

QUALITY IMPROVEMENT PRIMERS

Guide to the Science of Quality Improvement

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Ontario Health

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Quality Improvement and the Science of Improvement in Health Care

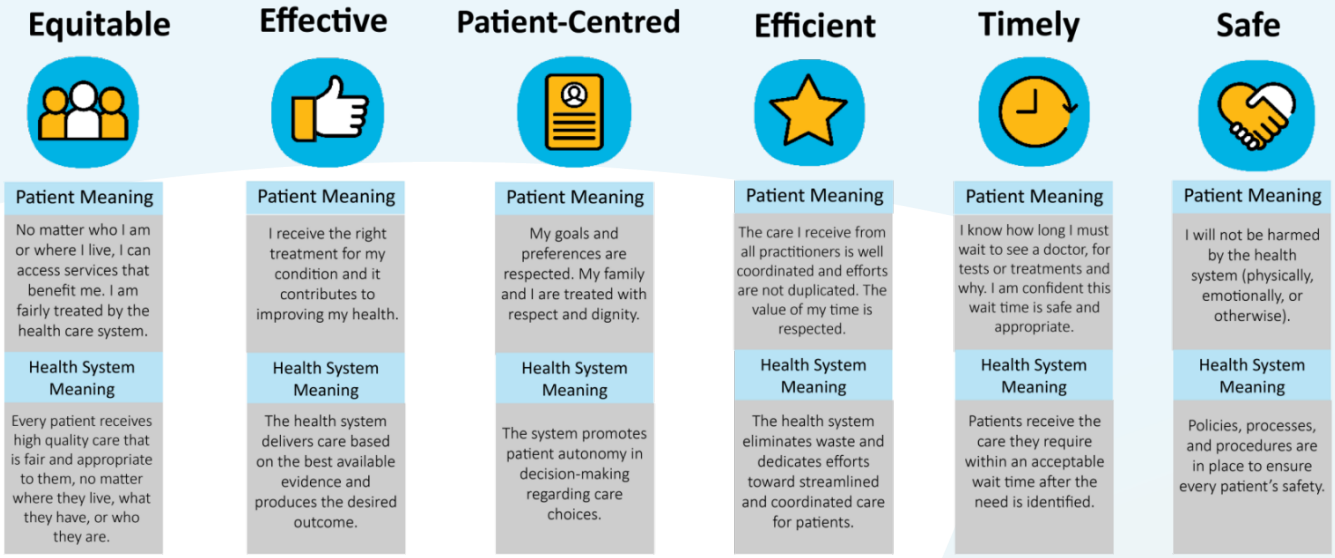
Quality improvement (QI) is a systematic, formal approach to analyzing performance and efforts to improve performance. In health care, QI is a proven, effective way to improve care for patients, residents, and clients – and to improve practice for staff. The science of improvement is defined as "an applied science that emphasizes rapid cycle testing in the field and spread in order to generate learning about what changes, in which contexts, produce improvements."[1] The science draws upon multidisciplinary knowledge and a combination of system theories, improvement methods, and tools.

Health care QI took hold in North America after the publication in 2000 of the Institute of Medicine report *To Err is Human: Building a Safer Health System*.[2] This report noted that 44,000 to 98,000 Americans died each year as a result of medical errors, and it called for a national effort to make health care safer, spurring an increased focus on QI activities in health care. In Ontario, the *Excellent Care for All Act*,[3] enacted by the provincial government in 2010, strengthened the health care system's organizational focus and increased its accountability for delivering high-quality patient care. For example, the Act requires every Ontario hospital to embed QI in its structure and processes.

Domains of Quality

The Institute of Medicine has identified 6 domains that are crucial for quality health care: equitable, effective, patient-centred, efficient, timely, and safe.[4] Ontario Health has adopted earlier work from Health Quality Ontario in its report *Quality Matters: Realizing Excellent Care for All*.[5] This report used the 6 domains to frame a "vision for health system quality: Ontario's health system is world-leading in delivering the best outcomes across all 6 dimensions of quality. Our health care system is just, engages patients and families, and is relentlessly committed to improvement." The domains of quality offer a systematic but focused way to engage clinicians, administrators, and patients in our health care system.

Domains of Quality



Source: *Ontario Health North East and North West Integrated Quality Framework – Our North Star*.[6] Used with permission. See Appendix 1 for a text description of the content.

As part of implementing the 6 domains of quality, an important focus for Ontario Health is our commitment to identifying and addressing racism and discrimination in the health system. Ontario Health's Equity, Inclusion, Diversity and Anti-Racism Framework[7] is an essential tool that shows us how to embed equity in all our activities. Using this framework, our foremost priority is reducing disparities in services related to access, experiences, and outcomes.

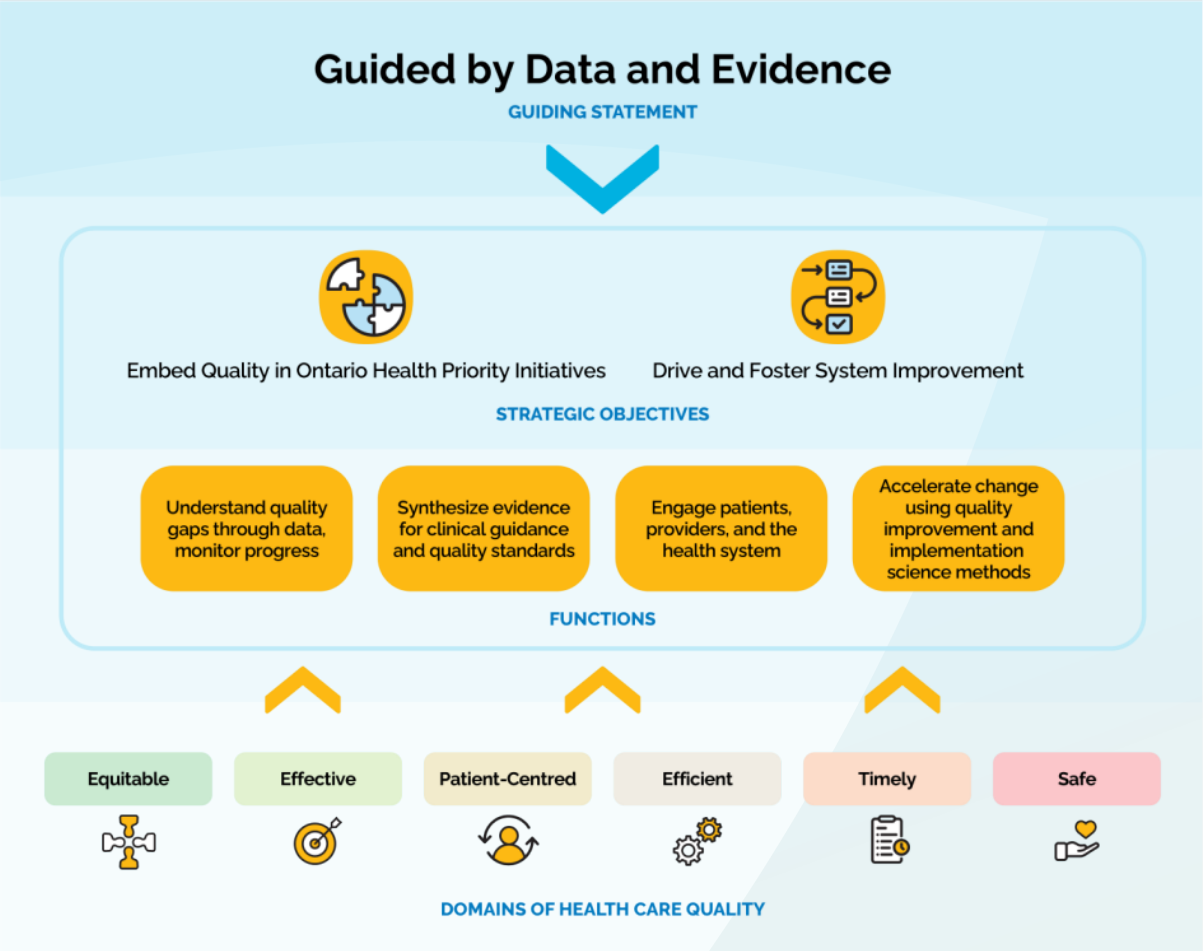
Quality Framework

The Quality division of Ontario Health has developed a framework to support the Ontario health care system in improving performance in the 6 domains of quality. The Integrated Quality Framework has 2 strategic objectives: to embed quality in Ontario Health priority initiatives; and to drive and foster system improvement. It focuses provincial efforts on 4 main functions to maximize the impacts of our work, use appropriate change levers, and spread and scale QI across the system:

- To understand quality gaps through data and monitor progress.
- To synthesize evidence for clinical guidance and quality standards.
- To engage patients, providers, and the health system.
- To accelerate change using quality improvement and implementation science methods.

The 4 functions are supported by the 6 domains of quality (equitable, effective, patient-centred, efficient, timely, and safe).

Ontario Health's Integrated Quality Framework



Quintuple Aim

At Ontario Health, we also use the Quintuple Aim as a tool in our overall health system planning. The 5 objectives are included in our annual business plan to support the delivery of a world-class health care system. The objectives of the Quintuple Aim are to:

1) Enhance patient experience.
2) Improve population health.
3) Improve provider experience.
4) Improve value.
5) Advance health equity.

We recognize that quality improvement is aligned with a set of aims that continues to evolve over time. Other goals, such as environmental sustainability, are also important.[8]

Steps for Quality Improvement

To facilitate QI initiatives, Health Quality Ontario (now part of Ontario Health) developed a comprehensive QI process in 2013 that brought together several QI science models and methodologies. This process used the theories of W. Edward Deming[9] and the Model for Improvement,[10] as well as traditional manufacturing process improvement methods such as Lean and Six Sigma.[11] It also includes the sustainability model from the United Kingdom National Health Service[12] and philosophies from the Center for Implementation.[13]

In 2023, Ontario Health simplified the original QI process into 3 Quality Improvement Steps that can be applied to any QI initiative, in any health care sector. Each of the steps is iterative and designed to build on knowledge gained in the previous phase.

Quality Improvement Steps



Planning for Change

Assembling a Team

When planning for change, forming a QI team is essential to a successful effort. The QI team should include people who are directly involved in the receipt and delivery of care, such as front-line staff and clinicians; it should also include patients, residents, clients, and care partners. The QI team should be sure to represent the diversity of the local population, so that patient and clinician experiences are adequately reflected. Support and involvement from leadership is also critical to the success of a QI project: leadership can be represented on the QI team or kept informed as the work progresses (for example, as an executive sponsor).

Understanding the Problem

Once the QI team has been assembled, they can begin identifying and understanding the problem they are trying to solve. To understand the issues and current state, it is essential to engage with patients, clinicians, and care partners to learn about their experiences, what is important to them, and what they would want or need if processes were improved. This is often called *capturing the voice of the customer*, and can happen using many different methods, including the following:

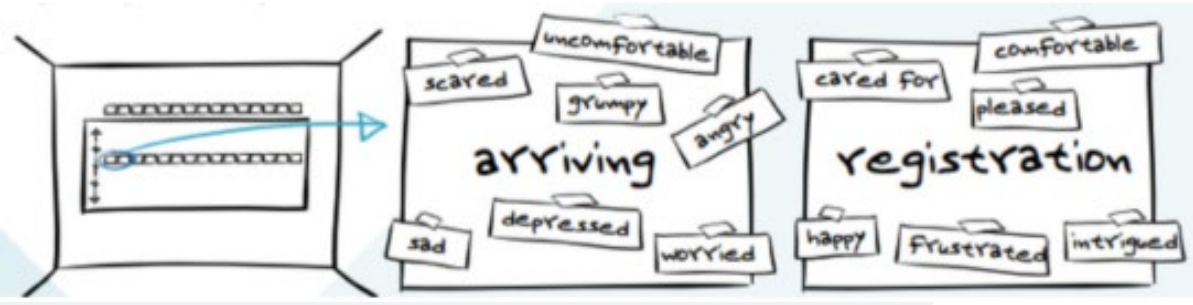
- Value stream analysis
- Focus group findings
- Survey data
- Interview information
- Complaint feedback or data

When trying to capture the voice of the customer, it may also help to use emotional mapping to identify the moments when a user interacts with a service, and how they feel in those moments. Emotional mapping should clearly identify interactions in which people are engaged, as well as functions that occur automatically, without human involvement. The QI team can use emotional mapping to document people's positive and negative emotions during an interactions as a way of understanding the experiences of those seeking care and of those providing care.

Ideas for facilitating emotional mapping:

- Gather the group: a group of 10 staff members and patients is ideal.
- Arrange for a large room with blank wall space, sticky notes, markers, tape, and large bulletin-board-sized paper.
- On a large piece of paper, outline the stages of the process to be improved. Add a scale showing that the bottom of the paper indicates negative emotions, and the top of the paper indicates positive emotions.
- Map the stages on the scale to determine which areas require improvement.

Example of an Emotional Map



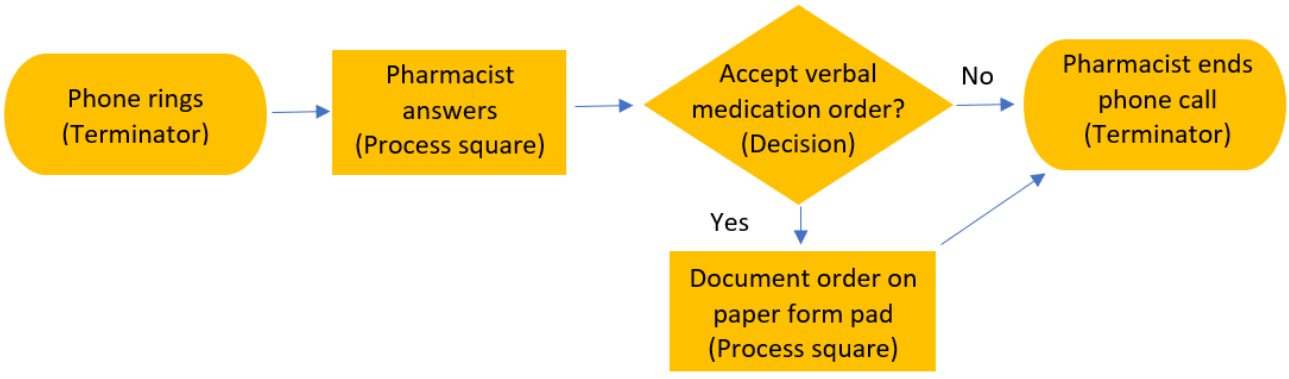
Mapping the Process

As well as understanding the emotions of patients and staff via their experiences, it is important to truly understand how the processes of care work. A process map is a visual display of the exact steps in any process, and of the individuals or groups responsible for each step. By visualizing how the entire process works, it becomes easier to identify inefficiencies, duplication, variation, and unnecessary steps, and in this way find opportunities for improvement. Process mapping should be used any time the QI team is focusing on a particular process, especially when that process is unclear or inconsistent. Process mapping also sparks good ideas and helps a team know where to make improvements that are likely to have the greatest impact for patients and staff.

Some suggestions for process mapping:

- Identify the beginning and the end of the process. To help with this, try thinking of trigger(s) that start the process and milestone(s) that indicate when the desired outcome has been produced. Once the beginning and end have been identified, indicate them on the process map as ovals or terminators.
- Define each process step with an action word, and indicate who does the action (e.g., Pharmacist answers the phone). Each process step is indicated on the map as a square.
- Use arrows to connect process steps and terminators. Draw arrows on sticky notes rather than directly on the map in case the process steps need to be rearranged.
- Identify decision points and define each with a question (e.g., Is the correct Tena product available?). Each decision point is indicated on the map as a diamond.
- Ensure that each decision point is followed by 2 arrows, representing Yes and No. Make sure that a process step follows each arrow.
- Validate the process map. Ensure that people familiar with the process review it for clarity and content. Discuss their input with the team.
- Draw the finalized process map using mapping software.

Example of a Process Map



Defining the Problem

Once the process map is complete, the next step is to analyze it to help the QI team identify opportunities for improvement. Questions the team can ask include the following:

- What types of waste do we see?
- What are the most chaotic parts of the process?
- Where do we see the problem most often?
- Are the right resources used?
- What are the slowest parts of the process?
- What drives the process?
- Who or what is waiting? What are they waiting for?

After engagement with staff and patients and mapping the current process to identify concerns, the team can use tools such as Fishbone and 5 Whys to identify and understand the root causes of the main problem. Formal root-cause analysis is often used to investigate patient safety events, and Healthcare Excellence Canada has produced a valuable Canadian Incident Analysis Framework tool for this.[14] The issues that come to the forefront during this analysis will serve to focus the efforts of the QI team.

The QI team may begin communicating about the improvement journey at this early step to facilitate ongoing buy-in and participation. A story board could illustrate some of the problems and describe how current processes are affecting patients or clients. At this stage, the story board can include the names of QI team members, as well as the goals or aims of the initiative. The story should be heartfelt and capture people's interest.

At this stage, it is important for the QI team to draft a problem statement. A problem statement is 1 or 2 sentences that identify and summarize the condition, problem, or issue that a QI team is seeking to address. The problem statement will form the basis of a goal statement or aim statement. See the Model for Improvement section in this guide (page 14) for information about how to create an aim statement.

Assessing and understanding the readiness of the affected teams is also important at this stage; it will help to identify barriers and enablers to implementing change.

Measurement

At this point, the QI team should create a measurement plan to further understand the root causes of an issue and track improvement. Measurement allows a QI team to show current performance (or baseline), set goals for future performance, and monitor the effects of changes as they are made. Measurement is a cornerstone of successful improvement.

Once the QI team has some initial data, they can begin to gather and brainstorm change ideas to address the issue or problem. Collecting information and displaying it visually using run charts or control charts will help the team understand variations in performance that require change.

If it has not already been started, a QI charter should be created before proceeding with any change. A QI charter can provide a 1-stop summary for everyone involved in supporting the change.

Tools and Resources: Planning for Change

- Assemble a Team: a video from the Regional Geriatric Program of Ontario
- Ontario's Patient Engagement Framework: guide
- Equity in Engagement Framework: a framework to promote equitable engagement, and tools to assist organizations in their efforts to engage and connect with diverse marginalized populations
- Understand the Problem: a tool for exploring the problem and mapping the current state
- Identifying the Problem and Determining Your Aim Statement/Selecting Indicators: video
- Diagnostics: video
- Fishbone/Cause and Effect: tool
- 5 Whys: tool
- Canadian Incident Analysis Framework: a framework from Health Care Excellence Canada
- Pareto Analysis: tool
- Writing a Problem Statement: tool
- Measurement for Quality Improvement: guide
- Measurement Plan: tool
- Measurement: Interpreting Run and Shewart Charts: tool
- Quality Improvement Charter: tool

Implementing Change

At this point, the QI team understands the problem they are trying to solve and why it is happening. Now they can begin to design and test change ideas to address the root causes. Please refer to Ontario Health's guide on Change Concepts and Ideas for further information.

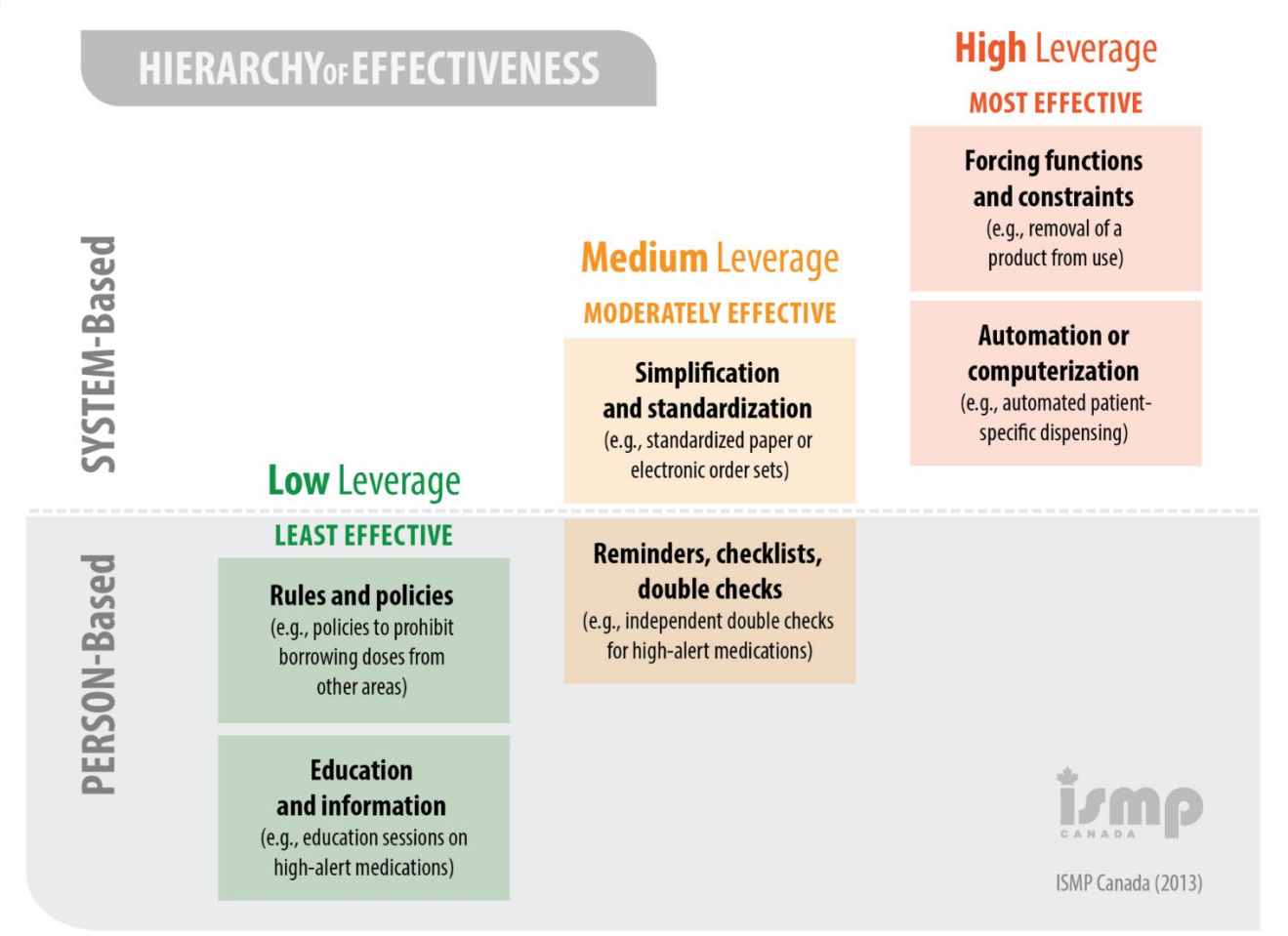
Hierarchy of Intervention Effectiveness

"While all changes do not lead to improvement, all improvement requires change."[15] When developing change concepts and ideas, it is important to consider human factors and the hierarchy of intervention effectiveness as described by the Institute for Safe Medication Practices (ISMP).[16] The hierarchy ranks change ideas and strategies based on their ability to make it "hard for practitioners to do their job wrong, and easy for them to do it right."[17]

- Change ideas with low leverage include rules and policies (e.g., policies to prohibit borrowing doses from other areas) and education and information (e.g., education sessions on high-alert medications).
- Change ideas with medium leverage include simplification and standardization (e.g., standardized paper or electronic order sets) and reminders, checklists and double checks (e.g., independent double checks for high-alert medications).

- Change ideas with high leverage include forcing functions and constraints (e.g., removal of a product from use) and automation and computerization (e.g., automated patient-specific dispensing).

Hierarchy of Intervention Effectiveness: Flow Chart



Source: Institute for Safe Medication Practices Canada, 2013.[18] Used with permission.

The ISMP in Canada and the United States has done a considerable amount of work to encourage and promote the use of the hierarchy when creating change ideas in health care.

Plan–Do–Study–Act

The Plan–Do–Study–Act (PDSA) cycle is a way to test and adjust change ideas (for more information, see the Model for Improvement section on page 14). Analyzing and documenting the impacts of a change idea is a fundamental step that is often overlooked. It takes dedicated energy to track and document these findings, but completely understanding the impact of a change is vital to ongoing adoption and spread. Continuous data analysis is key to understanding what creates a positive change. Essential activities at this stage include:

- Identifying change ideas that address the root causes of the problem.
- Carrying out a test by implementing the change idea on a small scale and collecting data to track improvement.
- Analyzing results to determine whether the change idea resulted in improvement.
- Determining if and how the change idea needs to be tweaked and preparing for another cycle of testing.

Testing change ideas provides additional material for the story of a QI team's improvement efforts. Teams can tell the story of what they have learned (including the improvements achieved to date) through their QI charters. The more information shared in each phase of the QI journey, the greater the chances of acceptance when QI teams are ready to spread improvement.

Tools and Resources: Implementing Change

- Change Concepts and Ideas: guide
- Driver Diagram: tool
- PDSA: Plan–Do–Study–Act: tool
- Implementation – Key Areas: tool
- Implementing and Sustaining Changes: guide
- Measurement: Interpreting Run and Shewart Charts: tool

Sustaining Change

After teams have assessed their QI ideas through small tests in PDSA cycles and are confident that the changes do constitute an improvement, they are already on the path to sustaining change. At this point, change ideas are ready for formal implementation into everyday practice. Ongoing tracking of performance will help the team sustain successes. Data can also be powerful for garnering support for QI efforts.

The QI team needs to continue sharing their story and talk about how the changes they have made positively affect the experiences and outcomes of those affected. It is important to clarify the "what's in it for me," so that the team can help people understand how they benefit from ongoing improvement. Key activities at this stage include the following:

- Formalizing and standardizing the changes and documenting new processes.
- Communicating new processes widely among staff.
- Generating buy-in by sharing the improvement story and the impact on patients, families, staff, and clinicians.
- Collecting information and displaying it visually using run charts and control charts to understand variations in performance.

After the QI team has successfully implemented a change in one area or department, the goal will be to spread the change to other areas or departments. Health care is a service provided for people and by people; making changes to routines or processes can be difficult. Leaders should make change appealing for the majority by considering people's emotional and logical responses. For example, it may help to justify the change based on personal growth or improved patient outcomes, and then make the change feel small and easy to implement.

To determine where to begin spreading improvement, the QI team should engage initially with those who accept the change and are enthusiastic about further change. By concentrating first on units or departments that are eager for change, the QI team can then build the momentum needed to engage the people or departments who are most reluctant to adopt the change.

Developing a plan and laying the groundwork for spread will make it easier to ensure that people feel the effect of the QI team's efforts. The team's spread plan should contain key measures for continually assessing the performance and reliability of the new processes. These measures will allow the QI team to quickly assess whether processes have begun to break down and take immediate action. Key activities at this stage include creating a spread plan and using the measurement plan to monitor adoption and improvement.

Tools and Resources: Sustaining Change

- Implementing and Sustaining Changes: guide
- Implementation – Key Areas: tool
- Sustainability Planner: tool
- Spread Primer: guide
- Spread Planner: tool

The Science of Improvement: Theories and Methodology

Deming's System of Profound Knowledge

Dr. W. Edwards Deming's management philosophy is grounded in systems theory. It is based on the principle that each organization is composed of a system of interrelated processes and people. Although the components may be put together by different teams, management should focus on increasing quality and simultaneously reducing costs.

The 4 parts of Deming's System of Profound Knowledge are appreciation of a system, knowledge about variation, theory of knowledge, and psychology theory. Deming believed that understanding and applying the 4 parts of his theory would create a better leadership culture. For more details on Deming's theory, see his book *The New Economics for Industry, Government, Education*.[9]

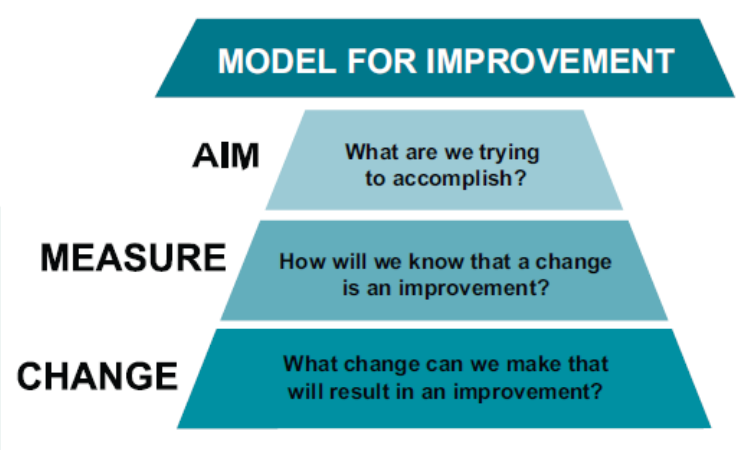
Model for Improvement

Based on Deming's work, the Model for Improvement[10] was created by Associates in Process Improvement as a simple yet powerful tool for accelerating improvement. The Model for Improvement consists of 2 parts.

The Thinking Part of the Model

The first part of the model (the thinking part) consists of 3 questions that are essential for guiding improvement work (described in more detail below):

- What are we trying to accomplish?
- How will we know that a change is an improvement?
- What change can we make that will result in improvement?



Aim: What Are We Trying to Accomplish?

The QI initiative requires a clearly defined goal or aim that answers the question: "What are we trying to accomplish?" In the model, the goal is written as an aim statement. The aim statement should be:

- Clear: A clear and specific aim is an essential component of an unambiguous QI plan. The aim statement should share how much the QI initiative will change something. Examples might include aiming to decrease adverse events or undesirable wait times by half, or to improve a measure by 50%.
- Time-specific: The statement articulates when the goal will be achieved.
- Stretchable: The aim statement should be supported by a stretch goal. A goal of small, incremental change (e.g., moving from below average to average, or changing by 10%) does not necessarily represent a true breakthrough in quality, nor does it justify stakeholder investment. It may be helpful to review the practices of leading organizations and or use established benchmarks for support in setting a stretch goal.
- Of real value: The aim should meet the expectations and needs of patients and clients.

Example of a poor aim statement: We will work more efficiently to reduce wait times for new patients this year.

Example of a good aim statement: Within 7 months, we will reduce wait times for all new patients referred to our specialty clinic from 53 days to no more than 26 days.

Measure: How Will We Know That a Change Is an Improvement?

To determine whether changes made as part of QI initiatives are leading to tangible improvement, information about the impact of the changes needs to be collected, analyzed, and reported. This is called measurement, and it provides concrete evidence to support the case for change. By demonstrating tangible results, measurement can increase buy-in for an initiative.

Four types of measures can be used to gauge the QI team's progress and support the achievement of its aims:

- **Outcome measures** are the clinical or experiential impacts for the patient. They capture information about system performance. They answer the question "What are the end results of our QI work?" Examples include reductions in infection rates, wait times, or falls.
- **Process measures** reflect the workings of the system. They capture how QI efforts change the inputs or steps that contribute to system outcomes. An example might be the percentage of time staff members adhere to a best-practice recommendation, such as the bundle of best practices to prevent ventilator-associated pneumonia.
- **Balancing measures** determine whether changes designed to improve one part of the system are causing problems in other parts. They include staff and patient or client satisfaction, or financial

implications. An example might be, “Does this QI change improve staff satisfaction but decrease patient or client satisfaction?”

- **PDSA measures** are collected with each test of a change (PDSA) that is carried out. They provide knowledge about the effect of each change attempt on the process and the system. An example might be staff satisfaction with the ease of using a new process or the percentage of time that the new process achieves the results it was designed to achieve.

For more information about using measures in a QI initiative, see the Measurement for Quality Improvement guide.

Change: What Change Can We Make That Will Result in Improvement?

Once an aim is in place and measures have been established, teams need to identify promising ideas to improve quality through change. Change ideas are actionable steps targeted at improving specific processes, often originating from brainstorming sessions with the QI team and evidenced-based best practices. For example, a change idea for improving access might be to schedule prebooked appointments on days of the week that have the least demand. These ideas are practical and can be readily tested.

In cases where no clear, evidence-informed change ideas exist, the team could start with a **change concept** to help generate ideas, and then develop specific change ideas for testing. The Institute for Healthcare Improvement defines a change concept as “a general notion or approach to change that has been found to be useful in developing specific ideas for changes that lead to improvement.”[19] Change concepts are broader theories or approaches to improving quality (e.g., reducing waste, improving workflow, standardization, and other principles common to QI methodology). A change idea is a specific idea, and a change concept is an umbrella with many change ideas under it.

For detailed information on change ideas and concepts, see the Change Concepts and Ideas guide.

The Doing Part of the Model

The second part (the doing part) of the model relies on a continuous process of developing and conducting small tests of change (PDSA cycles).

After the QI team has worked through the thinking part of the Model for Improvement and has some information to support answers to the 3 questions above, they are ready to for the doing part. This part supports trying an improvement idea on a small scale first, before fully implementing a change. Small tests of a change may also help to uncover undesirable effects, allowing QI teams to modify or abandon a change idea that has unintended consequences. A PDSA cycle can help to build knowledge for further testing, demonstrate the benefits of new ideas, and be used to engage staff.

For detailed information on PDSA, see the PDSA: Plan–Do–Study–Act tool.

Lean

Lean methodology was first developed in the 1950s by Taiichi Ohno at Toyota.[20] One of the Lean system's major innovations was that workers were seen as key problem-solvers and were empowered to improve processes and eliminate waste. Since the 1950s, the use of Lean methodology has moved beyond manufacturing and is now applied to improvements in health care delivery processes.

Lean practice begins with the work and the people doing the work. It involves systematic and continuous identification and elimination of waste (e.g., inefficiencies, errors, and nonproductive or non-value-added activity) from processes. Waste is anything that does not add value from the point of view of the customer, whether internal or external.

Lean is about ensuring that the right thing happens at the right time, done by the right person, and that staff are engaged in the change process.[11] It is about making the work environment more efficient and effective, and about improving safety, quality, costs, and service delivery. In health care, the objective of applying Lean methodology is to release time for more direct care and to integrate QI into daily activities.

The 5 Principles of Lean

1) Specify value from the customer perspective: A customer may be internal (e.g., a resident) or external (e.g., a vendor).
2) Identify steps in the value stream and map the process: The status of virtually every process should be apparent (this knowledge can be acquired over time), allowing for easy comparison of expected versus actual performance. Process mapping is a tool used to create a picture of the process so that all activities are obvious.
3) Improve flow by eliminating waste: A process flows or progresses more efficiently when inefficiencies and errors are permanently removed from the process steps.
4) Establish pull: This is about understanding the customer demand for a service and then creating a process to respond to the level of demand – in other words, supplying only what the customer wants when the customer wants it.
5) Seek perfection: Lean thinking is not about a 1-time improvement in a process; rather, it is about the continuous pursuit of quality and continuous quality improvement.

What Lean Is

- Solutions to customer needs
- Identification and removal of process waste
- Redeployment of resources to value-added activities
- Reduction or elimination of defects
- Improvement of process flow
- Doing necessary and efficient tasks

- Continuous improvement
- Focus on value-added activities
- Quality at point of service

What Lean Is Not

- Focus on clinician needs
- Writing new policies or procedures
- Job reduction
- Measuring quality into the service
- Batch and queue
- Doing a lot of work
- One-time random improvement
- Busywork that fills your day
- Speeding up an inefficient or ineffective process

Recommended Reading

- American Society for Quality: Quality Tools
- Baker, R., MacIntosh-Murray, A., Porcellato, C., Dionne, L., Stelmacovich, K., & Born, K. (2008). *High performing healthcare systems: Delivering quality by design*. Longwoods Publishing.
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- Six Sigma Tools and Templates
- Womack, J. P., & Jones, D. T. (2003). *Lean thinking: Banish waste and create wealth in your corporation.* Productivity Press.

Appendix 1: Domains of Quality

Descriptions of the 6 domains of quality from the figure on page 4.

Patient Meaning

- Equitable: No matter who I am or where I live, I can access services that benefit me. I am fairly treated by the health care system.
- Effective: I receive the right treatment for my condition, and it contributes to improving my health.
- Patient-centred: My goals and preferences are respected. My family and I are treated with respect and dignity.
- Efficient: The care I receive from all practitioners is well coordinated and efforts are not duplicated. The value of my time is respected.
- Timely: I know how long I must wait to see a doctor for tests or treatments, and why. I am confident this wait time is safe and appropriate.
- Safe: I will not be harmed by the health system (physically or emotionally, or otherwise).

Health System Meaning

- Equitable: Every patient receives high-quality care that is fair and appropriate to them, no matter where they live, what they have, or who they are.
- Effective: The health system delivers care based on the best available evidence and produces the desired outcome.
- Patient-Centred: The system promotes patient autonomy in decision-making regarding care choices.
- Efficient: The health system eliminates waste and dedicates efforts toward streamlined and coordinated care for patients.
- Timely: Patients receive the care they require within an acceptable wait time after the need is identified.
- Safe: Policies, processes and procedures are in place to ensure every patient's safety.

Source: *Ontario Health North East and North West Integrated Quality Framework – Our North Star*.[6] Used with permission.

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