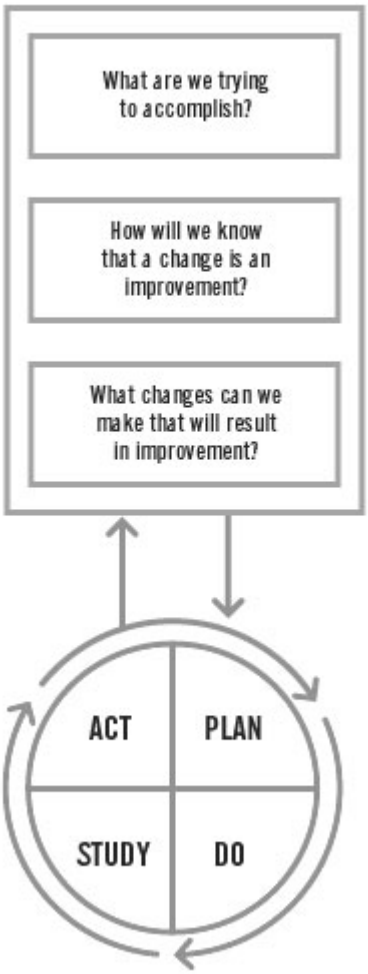
IHI QUALITY IMPROVEMENT RESOURCES:
A Model for Accelerating Improvement

Introduction



Organizations in the Breakthrough Series use a simple, yet powerful model for accelerating improvement. The model is not meant to replace change models that organizations may already be using, but rather to accelerate improvement.

The model has two parts:

1. Three fundamental questions, which can be addressed in any order

2. The Plan-Do-Study-Act (PDSA) cycle to test and implement changes in real work settings

Setting Aims

Improvement requires setting aims. An organization will not improve without a clear and firm intention to do so. The aim should be expressed in specific terms—for example, reduce operating room costs by 30%, reduce time on mechanical ventilation to 6 hours or less, or reduce the 30-day readmission rate by 50%. Agreeing on the aim is crucial; so is allocating the people and resources necessary to accomplish the aim.

Establishing Measures

Teams use qualitative measures to determine if a specific change actually leads to an improvement—for example, is ICU length of stay decreasing? Is median ventilator time

decreasing? Are operating room costs for DRGs 106 and 107 being reduced?

In addition, teams need to make sure that changes designed to improve one part of the system are not causing new problems in other parts of the system. For example, teams working to reduce ventilator times should also measure to make sure reintubation rates are not increasing. Teams working to reduce length of stay should also measure to make sure readmission rates are not increasing.

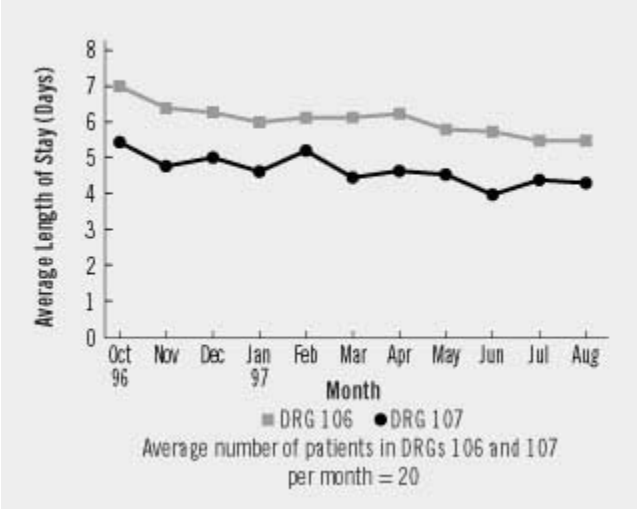


Figure 3.1
Length of Stay for Patients in DRGs 106 and 107
Sample

Testing Changes

All improvement requires making changes, but not all changes result in improvement. Organizations must, therefore, identify the changes that are most likely to result in improvement.

Ideas for change can come from a variety of sources: critical thinking about the current system, creative thinking, observing the process, a hunch, an idea from the scientific literature, or an insight gleaned from a completely different situation. This Guide refers to good ideas for change as “change concepts.” A change concept is a general idea—with proven merit and a sound scientific or logical foundation— that can stimulate specific ideas for changes that lead to improvement. Using change concepts and combining them creatively can inspire new ways of thinking about how to improve processes.

Improvement begins with setting aims. Starting with a clearly stated, mutually agreed-upon aim will help teams stay on track throughout their improvement efforts.

Tips for Setting Aims

1. State the aim clearly.
Achieving agreement on the aim of a project is critical for maintaining progress. Teams make better progress when they are very specific about their aims.

2. Include numerical goals.
Including numerical goals clarifies expectations. For example, the aim “Reduce operating room time” is not as effective as “Reduce operating room time by 50% within 12 months.” Including numerical goals not only clarifies the aim. It also helps team members begin to think about what their measures of improvement will be, what initial changes they might make, and what level of support they will need.

3. Set stretch goals.
Setting stretch goals — for example, “Reduce operating room time by 50% within 12 months” — communicates immediately and clearly that maintaining the status quo is not an option. Effective leaders make it clear that the goal cannot be met by tweaking the existing system. Once this is clear, people begin to look for ways to overcome barriers and achieve the stretch goals. Tips for Setting Aims

4. Avoid aim drift.
Once the aim has been set, the team needs to be careful not to back away from it. The initial stretch goal — “Reduce operating room time by 50% within 12 months”— can slip almost imperceptibly to “Reduce operating room time by 40%” or “by 20%.” To avoid aim drift, repeat the aim continually. Start each team meeting with an explicit statement of aim, for example, “Remember, we’re here to reduce operating room time by 50% within 12 months,” and then review progress quantitatively over time.

5. Be prepared to refocus the aim.
Every team needs to recognize when to refocus its aim. If the team’s overall aim is at a system level (for example, “Reduce total length of stay for all CABG patients by 30% within 12 months”), team members may find that focusing for a time on a smaller part of the system (for example, “Reduce length of stay in the ICU for low-risk CABG patients by 30% within 12 months”) will help them achieve the desired system-level goal. *Note*: Don’t confuse aim drift, or backing away from a stretch goal (which usually isn’t a good tactic), with consciously deciding to work on a smaller part of the system (which often is a good tactic).

Examples of Effective Aim Statements:

- Reduce the time from cardiac catheterization to CABG surgery to less than 48 hours.
- Admit 100% of elective patients (DRG 107) on the day of surgery.
- Reduce operating room time for a standard three-vessel CABG to 180 minutes or less.
- Reduce operating room costs (supplies and personnel) for DRGs 106 and 107 to $4,500 per case.
- Reduce postoperative ventilator time to 6 hours or less.
- Reduce length of stay for DRGs 106 and 107 to 5 days or less.
- Reduce the readmission rate within 30 days post-cardiac surgery to less than 10% of all cases.
- Reduce 30-day mortality for all CABG cases, excluding re-ops, to 2% or less.

Forming the Team

Getting the right people on the team is critical to a successful improvement effort. Teams vary in size and composition; each organization builds teams to suit its own needs. Teams working on improving adult cardiac surgery should include members with different kinds of expertise—cardiologists, surgeons, anesthesiologists, nurses, technicians, and managers—people who represent different departments and parts of the system of care.

Tips for Forming Teams

Effective teams include members representing three different kinds of expertise within the organization: system leadership, technical expertise, and day-to-day leadership. There may be one or more individuals on the team with each kind of expertise, or one individual may have expertise in more than one area, but all three areas should be represented in order to successfully drive improvement in cardiac surgery.

System Leadership

Teams need someone with enough authority in the organization to institute a change when one is suggested and to overcome barriers when they arise. The team's system leader understands both the implications of the proposed change for various parts of the system and the more remote cause-and-effect relationships such a change might trigger. It is important that this person have authority in all areas that are affected by the change, including possibly the emergency department, pharmacy, and other nursing units. This person must have the authority to allocate the time and resources the team needs to achieve its aim. The Chief of Cardiothoracic Surgery or the Vice President for Cardiac Services can fulfill this role.

Technical Expertise

Teams need a subject matter expert, someone who understands the entire process of cardiac care. Additional technical support may also come from an expert on improvement methods or information systems, who can help a team understand what to measure and how to design simple, effective measurement instruments, collect and display data, and understand the information contained in the data. It is critical to have at least one physician champion on the team. This champion should have a good working relationship with colleagues and with the day-to-day leader(s), and be committed to driving change in the cardiac surgery system.

Day-to-Day Leadership

Most of all, teams need a person who will be the critical driving component of the project on a daily basis, ensuring that changes are being tested and data are being collected. Most often, this person understands the details of the system because he or she actually works in it, understands the various effects of making changes in the system, and works well with the physician champion.

Improvements in cardiac surgery depend on the cooperation and leadership of physicians.

- Surgeons and anesthesiologists have the most intimate knowledge of cardiac surgical patients and processes.

- Some changes may require surgeons and anesthesiologists to sustain what they may perceive as a short-term loss in order to achieve improvement. Standardization, for example, may require surgeons to give up familiar processes or instruments in order to reduce variation and make the process more efficient in the long run.

- Physician champions — physicians who are willing to test changes in their own practice — are in the best position to convince others that the changes are feasible, safe, and advantageous.

If physicians aren't on board, seek out those who will work with you.

- Engage the help of the administration: managers of cardiac service lines, senior leaders, and OR managers.

- Identify other professionals who are willing to test changes: anesthesiologists, circulating nurses, scrub nurses, housekeeping personnel, and perfusionists.

Examples of Effective Teams

A team's composition depends on its aim:

- First, review the **Aim**.

- Second, given the aim, consider the **System** on which you will be working: What processes will be affected by the improvement? For example, if your aim is reducing the time from catheterization to surgery, the system includes the cath lab, cardiology, private physicians, cardiac surgeons, and OR scheduling.

- Third, given the aim and the system, choose an effective **Team** — individuals who can drive improvement in pertinent areas and develop the support necessary for the success of the project

Example 1

Aim:
Reduce overall length of stay for elective CABG patients from 8.2 days to 6.0 days.

System:
Total CABG system, from pre-admission testing to post-discharge follow-up

Team:

SL Vice President of cardiac services

TE Physician directors of cardiac surgery and cardiac surgery ICU; cardiothoracic surgeon who is a champion for improving the process

DL Cardiac surgery case manager, clinical nurse specialist, physician assistant, ICU nurse, floor nurse

Additional Members: Representatives from admitting, respiratory therapy, physical therapy, home health, cardiology, and anesthesia

Example 2

Aim:
Reduce operating room costs for all cardiac surgery by 30%.

System:
Operating room and related areas such as supplies and housekeeping

Team:
SL Director of cardiac surgery, Vice President for surgical services

TE Cardiac surgeon, anesthesiologist, perfusionist, scrub nurse, finance personnel

DL Operating room manager, operating room nurse

Additional Members: Housekeeping representative, operating room supply manager

Example 3

Aim:
Reduce time from cardiac catheterization to surgery from 3.9 days to 2 days.

System:
Catheterization laboratory, medical floors, cardiology and cardiac surgery services, admitting, operating room scheduling

Team:
SL Vice President of cardiac services

TE Cardiology champion and cardiac surgery champion

DL Cardiac surgery physician's assistant or nurse practitioner, manager of cardiac surgery operating rooms, cath lab personnel

Establishing Measures

After setting a clear aim and forming the right team, the next step is establishing simple measures that will indicate if a change leads to an improvement. If a team has done a good job articulating its aim, it can easily define simple, effective measures.

Tips for Effective Measurement

Measurement should be used to speed improvement, not slow it down. Often, organizations get bogged down in measurement and delay making a change until they have collected enough data.

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1. Plot data over time.

Improvement requires change, and change is, by definition, a temporal phenomenon. Much information about a system and how to improve it can be obtained by plotting data—on length of stay, volume, patient satisfaction— over time and observing trends and other patterns. Tracking a few key measures over time is the single most powerful tool a team can use.

2. Seek usefulness, not perfection.

Remember, measurement is not the goal; improvement is the goal. In order to move forward to the next step, a team needs just enough data to know whether changes are leading to improvement.

3. Use sampling.

Sampling is a simple, efficient way to help a team understand how a system is performing. In cardiac surgery, the patient volume is typically low enough to allow tracking of key measures on all patients. However, sampling can save time and resources while accurately tracking performance. For example, instead of monitoring the time from catheterization to CABG continuously, measure a random sample of 10 to 20 patients (DRG 106) per month.

4. Integrate measurement into the daily routine.

Useful data are often easy to obtain without relying on information systems. Don’t wait two months to receive length of stay data from the information systems department. Develop a simple data collection form and make collecting the data part of someone’s job. Often, a few simple measures will yield all the information you need.

5. Use qualitative and quantitative data.

In addition to collecting quantitative data, be sure to collect qualitative data, which often are easier to access and highly informative. For example, ask the nursing staff how the weaning is going or how to improve the sedation protocol. Or, in order to focus your efforts on improving patient and family satisfaction, ask patients and their families about their experience of the cardiac surgery process.

Examples of Effective Measures

- Time from catheterization to CABG surgery
- Percentage of same-day admissions for elective CABG
- Operating room time per case
- Operating room cost per case
- Time on the ventilator • ICU length of stay
- Total length of stay
- Incidence of new onset postoperative atrial fibrillation
- Readmission rate (30-day)
- Mortality rate (30-day) for CABG

Testing Changes

Once a team has set an aim, established its membership, and developed measures to determine whether a change leads to an improvement, the next step is to test a change in the real work setting. The PDSA (Plan-Do-Study-Act) cycle is shorthand for testing a change—by planning it, trying it, observing the results, and acting on what is learned. This is the scientific method, used for action-oriented learning.

Testing a Change: The PDSA Cycle

Teams need to address several challenges in each step of the PDSA cycle:

Step 1 Plan

• State the objective of the test.
• Make predictions about what will happen and why.
• Develop a plan to test the change. (Who? What? When? Where? What data need to be collected?)

Step 2 Do

• Carry out the test.
• Document problems and unexpected observations.
• Begin analysis of the data.

Step 3 Study

• Complete the analysis of the data.
• Compare the data to your predictions.
• Summarize and reflect on what was learned.

Step 4 Act

• Determine what modifications should be made.

• Prepare a plan for the next test.

Tips for Testing Changes

1. Stay a cycle ahead.
When designing a test, imagine at the start what the subsequent test or two might be, given various possible findings in the "Study" phase of the Plan-Do- Study-Act cycle. For example, teams that are redesigning same-day admission criteria should also be planning how those criteria will be applied.

2. Scale down the scope of tests.
Dimensions of the tests that can be scaled down include the number of patients, doctors, and others involved in the test ("Sample the next 10" instead of "Get a sample of 200"), and the location or duration of the test ("Test it in Operating Room #1 for one week").

3. Pick willing volunteers.
Work with those who want to work with you. ("I know Dr. Jones will help us" instead of "How can we convince Dr. Smith to buy in?")

4. Avoid the need for consensus, buy-in, or political solutions.
Save these for later stages. When possible, choose changes that do not require long processes of approval, especially during the early testing phase.

5. Don't reinvent the wheel.
Instead, replicate changes made elsewhere. For example, instead of creating your own atrial fibrillation treatment protocol, try modifying another hospital's protocol.

6. Pick easy changes to try.
Look for the concepts that seem most feasible and will have the greatest impact.

7. Avoid technical slowdowns.
Don't wait for the new computer to arrive; try paper and pencil instead.

8. Reflect on the results of every change.
After making a change, a team should ask: What did we expect to happen? What did happen? Were there unintended consequences? What was the best thing about this change? The worst? What might we do next? Too often, people avoid reflecting on failure. Remember that teams often learn very important lessons from failed tests of change.

9. Be prepared to end the test of a change.
If the test shows that a change is not leading to improvement, the test should be stopped. Note: "Failed" tests of change are a natural part of the improvement process. If a team experiences very few failed tests of change, it is probably not pushing the boundaries of innovation very far.

Linking Tests of Change

Testing changes is an iterative process: the completion of each test rolls directly into the start of the next test. A team learns from the test (What worked and what didn't work? What should be kept, changed, or abandoned?) and uses the new knowledge to plan the next test. The team

continues linking tests in this way, refining the change until it is ready for broader implementation.

People are far more willing to test a change when they know that changes can and will be modified as needed. Linking small tests of change helps overcome an organization's natural resistance to change and ensure physician buy-in.

Ask, "What Can We Do by Next Tuesday?"

Accelerating improvement means acting quickly. Most improvement efforts fail because so much time is spent considering, studying and meeting that nothing ever changes. Organizations that want to improve can simply begin small-scale tests right away - today even! Running small-scale tests sooner improves patient care much more surely and quickly than does running large-scale cycles later. Even an ambitious and innovative change can be tested first on a small scale - for example, with only one or two physicians, with the next five patients, for the next three days. In general, make the strongest change that the team can do quickly, on the smallest sample that will be informative. When a team can show improvement, then expanding the scope will be much easier. But don't be timid about how substantial the change should be. Too trivial a change ruffles no feathers - but it inspires others to accept the status quo.

Each test, properly done, provides valuable information and forms the basis for further improvement. If a change works on a small scale and is improved in successive tests, it can then be implemented with assurance on a larger scale.

Teams should ask, "What is the largest, informative change we can make by next Tuesday?" This will not be the only change a team should make, and probably will not be the most important one, either. But by making an informative change "by next Tuesday," teams can break the inertia that keeps many improvement efforts from getting off the ground.

It is easy to become comfortable with the status quo. What is easy and routine is what happens. By showing practitioners that another way actually works better, you help them to see just how limited and suddenly archaic their routine practice has been.

Note: This above text is from the book Improving Care for the End of Life : A Sourcebook for Health Care Managers and Clinicians by Joanne Lynn, MD, Janice Lynch Schuster, and Andrea Kabcenell, RN, MPH.

Putting It All Together: Cutting Intubation Time in Half

Setting Aims

Fort Sanders Parkwest Medical Center, in Knoxville, TN, set the following aim:
Extubate all CABG patients in less than 6 hours.

Forming the Team

The team working on reducing extubation time consisted of the following members:

• **Anesthesiologist:** Manages anesthesia during surgery and assists with the extubation. The

anesthesiologist is a key member of any early extubation team because early extubation is possible only with changes in anesthetic management of the patient during surgery.
• **ICU nurse:** Has primary responsibility for extubating patients.
• **Respiratory therapist:** Works with ICU nurse to extubate patients early.
• **Surgeon:** Helps identify patients who could be extubated early. The surgeon needs to be comfortable allowing patients to be extubated early and must delegate control of that process to the ICU nurse.
• **Lab personnel:** Help design a process to expedite obtaining arterial blood gas (ABG) results.

Establishing Measures

To determine if changes were leading to improvement, the team decided to track the following measures:

• Average time from admission to the ICU to extubation (Figure 3.2)
• Reintubation rate
• Average number of ABGs per case
• Rate of pulmonary complications
• ICU length of stay

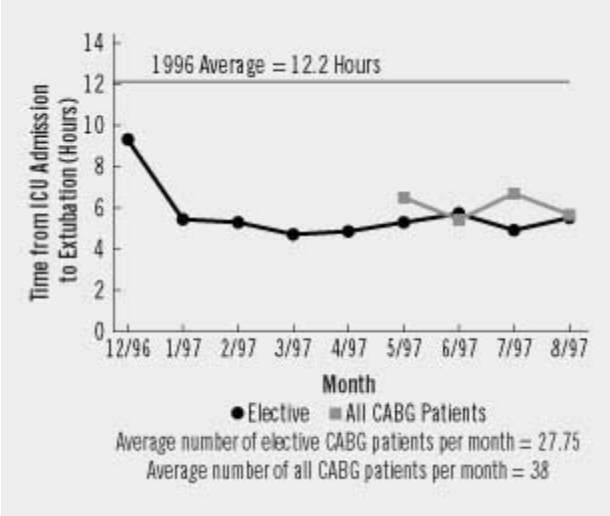

Figure 3.2 Average Extubation Time for CABG Patients

Testing Changes

In order to get buy-in from anesthesiologists and surgeons, the team first tested the following changes only on elective CABG patients. As the comfort level of the physicians grew and data showed that patients could safely undergo early extubation, the team extended the changes to include all CABG patients.

Change 1: Standardize pain management.
In order to be extubated early, patients must not be too heavily sedated. The team began by

revising the existing standards for postoperative pain management. Instead of using the traditional high dose of morphine, the team tested the use of smaller, more frequent doses. In this way, patients' pain was managed adequately, yet patients were awake enough to be extubated safely.

Change 2: Standardize anesthesia management.
Patients cannot be extubated if they are heavily sedated. The team tested having anesthesiologists use lower doses of sedatives to prevent patients from remaining heavily sedated long after the surgery was completed.

Change 3: Establish a nurse- and respiratory therapist-run rapid weaning and extubation protocol.
The team also developed a set of criteria that patients need to meet in order to be extubated safely, given the changes in anesthesia and pain management.

Change 4: Reduce delays in obtaining arterial blood gas (ABG) results.
The team identified delays in obtaining ABG results and weaning parameters as barriers to early extubation. They assigned a dedicated respiratory therapist to obtain these results.

Change 5: Educate physicians, nurses, certified registered nurse assistants (CRNAs), and respiratory therapists on the new goals and procedures for early extubation.

Change 6: Extend the changes from elective CABG patients to all CABG patients.

Results

Within several months, Fort Sanders Parkwest Medical Center reduced the average extubation time for elective CABG patients from 12.2 hours to less than 5 hours. In May 1997, the changes were extended to all CABG patients, and by October the average extubation time for all CABG patients was less than 6 hours.