts between QI and observational research study designs are readily apparent and important to consider when deciding what type of study to pursue. Research is defined as "an activity designed to test a hypothesis, permit conclusions to be drawn, and thereby to develop or contribute to generalizable knowledge (expressed, for example, in theories, principles, and statements of relationships)." (4) Although QI teams often make a prediction about what will happen in relation to an intervention, the ability to test hypotheses and contribute generalizable knowledge is limited in QI studies for many reasons. For example, QI projects often involve limited populations or single centers. Similarly, QI projects often use multiple co-occurring interventions, hindering the ability to draw firm conclusions about causality or to predict how interventions will behave in other settings.

QI teams should consider the nature of their project and reflect on the project aim(s). If the aim is to test a specific hypothesis (eg, Is a patient characteristic associated with a particular outcome? Does an intervention result in shorter length of stay?) or to randomly assign interventions, then a QI project is not the appropriate vehicle. If the primary aim is to improve quality of care and there is reasonable evidence and/or consensus about the appropriate clinical management for the situation to be studied, a QI project is appropriate. However, this distinction can be challenging to discern at times, and many projects may exist in a gray area. For example, a team may decide to conduct a retrospective cohort study using data collected as part of a QI project to test the hypothesis that age is associated with certain patient outcomes during their improvement work. QI teams should consider communicating early with their local institutional review board to understand whether review and approval are necessary before proceeding with a QI project.

Multiple improvement frameworks are commonly used within health-care, including the Model for Improvement

(Institute for Healthcare Improvement), Lean, and Six Sigma. The Model for Improvement uses the central principle of iterative small-scale interventions with adaptive learnings from each testing cycle. (5) Lean methods focus to eliminate waste and improve efficiency so that all efforts add value to a process. (6)(7) The Six Sigma approach centers on decreasing variation and defects. (6)(7)(8)

For the purposes of this QI review, we focus on the Model for Improvement as our guide because it is a comprehensive approach that is well-accepted and can be used in a variety of process improvement scenarios and in combination with principles of Lean and Six Sigma. The Model for Improvement centers on 5 guiding principles of improvement (5):

- Know why improvement is needed
- Develop change that will result in improvement
- Test change before implementation
- Seek feedback to know improvement is happening
- Implement change

Embedded within these 5 guiding principles, the Model includes 3 main questions for every project: 1) What are we trying to accomplish? 2) How will we know the change is an improvement? 3) What changes can we make that will result in improvement? (5) These fundamental principles and questions will guide a team through their project's QI journey.

Before embarking on a new QI project, determining team structure is critical. Including the correct members or stakeholders on a QI team is important to project success, and project leaders should seek to invite individuals from different sections of the system to be examined. Representatives can serve as subject matter experts and spokespersons for their respective areas of expertise, particularly when designing or studying a test of change. Team members can also help lead change in their system and serve as a project point person for their colleagues. All QI project teams in health-care should also consider whether patients or families are stakeholders. If a patient or family member is not a formal team member, then feedback and input from patient representatives should be solicited before and throughout a QI initiative.

Throughout this article, we use the previous example regarding the discharge of a patient with bronchiolitis. This example is drawn from a previously published QI project focused on discharge efficiency to demonstrate key principles, processes, and other important considerations for successful QI work. (9)

## PERFORMING A QI PROJECT

### Know Why Improvement Is Needed

When faced with a problem that warrants improvement, the initial step is to define the overarching aim you want to achieve. This aim, described as the "global aim" of a project, seeks to answer question 1 from the Introduction: "What are we trying to accomplish?" Often the global aim is a broad clinical outcome with multiple different influencers, requiring several coordinated improvement efforts to achieve. To achieve this central aim, numerous factors need to be considered and potentially modified, a seemingly insurmountable task at the outset, but one that can be tackled on a smaller scale through several distinct efforts. In the discharge example, the global aim is to improve hospital throughput through efficient bed use. (9)

QI teams should further define project aims with a specific, measurable, attainable, relevant, and time-bound (SMART) aim. (5) Creating an objective, numerical aim with a relevant deadline (time-bound) keeps a team focused on the project aims and allows a structured approach for a team to measure for improvement. One SMART aim template is to "increase/decrease [desired outcome] for [patient population] from [current state] to [aim state] by [specific date]." For the discharge efficiency project, the team considered pediatric hospital medicine patients as the patient population. By studying the process over several months' time, the team identified the need for clear discharge criteria and determined that patients should ideally be discharged shortly after meeting those criteria. Thus, the SMART aim they determined was to "increase the percentage of patients discharged within 2 hours of meeting medical discharge criteria from 42% to 80% within 18 months." (9)

When considering interventions that may lead to improvement, a QI team should next examine the factors affecting their aim by mapping the clinical process. A process map seeks to provide a high-level roadmap of the steps required to achieve an aim and accurately reflects the system as it currently performs, not as it is expected to function. With this outline, the team can gain better insight into the scope and complexity of a system, including recognition that multiple processes may occur in parallel for successful task completion. In the discharge example, a process map identified each action required for patient discharge, from the time of admission through the time the patient leaves the hospital. (9) For a patient with bronchiolitis, discharge tasks might include prescribing nasal saline drops, teaching the family how to use a bulb suction device, and outlining reasons to call their doctor after the patient is discharged.

Each step of the newly created process map should then be analyzed for known system failures (failure modes) and for possible improvement opportunities. This evaluation, termed simplified Failure Mode Effects Analysis (sFMEA), correlates intervention efforts with individual process steps where the intervention effort will have the highest value. sFMEA also seeks to mitigate expected barriers to success through preemptive recognition of these barriers (Fig 1).

## Develop Change That Will Result in Improvement

After a QI team has mapped out the current process and considered possible failures/interventions through the creation of an sFMEA diagram, how should the team identify the change(s) that leads to improvement in a system? In other words, which intervention(s) will achieve both the SMART and global aims? This question is the key concept of QI work: determining which change(s) leads to measurable improvement. When considering possible interventions, a QI team should acknowledge that a change in a process or a system does not necessarily indicate that an improvement occurred. The aim is to move from reactive change, which is required to keep a system at its current performance state, into positive fundamental change, which alters how a system works. (5)

Defining clear measures of improvement will maintain QI team focus on the specific improvement project, particularly in complex medical systems that may present additional challenges that risk distracting the team from the problem at hand. Teams should delineate 3 types of measures: outcome, process, and balancing. Outcome measures are directly related to the project global aim and measure the impact of interventions on the system. Process measures evaluate a narrower perspective of the system by following adherence to a new or altered process that is central to the team's approach to improvement. A project's SMART aim may be an outcome or process measure, which is determined by the QI team's overarching aim. Balancing measures monitor for negative consequences of a project, ensuring that the outcome and process measures are not

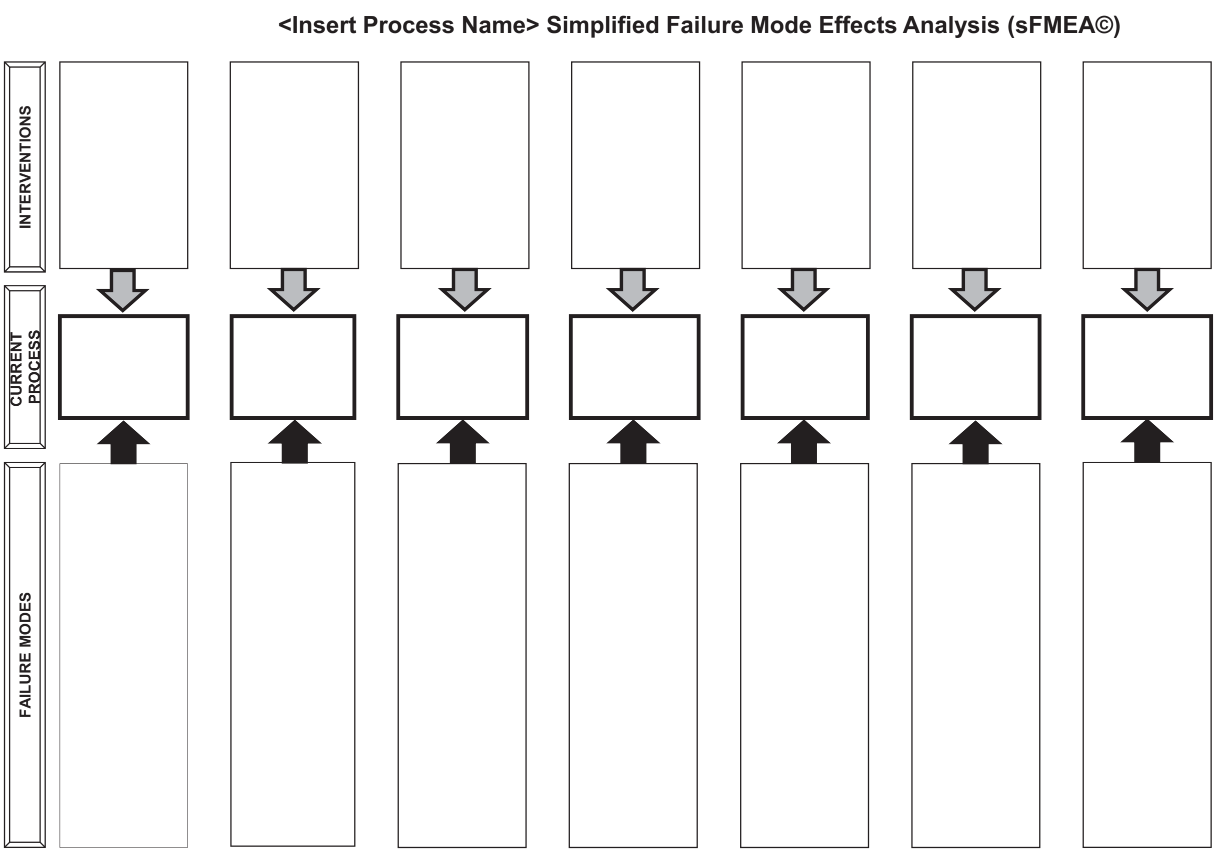




**Figure 1.** An example of a blank simplified Failure Mode Effects Analysis. The middle row of boxes sequentially lists the steps of the current process. The bottom row lists the known or expected failure(s) at each process step. The top row lists a possible intervention(s) to the process failure(s).

negatively affecting related areas within the system. A project may have multiple process and balancing measures, depending on the nature of the intervention(s). Instances also exist when the outcome measure and the process measure may be the same. For example, if the aim of a QI project is implementation of a new checklist, compliance with the checklist may be both the process measure and the outcome measure. (5)

Using the discharge example to consider measures, the outcome measure was aligned with the SMART aim regarding the overall discharge timeliness after a patient met medical goals. The process measure was physician compliance with writing the order outlining discharge criteria for each patient. The balancing measure was readmission rates, acknowledging that if patients left the hospital too soon, they could be at risk for increased hospital readmissions. (9)

When choosing measures, a team should prioritize measures that are practical to review at frequent intervals and should consider whether existing data sources can be used. When possible, avoiding laborious hand collection of data is advisable, except in limited circumstances, given the challenge of sustaining this type of data collection. If hand collection of data for 1 measure is necessary, a reasonable trade-off is ensuring that the data collection is as simple and streamlined as possible and that it does not add undue burden to frontline providers who are likely already involved in executing interventions.

Once the levels of measurements are defined, they should be applied to the current, unaltered process. Testing the measures against the system before starting interventions provides baseline data, allowing for feedback comparison once testing begins. Occasionally, when initiating a new process, baseline data may be unavailable or may start at zero if a new process is being initiated. In this instance, the QI team may elect to continue following this new process measure to ensure that it is being used, but they may also consider a different primary measure that reflects the team's overarching, global aim.

Measurable improvement is more successful when a QI team identifies and maintains focus on the project's primary influencers, or the key drivers, of the SMART aim. Key drivers are the leading factors affecting the performance of a system, and they regularly emerge as common points of failure in an sFMEA. Examples of common key drivers for a health-care QI project include provider education, provider/patient engagement, and real-time identification and mitigation of failures. In the discharge example, a key driver was "buy-in from nurses and providers," and the team pursued interventions aimed at maximizing the engagement of bedside teams to create discharge goals and proactive collaboration to prepare patients for discharge; for a patient with bronchiolitis, the team agreed that medical discharge goals should include ability to take 2 feeds without needing mechanical nasal suction and no need for oxygen for 6 hours. (9)

Similarly, through the lens of the newly created key drivers, a team should review their sFMEA failure modes for future intervention possibilities. This steady focus on key drivers will lead to increased influence on the SMART aim, thereby ensuring improvement as an outcome. A key driver diagram is a visual tool that demonstrates connections between interventions and key drivers to keep a team concentrated on its aims throughout the project's course (Fig 2). (5)

## Test Change Before Implementation

With a heightened understanding of the current process to be studied, an appreciation of the current process's key drivers, recognition of opportunities for process improvement, and measurable baseline data, the QI team can proceed to test interventions. One approach to prioritizing intervention ideas is to apply reliability principles. These principles help identify a process(es) that performs as intended in the required time under existing conditions, compensating for the realistic possibility of human error. Reliability is the inverse of a system's failure rate: a system or process with a 10% failure rate performs as a level of $10^{-1}$ (level 1), a 1% failure rate as a level of $10^{-2}$ (level 2), and a 0.1% failure rate as a level of $10^{-3}$ (level 3). (10) Examples of level 1 interventions include clinical checklists, directed provider feedback, and online training modules. These examples demand continued vigilance on the system for success. Level 3 examples include prepopulated admission order sets and standardized medical response teams, which have higher reliability. An intervention with a higher level of reliability will more dependably reduce errors, inefficiency, and safety events, ultimately improving patient outcomes. (10)

When testing a change in a process, the 3 main principles to follow include 1) testing on a small scale, building knowledge sequentially; 2) including differing testing conditions when expanding the testing scale; and 3) planning for data collection over time to measure improvement. (5) Small-scale testing (eg, 1 question, 1 patient, 1 day, or 1 encounter) offers knowledge about the change while minimizing risk to the overall care system. This approach does not imply that the change needs to be small but rather that the initial scope of the change's effect should be manageable to ensure

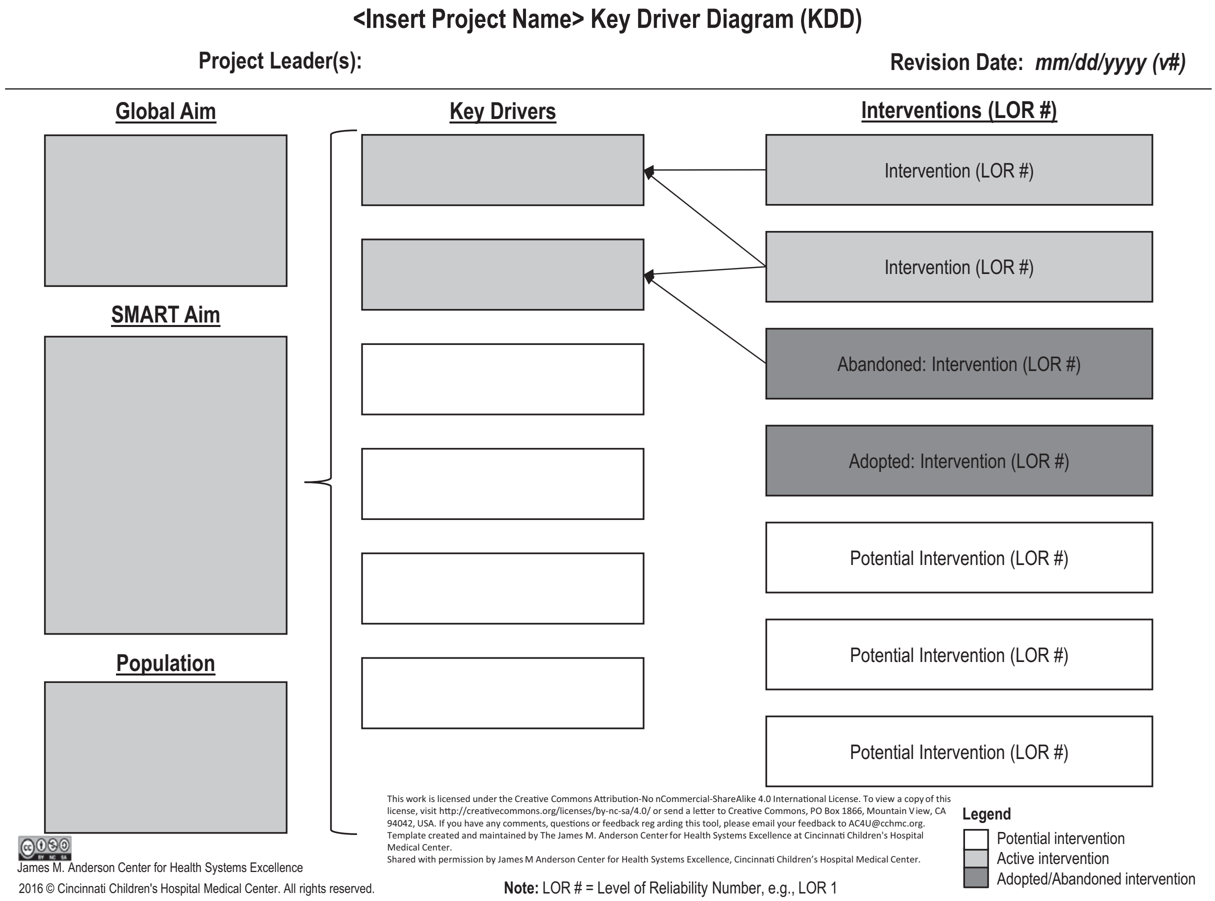


**Figure 2.** An example of a blank key driver diagram. The left column lists the global and specific, measurable, attainable, relevant, time-bound (SMART) aims and the population to be addressed by the aims. The middle column lists each key driver identified for the project. The right column lists project interventions, using a grayscale legend to denote intervention status in the project timeline. The middle and right columns are editable, signified by "Revision Date" information. LOR#=level of reliability number, v#=version number.

maximum learning with minimal risk on the overall system. As confidence in an intervention or group of interventions increases, testing expansion will continue progressively. Involving an increasing number of system components is important to test different circumstances around the change, allowing trials of multiple possible scenarios that might be affected.

Following the Model for Improvement, testing occurs along 4-step Plan-Do-Study-Act (PDSA) cycles. (5) The first step, Plan, formalizes each testing detail, including data collection. During the second step, Do, the QI team runs the test and puts its plan(s) into action. This phase requires close observation and documentation of all expected and unexpected results. In the third step, Study, the QI team summarizes learnings from the recent test, examining successes and failures of the intervention. From this analysis, the QI team completes the final step, Act, to determine the project's subsequent action. The team can adopt, adapt, or abandon the recent test in preparation for the next PDSA cycle. These testing cycles are small and sequential interventions, continuing iteratively while working toward achieving the SMART aim. Careful documentation of each PDSA cycle allows for an ongoing record of evolved learnings and helps the QI team tell its improvement story over time.

Failure is inevitable during this process, and a successful QI team maintains the ability to abandon or adapt imperfect interventions. Careful analysis of failures and successes during each PDSA cycle provides necessary feedback to the team, accelerating team progression toward their desired outcomes. Compared with the testing phase, in which failures are expected to occur, in the implementation phase, described later in this review, the change to the system is permanent, with failures expected to be rare.

Using the example of improving discharge efficiency for hospitalized children, 1 PDSA cycle included partnering with the outpatient pharmacy to prioritize discharge medications in their daily workflow. The QI team trialed a new process in which the outpatient pharmacy received a list of patients expected to be discharged that morning, with the plan for the pharmacy to prioritize filling the prescriptions for those same patients. (9) The improvement team studied the results of this trial and noted that a challenge to the trial was that the start time for filling the prescriptions was too late in the day. The process was adjusted to incorporate earlier work hours for 1 pharmacy technician for 1 day. After this adjustment led to success, the small cycle was sequentially scaled up from 1 day to 1 week to involve more patients.

Feedback was also helpful in this example of improving discharge as the process became more established. By reaching out to providers to ask why patients were delayed in going home, the improvement team simultaneously provided directed personal feedback and reminders to the providers about the process, while learning from the providers about systems failures that might need more attention. (9)

## Assess Feedback to Know Improvement Is Happening

Through regular data analysis during iterative PDSA cycles, a QI team gains timely feedback and makes continued progress toward achieving a project's aim(s). As mentioned in the previous section, thoughtful planning during the Plan step ensures successful data collection and enhanced feedback on the test itself. When planning a test of change, a QI team should determine all details of data collection up front: what, how, who, and when.

Analyzing data over time is a core feature of QI studies and is critical to allow QI teams to understand the effect of their interventions. A histogram is an analytic tool that can help a QI team focus on improvement areas that have the greatest perceived impact to their project. When examining a particularly challenging environment, a histogram plot of failure reasons (Pareto chart) for a specific period may highlight previously unrecognized areas deserving intervention using the 80-20 rule (80% of problems arise from 20% of failures) (Fig 3). (11)

Run charts and statistical process control (SPC) charts are other common QI analytic tools used to graphically display data in a sequential format. (12)(13)(14)(15) A run chart displays a measure (eg, discharge order completed; y-axis) plotted over some order of time or sequential events (eg, admissions; x-axis), while preserving the order of data. (5)(12)(13) A continuous horizontal line in the chart, the "center line," demonstrates the data's median line and provides visible representation of project progress. Annotations denote key interventions/changes, including implementation and spread, to assist in determining whether change resulted in improvement. A simple run chart diagram is provided in Fig 4.

Run charts adhere to probability-based criteria (probability for either of 2 mutually exclusive events occurring) to objectively analyze the data. (13) When QI teams

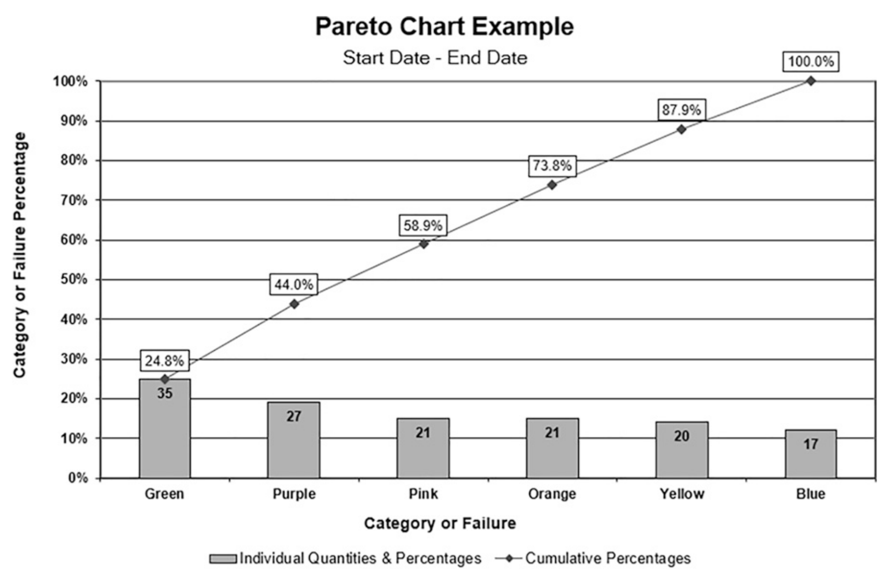


**Figure 3.** An example of a Pareto chart. A histogram plot of failure reasons in a cross-section of time with percentages cumulating from left to right. This example is a fictional representation with each color representing a different failure reason. Green is the most prevalent in the example, with 24.8% of all failures.

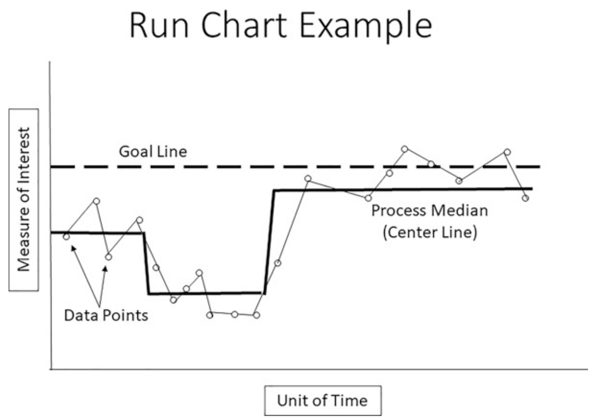


**Figure 4.** An example of a run chart. The x-axis represents a defined unit of time or sequential event, progressing from left to right. The y-axis represents the measure of interest, with individual data points plotted over the determined time or event. The solid center line represents the process median, shifting based on probability-based rules. The goal line is added as a visual representation of the desired project outcome.

observe their data meeting any of these criteria, and if this occurs after an intentional change in the system or intervention, the center line shifts using the first point of the rule as the start of the new median. Common run chart rules are described in Table 1. (5)(12)(16) The most common run chart rule used in health-care QI is a "shift," where the center line shifts to a new median when 6 to 8 consecutive points are either all above or all below the current center line, which would occur. (12)(14)(15)(16)(17) Context- or institution-specific guidelines will define the number of required points to move the center line in this rule, and there are many excellent existing resources on the rationale behind each of the rules. (5)(13)

SPC charts are another way to visibly represent QI data and can provide additional analytic tools for a QI team. These graphs have 2 major distinctions from run charts. In contrast to run charts, the SPC center line designates the data's average or mean, rather than its median. (12)(14) SPC charts also indicate the range of expected data values by displaying upper and lower control limits. (12)(14) These control limits typically indicate 3 SD from the center line, further distinguishing between common and special cause variation. Variable data contained within the control limits represent common cause variability, which is the type of variation one would anticipate seeing in a stable system where there is some small, expected variation over time. Conversely, data falling outside the control limits represent a change to the system that is unexpected, or special cause variation (Fig 5). Common probability-based rules for SPC charts' special cause variation are described in Table 1. (5)(15)(16)

Indications for a QI team to use either run chart or SPC chart data analysis depends on the team's goals, capacity for data management and analysis, and stage of the project. A run chart's simplistic design allows for easy creation and rapid analysis, particularly when a project involves a system with low complexity. A run chart can be used effectively for limited numbers of data points or small sample sizes at each time or event point, or for projects in which the system is experiencing a high degree of variation. In each of these instances, the control limits become more difficult to use as an analytic tool, either because they are overly wide or because a substantial number of points occur out of the control limits, thereby limiting their utility. Conversely, SPC charts require enhanced design complexity in that they require specific calculations to set the control limits. However, SPC charts can demonstrate variation in the system and detect special cause signals by other means, yielding a more

**Table 1.** Special Cause Variation Rules to Interpret Data Variability in Run and Statistical Process Control Charts

| TYPE OF CHART | RULES | DEFINITIONS |
|---|---|---|
| Run | 1. Shift | 6-8 consecutive points, all above or below the median (excluding any points on the center line) |
| | 2. Trend | ≥6 consecutive points, each going all up or all down |
| | 3. Too many/few runs | Nonrandom pattern by too many or too few run or center line crossings (using a Runs Rule Guidance table[a]) |
| Statistical process control | 1. Shift | ≥8 consecutive points, all above or all below the mean (excluding any points on the center line) |
| | 2. Trend | ≥6 consecutive points, each going all up or all down |
| | 3. Control limits | Any single point outside of the upper or lower control limits |
| | 4. Zig zag | 14 points in a row, each point alternating above and below the center line (indicating improved process and reduced variability) |
| | 5. Same side | Any 12 of 14 consecutive points on the same side of the center line |
| | 6. One third | 5 consecutive points beyond 1/3 of control limits on the same side of the center line |
| | 7. Two third | 3 consecutive points beyond 2/3 of control limits on the same side of the center line |

[a]See Provost LP, Murray SK. *The Health Care Data Guide: Learning from Data for Improvement.* San Francisco, CA: Jossey-Bass; 2011.

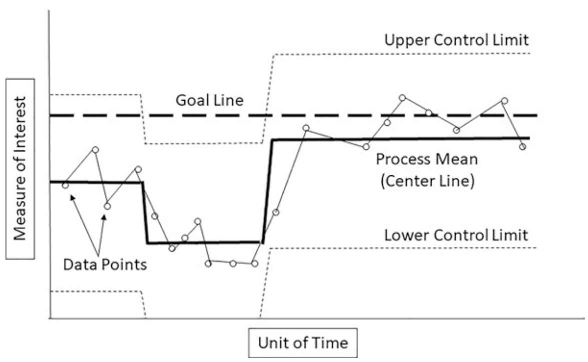


**Figure 5.** An example of a statistical process control chart. The x-axis represents a defined unit of time or sequential event, progressing from left to right. The y-axis represents the measure of interest, with individual data points plotted over the determined time or event. The solid center line represents the process mean or average, shifting based on similar probability-based rules to run charts. Upper and lower limit lines provide visual representation of ±3 SD from the center line. The goal line is added as a visual representation of the desired project outcome.

rigorous approach to analyzing a complex system and/or tackling multiple variables.

Studying unexpected results, by subgrouping data, is equally as important for QI team success as analyzing expected results. For example, if change demonstrates improvement on weekdays, but not on weekends, analyzing this dichotomy helps a QI team build an improvement theory and mitigate possible competing factors to success.

### Implement Change

Once a QI team successfully tests and adapts a change and generates sufficient feedback to show that the team's change yields the desired improvement, implementation is the subsequent step. Through implementation, a change becomes an integral part of a system. An implementation strategy should reflect the original testing environment, small in scope to ensure success and decrease failure risk. In the example to improve hospitalized patient discharge efficiency, once testing was completed, implementation started on 1 unit with 1 group of providers, increasing the chance of success before spreading the change to other groups and units. A successful implementation strategy focuses not only on the steps for immediate process integration but also on ways to sustain the system improvement. (5)

Key support structures that reinforce sustainability of any implementation process include 1) standardization, 2) documentation, 3) measurement, 4) training, and 5) social considerations. (5) Through standardization of a process or process components, a QI team establishes specific policies and practices to embed the new practice into a system. Documentation of these steps preserves consistency within a system, provides a common understanding, and can be helpful in training. Periodic audits of specific process measures allow surveillance over time and recognition if a system drifts away from an intended improvement. Training for new and current employees should explain why an improvement is necessary and demonstrate the actions required to achieve the desired results. Perhaps most importantly, an implementation strategy should appreciate the social implications of any change on the greater system. Change can be challenging in any work environment, particularly when the "why" or "how" of a change is not readily understood. A QI team should seek to share the purpose(s) and aim(s) behind the QI project with those involved in the improvement, thereby reaching a common understanding of the necessary change(s). When achieved, a social culture with a strong awareness of and heightened reaction to a change ultimately enhances communication of problems and new ideas over time.

In the discharge efficiency example, true implementation of a new process to create medical goals for each patient benefited from implementation into the daily workflow of the physician and nursing teams within an electronic health record. Discharge goals were incorporated into all admission order sets, making the new process a routine part of care; as providers interacted with the goals frequently, awareness of these goals became a shared tool for knowing when patients, such as those with a common diagnosis such as bronchiolitis, would be ready to go home. (9)

Spread of an idea occurs when a QI team desires to increase an idea's scope beyond its initial location. An improvement plan can spread into a new, yet similar environment within the same system (eg, new staffing shift, new unit, or new subspecialty service). Spread is eased when the 5 previously described key support structures of sustainability exist (standardization, documentation, measurement, training, and social considerations), allowing for simple translation of the standardization, documentation, and training models into novel locations. A succinct description of ideas, clear communication, strong leadership, and consistent measurement/feedback all contribute to effective spread plans. (5)

## QI PUBLICATION

Sharing rigorous QI work through publication is important. In authoring a manuscript on a QI project, one should use a systematic approach to ensure inclusion of all the project's critical components, facilitating reproducibility of the work in other settings. Manuscripts detailing QI methods are growing in popularity among many reputable pediatric journals. Authors should review guidelines for journals of interest to assess whether QI articles are listed as a specific type (often called quality reports or QI reports); as with any manuscript submission, adherence to specific requirements for a given article type is essential.

The accepted format for publishing QI work is called SQUIRE 2.0 (Standards for Quality Improvement Reporting Excellence), which provide a framework for reporting QI efforts. (18) The guidelines are accessible via the SQUIRE website (http://www.squire-statement.org) and offer a section-by-section approach to reporting QI work across a variety of methods commonly used in health-care process improvement. While using traditional manuscript headings, subheadings encourage authors to detail an introduction with rationale and specific aims; methods including context, interventions, and measures; results; and finally, robust discussion that encourages thoughtful interpretations of results, limitations, and next steps.

In addition to rooting a QI publication manuscript in SQUIRE 2.0 guidelines, authors should supplement with tables and figures that assist in telling their process improvement story. Common tables/figures include a key driver diagram, table of measures, process map(s), and run or SPC chart(s) annotated with key interventions. Details regarding chart rules used by the team to define a center line change should be included to assist the reader in interpreting charts.

## APPLICATION OF QI METHODS

The QI approach detailed in this review aims to promote high-value, high-quality health-care. The QI concepts as outlined by the Model for Improvement are accessible to providers in all practice settings where improvement is desired and can be applied to a variety of processes and settings. (5)(19)

When searching for an improvement project, individuals embedded within the practice are best served to appreciate where change should occur. An internal assessment of areas with a potential for poor efficiency, high risk of failure, frequent errors, low value added, or excess waste will yield multiple opportunities for improvement.

For its members, the American Academy of Pediatrics provides multiple QI resources, tools, and networks to incorporate QI tools into their practice. Similarly, the American Academy of Pediatrics provides members with opportunities to achieve the Maintenance of Certification Parts 2 and 4 points required to maintain board certification.

The health-care benefits of improvement science are countless; QI provides a universal language to implement positive change for our patients, our colleagues, and ourselves.


## Summary

- Based on strong research evidence, quality improvement uses a structured approach to address gaps in the quality or safety of care. (3)
- Based on expert opinion, measurable and time-bound aims and developing interventions using small sequential tests of change (Plan-Do-Study-Act cycles) are hallmarks of quality improvement. (5)
- Based on expert opinion of statistical analysis, following data over time using run charts and statistical process control charts allows teams to measure the impact of interventions in quality improvement studies. (5)(14)(15)(17)



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### Suggested Readings


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*References and teaching slides for this article can be found at* https://doi.org/10.1542/pir.2021-005314.

# PIR QUIZ

1. You have developed a new counseling tool in your clinic regarding water safety and would like to implement the tool during health supervision visits. You realize that your physician partners would be hesitant to implement another screening tool in the office. You find in a survey of families that approximately 40% of families who responded reported that they received water safety counseling. You decide to develop an aim statement. Which of the following is an example of a well-framed aim statement?
   A. Increase water safety counseling from 40% to 75%.
   B. Increase water safety counseling from 40% to 75% for children aged 0 to 10 years.
   C. Increase water safety counseling provided to families with children aged 0 to 10 years from 40% to 75% after 1 year in the clinic.
   D. Increase water safety counseling to 70%.
   E. Increase water safety counseling.
2. Given the project in question 1, you will be deciding next what kind of outcome measures will help you determine efficient counseling. Which of the following represents a process measure that best aligns with your project's aim statement?
   A. Handing out water safety materials to families.
   B. Having families respond to surveys on their water safety knowledge.
   C. Increasing the number of families counseled for health supervision visits from baseline.
   D. Measuring use of online water safety resources by families.
   E. Tracking counseling time over several Plan-Do-Study-Act cycles.
3. In the project in question 1, which of the following best represents an example of a balancing measure?
   A. Increased administrative time for physicians.
   B. Increase in visit time per patient.
   C. Number of health supervision visits seen per day.
   D. Physician burnout.
   E. Total number of patients seen per day, including both health supervision and sick visits.
4. Which of the following represents a primary key driver for this project?
   A. The American Academy of Pediatrics Bright Futures Guidelines for health supervision and preventive care knowledge.
   B. Data management knowledge.
   C. Drowning prevention education knowledge.
   D. Provider-patient collaboration and knowledge of clinical counseling strategies.
   E. Quality improvement primer core knowledge.

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MOC

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5. As interventions are implemented, which of the following represents a good way to prove to colleagues that this project and its interventions worked?

   A. Ask the medical assistant to perform the counseling.
   B. Engage the clinic nurse to perform the counseling.
   C. Demonstrate a decrease in counseling time iteratively over several Plan-Do-Study-Act cycles.
   D. Hand out water safety materials.
   E. Implement a small change, such as counseling a few patients per week.