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Quality Assurance Methodology Refinement Series

Achieving Quality Through Problem Solving and Process Improvement

Second Edition

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Acknowledgements

Achieving Quality Through Problem Solving and Process Improvement

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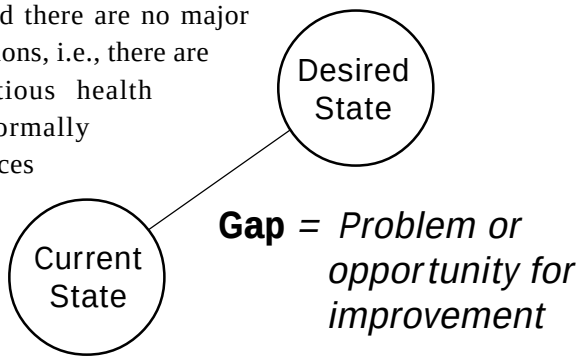
Solving Quality Problems and Improving Processes

I. Introduction

Quality deficiencies can be found in any health care setting, from the most sophisticated urban hospital to the village clinic. Poor quality reduces the benefit to clients, frustrates health care providers, and wastes scarce health resources. A systematic, ongoing process of ensuring and improving quality is therefore an essential component of an effective, efficient, and responsive health care system.

This monograph presents a step-by-step approach for improving processes and for solving problems related to health care quality. As such, the approach applies to any level of the health system. A quality-related problem has been described as the gap between what **is** and what is **desired**. Situations do exist in which the current service delivery process works well and there are no major gaps between performance and expectations, i.e., there are no "problems." However, conscientious health professionals recognize that it is normally possible to improve the quality of services by making them more efficient, more responsive to clients' needs, and less likely to run into problems.



Opportunities for improvement can be found at every level of the health system. Individuals or teams may find them in their own work, in the work of supervisees, or in the district, region, or country as a whole. Solving problems and improving processes require more than intuition and judgment. The methods presented in this monograph follow logical steps developed from practical problem-solving experiences in health care and other settings. While personnel solve problems every day without mapping out a stated plan, the steps presented here provide concrete measures for improving quality efficiently and effectively. They are designed to help to avoid common pitfalls.

Problem solving and process improvement work best when conducted as part of a quality assurance (QA) program in which standards are developed and quality indicators are monitored. Nevertheless, the problem-solving steps presented herein can be applied whenever and however an opportunity for improving quality arises.

A. The Approach to Quality Assurance

Four main principles define the approach presented in this monograph for ensuring and improving quality and for resolving quality problems as they arise. These are summarized below:

A Focus on Client Needs: Client needs and desires should drive the planning and performance of any activity. The term "client" refers to both:

- **External clients:** the final recipients and beneficiaries of health services and the reason the services exist, i.e., the patients and community served.
- **Internal clients:** those within the organization who rely on fellow workers for products and services that help them to fulfill their part in providing quality health care to the external client. Internal clients include front-line health workers, supervisors, and other health team members.

Ensuring quality begins with knowing who the clients are and understanding their needs and expectations. Within this idea of "client," every worker plays the complementary roles of serving clients and of being a client.

A Focus on Systems and Process: The quality of health services is usually judged by outcomes, specifically, the immediate and long-term effects on the health of the individuals and communities they serve. When the outcomes fail to meet expectations, people often point to poor worker motivation and inadequate effort as causes. But all productive work results from processes. A process is a series of steps or tasks that turns people, methods, and materials into products and services, e.g., administering a vaccine or monitoring a child's growth. Processes operate within systems: a system is a set of processes that function together. For example, a vaccination system includes processes for the delivery of vaccines, their storage and distribution, vaccine administration, and program evaluation.

Quality problems in one process are often due to a deficiency in one or more of the system's related processes or to a failure in coordination of the interrelated processes. If the processes are deficient, the outcomes will likely be deficient as well. Poor quality is often the result of poor job design (processes that do not work or take too long) or the failure of leadership to provide a clear purpose for activities. Quality improvement requires an understanding of the relevant processes and their acceptable levels of variation.

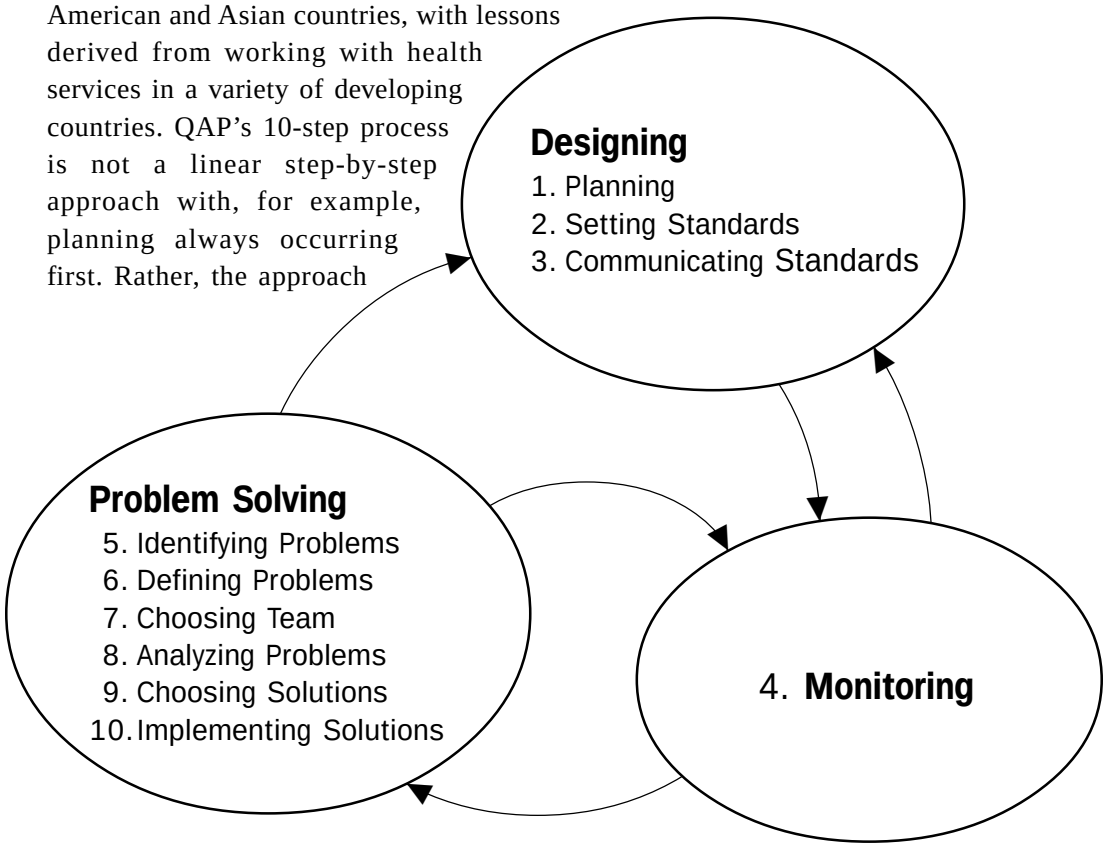
A Focus on Data-based Decisions: Improving processes requires information about how they function. Decisions about problem areas and improvements should be based on accurate and timely data, not on assumptions. Often, all the facts may not be immediately available, and data need to be collected. Insights should be verified by data whenever possible, although informed judgment about problematic processes is a valuable starting point. For example, instead of *assuming* what the client thinks, feels, and needs, the quality assurance team collects information on clients' needs and levels of satisfaction. Data are needed throughout the problem-solving process to 1) help to detect and define problems, 2) identify the root causes of problems or error-prone processes, and 3) monitor effects of

implemented solutions to ensure they are working. Care needs to be taken to ensure both that sufficient data are collected to have the essential facts and that too much time not be spent collecting more data than are really needed.

A Focus on Participation and Teamwork in Quality Improvement: For quality improvement to succeed, workers must participate in making changes in the organization's systems and processes. Empowering workers to carry out quality improvement has two advantages. First, those conducting the daily work often have a better sense of where things go wrong and which corrective actions may be feasible. Second, people are more likely to carry out changes when they feel they have had a part in developing the solutions.

B. The Quality Assurance Process

The four principles described above form the basic philosophy behind the Quality Assurance Project's (QAP)[1] 10-step quality assurance (QA) process. The QA process combines quality management approaches used in the United States, Europe, Canada, and some Latin American and Asian countries, with lessons derived from working with health services in a variety of developing countries. QAP's 10-step process is not a linear step-by-step approach with, for example, planning always occurring first. Rather, the approach



[1]The Quality Assurance Project is funded by the United States Agency for International Development to assist Ministries of Health and other groups to develop and implement mechanisms for monitoring and improving the quality of health services. For a more detailed discussion of the project's 10-step QA process, see: Brown, Lori D. et al., *Quality Assurance of Health Care in Developing Countries*, Quality Assurance Methodology Refinement Series, Center for Human Services, Bethesda, MD, 1992.

is cyclical and iterative, with each step depending on information provided by the others. Where to begin in the cycle depends upon the organization's priorities and needs. The QA cycle encompasses three sets of activities:
1) designing for quality assurance,
2) monitoring quality, and
3) solving quality problems and improving processes.

The following are the 10 steps of the QA process:

Designing for Quality

1. Planning for Quality Assurance: Develop a vision and strategy for QA activities, assign duties, and allocate resources.

2. Developing Guidelines and Setting Standards: Define expectations for quality health services.

3. Communicating Guidelines and Standards: Ensure that those who must apply the standards are aware of them, understand them, and believe in them.

Monitoring

4. Monitoring Quality: Develop indicators and collect data to measure performance and to identify current or impending problems.

Problem Solving and Improving Processes

5. Identifying Problems and Selecting Opportunities for Improvement: Examine information through monitoring, talking to people, conducting special surveys in order to identify existing or emerging problems. Then select the most important problem(s) or problematic process(es) to tackle.

6. Defining the Problem Operationally: Develop a clear statement of the problem in terms of its measurable effect on health service processes.

7. Identifying Who Needs to Work on the Problem: Determine which persons or groups should take part in the problem-solving process to help in analyzing the problem and in developing and implementing solutions.

8. Analyzing and Studying the Problem to Identify Major Causes: Gather and analyze data to understand the nature of the problem and its principal or "root" causes.

9. Developing Solutions and Actions for Quality Improvement: Generate a list of likely solutions, choose the one(s) which best address the principal causes, and design a practical, feasible solution.

10. Implementing and Evaluating Quality Improvement Efforts: Plan the implementation of the solution (who, what, where, when, how), execute the test, and determine

whether to expand implementation, modify the solution to make it more feasible or effective, or drop the solution in favor of another.

Steps 5-10 make up the problem-solving/process-improvement methodology described in detail in this monograph. Although integral to the comprehensive 10-step QA process, steps 5 through 10 can be applied independently for rectifying any health care quality problem.

C. Who can solve problems and improve processes?

Quality assurance, problem solving, and process improvement are not solely the domain of the central ministry of health: quality assurance is everyone's business. QA can be applied by an individual to his or her own work, by a district team to the services it provides, or by a designated body within the ministry of health. The four QA principles (focus on client needs, systems and processes, data-based decisions, and participation) and the problem solving process (Steps 5-10) apply to problems of varying complexity at all levels of the health care system. The context determines which particular QA step or principle should be applied.

Many individuals and teams hesitate tackling quality problems because they feel they do not have the resources to make improvements. Yet improving quality may not require additional resources; progress can often be accomplished simply by adjusting existing processes. The problem-solving process may assist in improving quality even in the face of serious resource constraints. If problem solving is carried out effectively, it can even heighten the efficiency of health service delivery, making better use of existing resources.

D. How To Use This Monograph

This monograph is divided into two cross-reference parts. Part One describes in detail how to conduct each step and suggest appropriate tools. Part Two presents the tools in detail, explaining how and when to apply each and providing step-by step instructions. Table 2-1 lists the tools that might apply during various stages of the problem-solving process. Throughout the monograph, two examples of health service areas are developed to illustrate the problem-solving process and tools. Example 1 deals with the efforts of a supervisor and his supervisee to improve client compliance with acute respiratory infection (ARI) treatment regimens. Example 2 deals with the efforts of a team of district supervisors to reduce excessive waiting times for prenatal services. Boxed sidebars demonstrate how the QA step or problem-solving tool being discussed on that page can be applied either to Example 1 or Example 2.

This monograph is not intended to provide a "cookbook" approach to all problem solving and quality improvement. Some problems may be relatively uncomplicated and, once clearly defined, may lend themselves to straightforward solutions. The problem-solving process may be simple, with some of the 10 separate QA steps more discernible than others. Some problems can be resolved by an individual; others require colleagues' participation (Step 7: choosing a team). Some situations will demand more concentration on

the initial steps (Steps 5-6: identifying and defining the problem) while others will require more focus on understanding the root cause(s) (Step 8: analyzing the problem). For some problems, once properly analyzed, the solution may be obvious. For others, many different changes in the process may be required to produce measurable improvement (Step 9: develop the solution(s)). Some solutions require pilot testing prior to full implementation (Step 10: implementing and evaluating the solution); others will not. Depending on the problem itself, more than one tool may be useful at a given step. This monograph provides information to make it easier to judge when enough time and energy have been spent on any single step and which tools are most appropriate. As in most human endeavors, flexibility, imagination, and common sense are indispensable.

A Few Hints To Getting Started on Problem Solving and Quality Improvement

Here are three hints that may help in applying this monograph's contents to your own problem-solving efforts.

1. After reading Part One on the six steps to problem solving, think about the logic of the steps. Think about a problem you recently encountered and see how well you applied the principles in these six steps.

2. Try out some of the tools at first for some problems that are outside your work situation. Apply them to a simple problem you have at home, or to a problem someone else is having. This way, you can become comfortable with the tools and what they can do for you before you embark on a problem that you may feel pressured to solve quickly. The learning process and quick results do not always go hand-in-hand.

3. We recommend starting with the simpler tools first, and if they do not seem to help your efforts, try the more complex.

Think of problem solving not as a chore or a hopeless task, but rather as a challenge, as the unraveling of a mystery.

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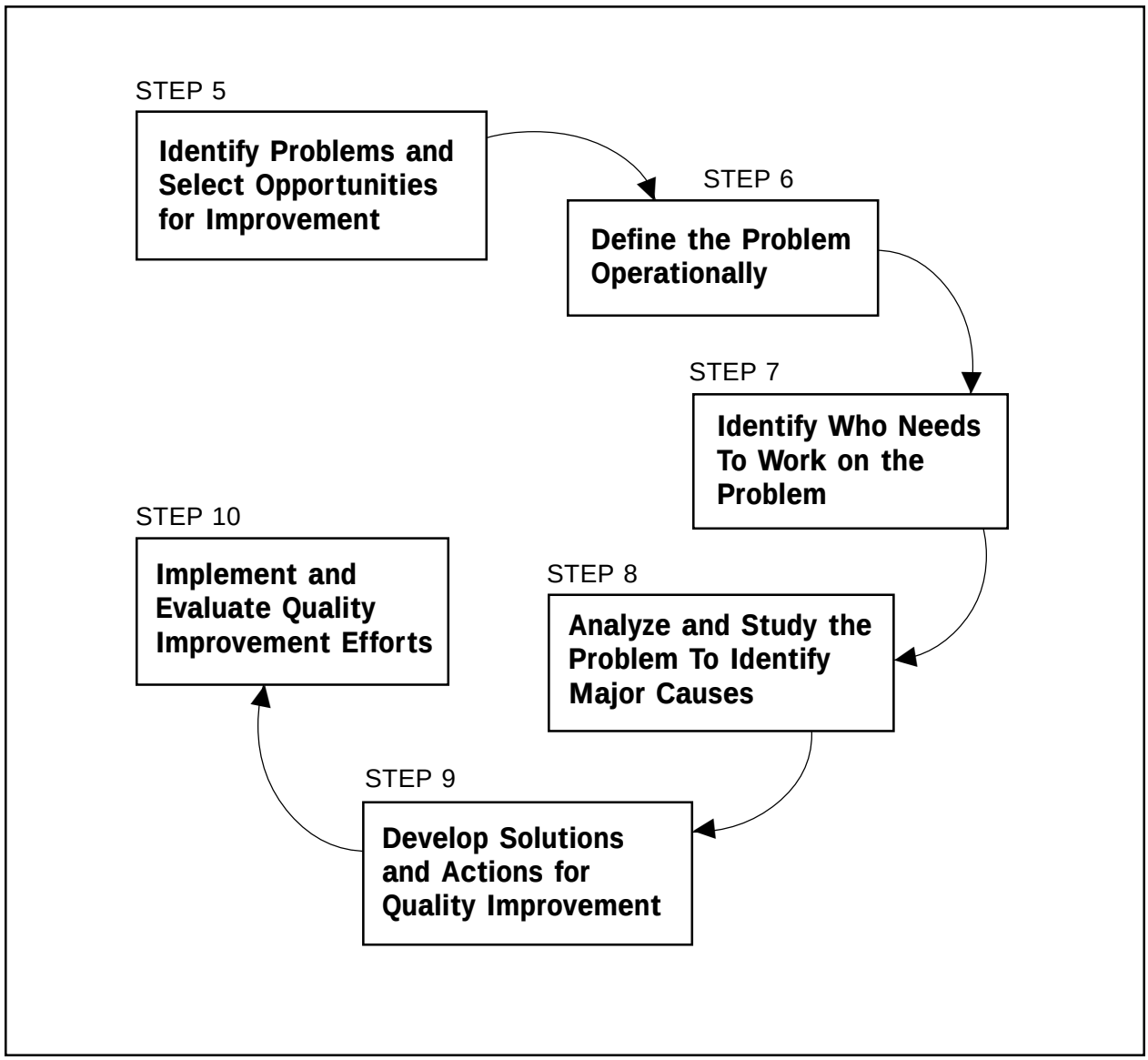
Part One

The Six Steps to Solving Quality Problems and Improving Processes



TOOLS Page

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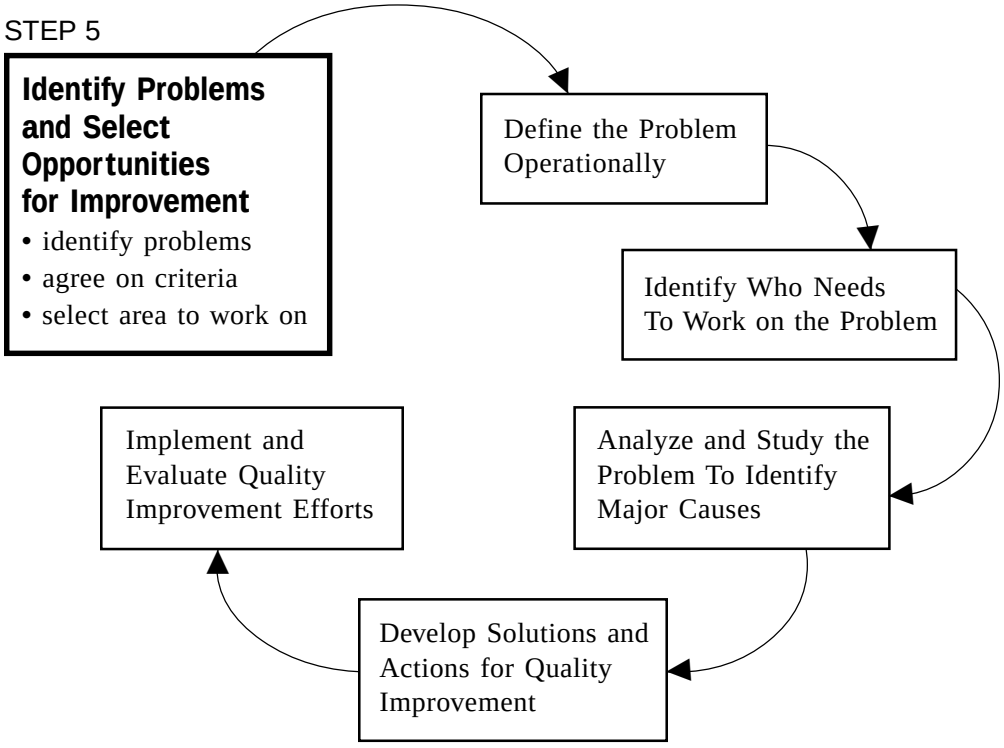
I. STEP 5. Identify Problems and Select Opportunities for Improvement

Improving the quality of health services begins with identifying quality problems and finding opportunities for improvement. Although some argue that this step lies outside the improvement process, it is the only way to start. Quality improvement looks beyond "problems": it applies to improvement opportunities in situations which have not become crises but could be improved. For example, a recent increase in clinic use has been accompanied by a gradual increase in client waiting times. Early attention to monitoring patient flow and to identifying and redesigning potential bottlenecks could prevent a crisis. Quality can always be improved.



The objective of this first step is to select a specific problem or process on which to focus. It is important to select carefully where to focus quality improvement efforts. Quality improvement is most attainable when those involved are enthusiastic about it and when it has a positive effect on patients and their community. Accordingly, managers, clients, and staff should select a problem which is important.

What constitutes a quality-related problem or area for improvement? As stated earlier, it is the gap between what **is** and what is **desired**. An opportunity for improvement need not stem from a major deficiency. It may represent simply a desire to improve a process that is operating in a satisfactory manner in order to reach a higher level of acceptable quality. When identifying areas of focus, individuals and teams often fall into the trap of extremes, believing that there are either no problems or a multitude of them. In our discussion of this step (Step 5), we will present some guidelines for considering possible focus areas and for narrowing down the choices.

Identifying and selecting problem areas or opportunities for improvement can be thought of as a two- (or more) stage cyclical process, each stage comprising three substeps:

Stage One

Select a service, care process or area on which to concentrate, e.g., outpatient care, surgical services, patient assessment, medication prescribing, and billing:

- ♦ review the areas/services that you are presently providing,
- ♦ agree on criteria for selecting an area on which to work and the process for making this choice,
- ♦ select an area on which to concentrate.

Stage Two

Within the area of concern, select a specific problem or opportunity for improvement, e.g., postoperative infections and outpatient waiting time:

- ♦ identify specific problems or improvement opportunities,
- ♦ agree on criteria for selecting an area on which to work and the process for making this choice,
- ♦ select a problem or specific process on which to work.

A. Identify Potential Areas for Improvement

Any staff member of a hospital or clinic can identify a potential area for improvement. For example:

- ♦ The Quality Assurance Committee may identify a potential area based upon its impact on the organization's overall quality. These areas for improvement usually require the participation of several departments in the organization.
- ♦ A department manager may identify a problem because of his or her team's inability to meet its goals and objectives.
- ♦ A group of workers may identify a project to increase their ability to work more efficiently.

To identify potential areas for improvement, it is essential to consider sources of information that can explain the current situation. Several sources can be used to identify specific areas for improvement. Information sources and appropriate data collection methods are listed in Table 1-1; the data collection methods are listed in order of ease in obtaining information. However, it should be noted that ease and reliability are not always compatible.

One need not be restricted to a single source or method for finding a potential area for

improvement: a combination of sources can be used to list potential areas for improvement or problems on which to work.

An effective, ongoing quality improvement system depends upon a management and health information system that routinely monitors important service quality indicators. Such a monitoring system provides timely data that can point to existing or emerging problems and potential areas for improvement. Besides the routine monitoring system, several other sources can provide information about quality deficiencies. These can be formal sources, such as surveys or sampling of existing records, or more informal methods, such as interviewing staff or clients. *Flow charting* a process that needs improvement can also reveal specific problems *(see page 2-20)*.

Table 1

Sources of information to identify problems and / or opportunities for improvement	Data collection methods
Data from monitoring or ad hoc studies: using existing sources of data, or rapid assessment techniques.	Reviewing clinic records, service statistics, reports; conducting observations using checklists; using survey questionnaires.
Staff concerns: asking workers about their concerns regarding quality and the processes they carry out.	*Brainstorming (see page 2-7)* at a meeting, interviewing, *flow charting (see page 2-20)* a process.
Impressions or data from personal observation: going to health facilities to look around.	Observing informally, or formally through observation checklists.
Feedback from clients: asking those who receive or use services how satisfied they are with them and what problems they feel are important.	Conducting informal conversations, compiling complaints, using *client windows (see page 2-42)*, conducting surveys or focus group discussions.

B. Agree on Criteria

When selecting services on which to focus, begin by listing the activities carried out, e.g., immunizations, curative care, maternal care, inpatient care, well-baby care. These activities or processes can then be ranked using the criteria of high risk (activities that could have the most negative effect if quality is poor), high volume (activities conducted most often), and problem prone (activities that are susceptible to errors). A *matrix (see page 2-14)* which rates activities and processes in terms of these criteria can be used to select the focus areas. Once an activity has been deemed a priority, its specific processes can be listed and the ranking process repeated until a reasonably narrow area for improvement has been selected.

Managers often find that they can work on only a few problems at a time. When several problems have been identified, choices must be made based on clear reasoning. People

always apply criteria when making decisions, although the criteria are usually unstated. However, it is essential that the selection criteria in the quality improvement process be clearly stated. All involved must recognize the importance of the selected problem and agree that the time spent is worth the effort. Quality improvement takes time and is most effective when focused on the "vital few," e.g., what people consider to be important and effective.

EXAMPLE 1

A district-level supervisor, while conducting a supervision visit to one of his health centers, entered into a discussion about quality of care with his supervisee. They developed a list of areas in which the supervisee encountered professional frustrations. They produced the following list:

- *not enough antibiotics,*
- *children do not come for their measles immunization,*
- *the community does not listen to the health worker.*

Each group or team should develop its own selection criteria, but the following list of commonly applied criteria can be used as a guide:

- **The problem is important**: It has been a problem for some time and is widespread. The benefit of solving it is obvious.
- **Support for change exists** in this area: People recognize the need for change. Management wants this to be worked on.
- **The project has emotional appeal/visibility**: People are motivated to work on this area.
- **There are risks** associated with *not* addressing this area: If something is not done about this, it may create other problems.
- **The project is within your sphere of influence**: Those who are interested in problem solving should have some control over the situation and the authority to make changes.

For initial quality improvement efforts, we suggest some additional criteria: The effort should address a **small** problem and one that can be **dealt with quickly**. If quality improvement is focused on a specific process, that process should be a **permanent** one: there is no need to work on a process that will eventually be eliminated.

C. Select the Targeted Area for Improvement

Once people have reached agreement on the criteria and their meanings, the specific problem area can be chosen. Whenever the particular decision can have a major impact on the group, the choice should be made by consensus, with everyone supporting the proposal. It does not mean that everyone gets his or her first choice, nor does it mean a majority decision (in which a minority gets something it does not want). Consensus means that the final choice is acceptable to all parties. Although developing consensus can be a time-consuming process, it is a wise investment as it helps to prevent future resistance.

EXAMPLE 2

A team of district supervisors met to determine where they wanted to start improving quality in their district. They followed a two-stage process to identify the improvement opportunity to work on. First they selected a broad program area, then they chose a specific problem within that area. To select the program area, they reviewed the types of services they provided: maternal care, well-baby care, curative treatments, immunizations, and communicable diseases. They ranked these activities according to the health risks for the population, the volume of activities, and how problematic these activities seemed to be (the quality status). Using a system of multivoting, they assigned a value of 1 through 5 to each of these activities for the three criteria. They determined that maternal care was the priority area because monitoring data had shown that many children were born with low birth weights (causing health risks later on, therefore a high volume health risk) and they felt that the quality of maternal care was not what they wanted it to be (quality status).

Next they reviewed the characteristics of quality (i.e., access, technical competence, etc.), to determine which were most important. They then held a meeting with their staff to discuss quality issues and interviewed some clients to learn of any complaints they had regarding the services they received. For each problem identified, they identified the characteristic of quality associated with that deficiency. In the end, the district team developed a list of four major areas for improvement:

- waiting times for pregnant women were very long and seemed to discourage women from coming for prenatal care (access),
- counseling of pregnant women appeared to be useless as women did not seem to understand the importance of good nutrition and malaria prophylaxis (technical competence, interpersonal relations),
- health centers were often out of stock of malaria prophylactic drugs and iron supplementation (access),
- standards for the content of prenatal visits were not always followed (technical competence).

The following are some methods for making decisions based on criteria (stated or unstated), as well as some of their advantages and disadvantages:

- ***Expert makes decision*:** The expert in the process intuitively knows which problem meets most of the criteria and chooses which problem should be solved. This method is fast, but there is danger that the expert could be wrong or that some will be unhappy with the expert's decision.

- ***Voting (see page 2-11)*:** In this commonly used method, individuals consider decision criteria themselves. It can be quick and efficient, but a minority can be left unhappy. The group may lose its team spirit, although some forms of voting can help to maintain teamwork.

- ***Matrices (see page 2-14)*:** A tool for guiding decision making based on previously agreed upon criteria. The group applies clearly stated criteria in an open discussion. This method can take time and risks adding complexity to the decision making process. However it is the most likely method for achieving consensus because the criteria are applied by the group.

D. Some Guidelines for Knowing When to Move on to the Next Step

One critical issue in applying these steps to problem solving is knowing when one step is completed and it is time to move on to the next. The following questions serve as a guide for when to **Define the Problem Operationally**:

- Do you (or the team) feel that the selected problem is important?
- Do you (or the team) *want* to work on it?
- Could you explain to someone else why this area for improvement has been chosen?
- Can you explain how this "problem" affects the quality of services and the population served?

If problems have not become self-evident (through monitoring or more informal means), two additional methods for identifying quality deficiencies include:

- **Looking at processes and choosing measures of quality.**
- **Choosing the characteristics of quality that mean the most to the context/situation:** Quality has many faces, and reviewing the various characteristics of quality can help to focus attention. These include: effectiveness, efficiency, technical competence, interpersonal relations, safety, continuity, accessibility, and amenities. The team can decide (using *voting techniques*, *see page 2-11*) which of these are relevant to their situation and which cause the most problems.

Both methods for identifying opportunities for improvement may, however, require the use of data to verify that these *are* problem areas or to provide more information about the problem area itself.

EXAMPLE 1

The supervisor suggested using a criteria matrix to choose the problem because he did not want to influence his supervisee too much, yet he wanted the supervisee to think clearly about what to choose. They agreed upon the following criteria: importance, risks, sphere of influence.

They developed the following matrix (using a scale of 1 to 3, i.e., from least to most), with the supervisor and the supervisee each getting a vote of equal weight:

Criteria/Problem	**Antibiotics**	**Immunizations**	**Community does not listen**
Important	3 + 1 = 4	2 + 1 = 3	1 + 3 = 4
Risks	3 + 2 = 5	2 + 2 = 4	2 + 3 = 5
Sphere of influence	2 + 2 = 4	2 + 1 = 3	3 + 2 = 5
Total	**13**	**10**	**14**

The matrix results led to choosing the listening issue, even though the supervisor was not too sure this was a "good" problem. However, he decided to go on to the next step to see how the problem would become defined as they worked on it.

EXAMPLE 2

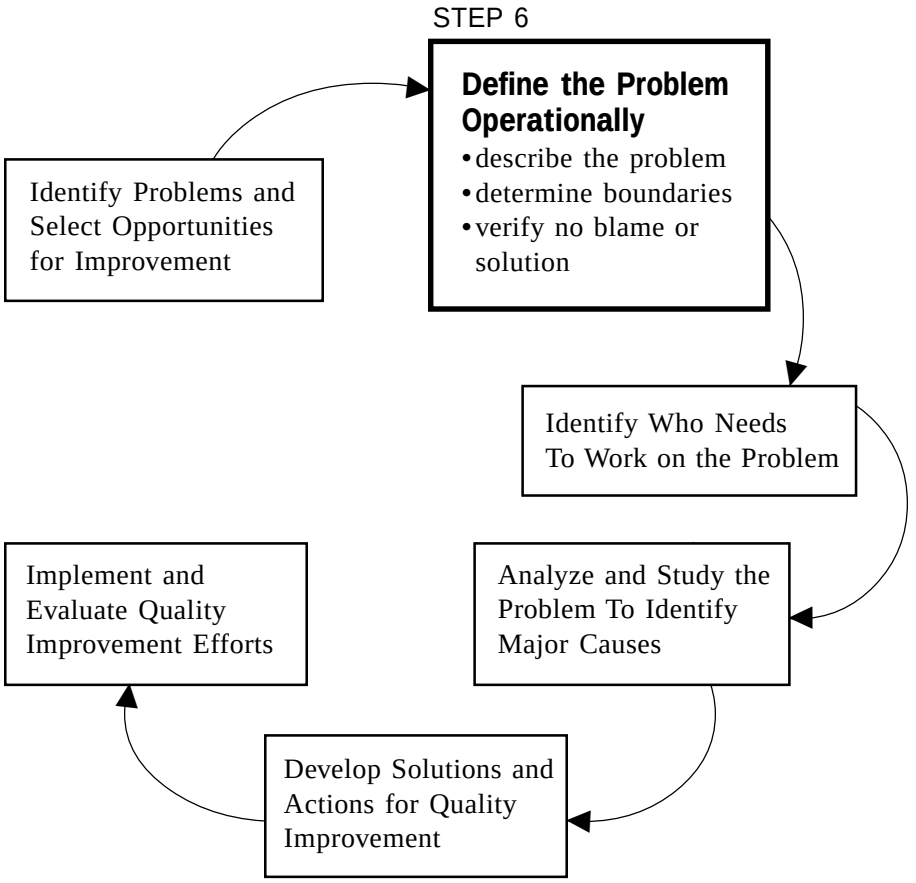
The district team discussed selection criteria and chose emotional appeal/visibility and importance as the criterion. They also felt it should be something that could be dealt with quickly. They then decided to conduct multivoting to select the problem to work on. Each of the four team members would be given a hypothetical $5.00 to spend and they could distribute this amount in any way they wanted, as long as they each applied the agreed upon criteria. The following results were obtained:

	Team Members				
Problem	**1**	**2**	**3**	**4**	**Total**
Waiting time	$4.50	$3.00	$4.00	$2.00	$13.50
Counseling	$0.00	$0.00	$0.00	$2.00	$2.00
Drug shortage	$0.00	$2.00	$1.00	$0.00	$3.00
Not following Standards	$0.50	$0.00	$0.00	$1.00	$1.50
Total	$5.00	$5.00	$5.00	$5.00	$20.00

Accordingly, they chose to work on waiting times for prenatal care.

II. STEP 6. Define the Problem Operationally

The purpose of Step 6 is to state clearly the targeted "problem." An operational definition of a problem or quality deficiency expresses the difference, in specific and observable terms, between the current and desired state of affairs. A clear problem statement helps to focus problem-solving efforts throughout the remaining steps. If the problem is poorly defined, it will become apparent later in the process that each team member has been thinking of a "different" problem. The lack of a clear problem statement can lead to internal conflict and to a loss of focus and motivation.



In identifying and selecting a problem or a deficient process on which to focus, it is natural to think about causes and remedial action. However, it is important not to allow these ideas to limit thinking or creativity. At this step in the improvement process, it is necessary to keep an open mind about both the cause(s) and potential remedies. Identifying the root cause(s) and generating effective solution(s) are the tasks of Steps 8 and 9 respectively. One way of maintaining an open mind, therefore, is to formulate the problem statement so that it does not include any hint of its cause or potential solution, and so that it does not implicitly "blame" someone for the difficulty. A problem statement should clarify the exact target of quality improvement, indicating clearly *what* is deficient, not *why* or *how* to fix it.

There are three steps to defining the problem operationally:

- Describe what the problem is and how you know it is a problem.
- Determine the boundaries of the problem: where the problem begins and ends.
- Check to see that the statement does not assign any blame or include an implied cause or solution.

A. Describe What the Problem Is and How You Know

The problem should be described in measurable, operational terms: if the problem is not measurable, it will be difficult to know when the problem has been solved. The following questions are designed to help to describe the problem:

1. *What* is the problem (not the cause or the solution)? What is not functioning as we desire?

2. *How* do we *know* it is a problem? What information do we have to support or confirm the existence of the problem or deficiency?

3. *What* are the *effects* of this problem on quality and on the population we serve?

4. *How long* has this been a problem? How *frequently* does it occur?

5. *How* will we *know the problem is solved*? What does the "desired" state look like? What data will we need to answer these questions?

> ***Hint:*** *If it is difficult to define the problem operationally, think about the effect of the problem, on the population being served. Think about how you would know that the problem had been solved: what would be different?*

B. Determine the Boundaries of the Problem

One common difficulty encountered in quality improvement is that an effort which starts by focusing on a small problem grows into tackling an enormous problem, beyond the capability of the individual or team. Thus, it is important to set some limits or boundaries around the problem; it is important to determine not only what is to be worked on, but also what is **not** to be worked on. These boundaries of the problem could be stated in terms of:

- Process or activity itself: where does it start and where does it end?
- Scope: which specific facilities, clinical services, geographic locations?
- Specific measures of quality: timeliness, effectiveness, etc.

It is not necessary to try to improve everything simultaneously. Teams are encouraged to start with a problem that can be handled comfortably; there will be time later to deal with other quality deficiencies.

C. Verify That the Problem Statement Does Not Assign Blame or Imply Causes or Solutions

Stay open-minded about cause(s) and potential solutions when formulating the problem statement. If the operational definition of the problem or deficiency already includes causes or solutions, then creativity has already been limited. If it already says who is to blame, not only does this imply a cause which may be incorrect, but it often alienates the very people who must be involved in designing and implementing any solution. Check to see that the problem statement describes the deficiency, not why it occurs or how to correct it. There will be plenty of opportunity to analyze the process and to collect data supporting hypotheses about causes in later steps.

EXAMPLE 1

The supervisor and his supervisee worked to develop an operational definition of the problem. They ran into a few difficulties as they tried to answer the guideline questions:

Supervisor:	Supervisee:
1. "What is the problem?"	"The community doesn't listen."
"That is fixing blame."	
2. "How do we know it is a problem?"	"They do not follow our advice."
"That still states the problem as someone else's fault."	"The counseling we provide does not seem to change their behavior with respect to treatment regimens we prescribe."
"But this states a cause."	"Patients do not respect the treatment regimens we prescribe."
3. "Is this true for all illnesses?"	"Mainly for respiratory infections."
4. "How do you know this?"	"People have said so."
5. "What are the effects on the population we serve?"	"They do not get better when we try to treat them."
6. "How long has this been a problem?"	"As long as I have worked here."
7. "How will we know when the problem is solved?"	"When the population takes the entire course of drugs that we prescribe."

By going through the questions, the team developed the following problem statement: ***Patients do not finish their treatments for respiratory infections. This problem, which can cause lingering health problems and resistance to antibiotics, has existed for a long time.***

EXAMPLE 2

The District team wrote three versions of their problem statement before they arrived at one that had all the necessary elements:

1st attempt: Waiting times for pregnant women are long because there are not enough midwives to see them all. This discourages women from coming for prenatal care.

2nd attempt: Waiting times for pregnant women are long because the midwives take too long for tea breaks. This discourages women from coming for prenatal care.

Final statement: ***Waiting times (elapsed time from when they arrive at the health center to when they are seen by the midwife) for pregnant women have been shown to take up to three hours. This has been stated as a reason that women do not make the desired four prenatal visits before delivery.***

D. Ensure that the Problem Statement is Clear

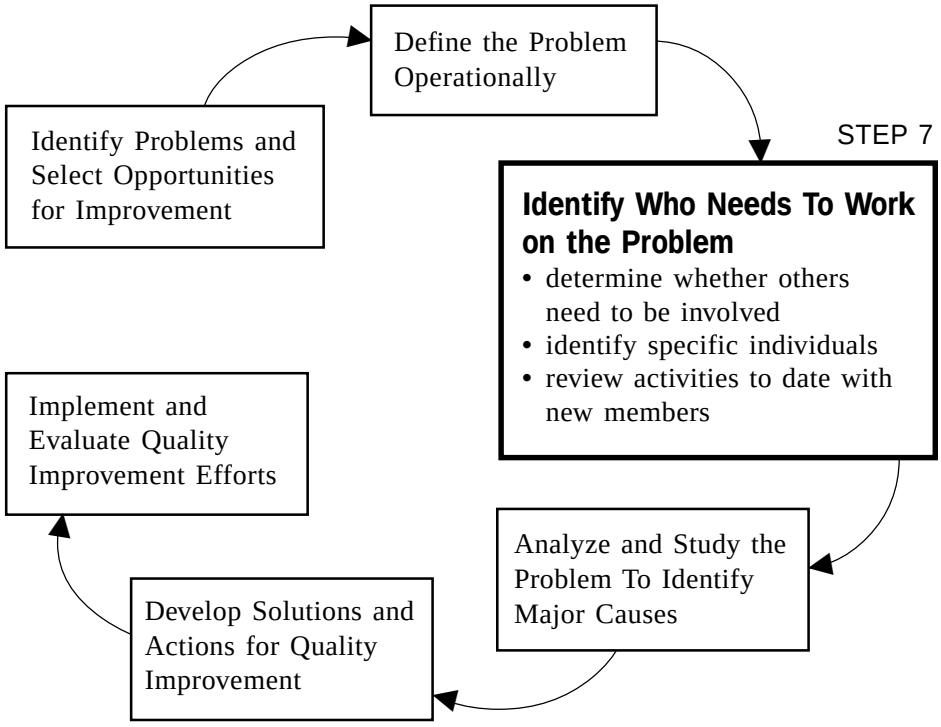
Review the problem statement to ensure that it is clear and understandable. If an individual is working alone on a problem, he will find it is useful to ask colleagues to read the problem statement and express in their own words what problem they think is being worked on. If a team has developed the problem statement, have everyone in the group describe what he or she thinks the terms or words used in the statement mean. It is common to find that different understandings still exist. One useful method is to ask everyone: How will we know when the problem is solved? How will things be different?

> ***Hint:*** *Even if a good problem statement has been developed at this point, it may need to be refined later on, since information obtained during the analysis phase may lead to changes in perspective about where to focus problem solving efforts.*

E. How to Know When To Go on to the Next Step

Finally, when the problem statement is clear and understandable to all concerned, it is time to progress to the next step, identification of the membership of the problem-solving team. This step focuses on considering who should be involved in the search for a solution to the problem or a way to improve the process in question, whether as informant, consultant, team member, or in another way.

III. STEP 7. Identify Who Needs To Work on the Problem



Many problems or processes can be resolved or improved by the individual health worker or manager using quality improvement practices. However, one person usually does not have all the information necessary to solve the problem; most problems need more than one person to understand fully what is happening. Quality improvement efforts work best when those who are involved in the process take part in the analysis and development of solutions. Determining who should work on the problem involves:

- identifying who needs to take part and in what capacities (team members, ad-hoc members, consultants, etc.),
- convening the team, and
- defining the team's working procedures.

A. Identify Others Who Need To Take Part

Quality assurance often requires teams composed of people from different departments and functions in the organization. Teams are needed due to the increasingly complex and multifaceted problems in health care. Solving these complex problems requires many divergent points of view and the effective collaboration of many individuals. The following are additional advantages derived from problem solving in teams:

- a more thorough working knowledge of the process,
- a more open atmosphere with less blaming of others for problems,

- a greater number of ideas to resolve problems, and
- greater acceptance of solutions and a higher implementation rate.

Team membership is determined by the person or group that developed the problem statement. To help them to determine who needs to take part, they need to answer a few questions: Where (what departments/sections) is the problem observed? What tasks are involved? Who carries out these tasks? Who determines how the tasks should be done? Who provides inputs to these tasks? Who uses the outputs of these tasks? If the answer to all these questions is a single individual, then the problem-solving effort does not require a team. If the answer to any or all these questions includes others, their involvement must be considered.

The following questions can help to identify the types of people that can be useful to the quality improvement efforts:

- Who works within the process containing this problem?
- Who is affected by the process or the problem?
- Who makes decisions related to the process (who has authority over it)?
- Who has the technical expertise to help understand the process and the problem?

EXAMPLE 1: Compliance with ARI Treatment Regimens

To decide who might help, the supervisor and supervisee reviewed the problem statement:

Patients do not finish their treatments for respiratory infections that can cause lingering health problems and resistance to antibiotics. This problem has existed for a long time.

They decided that patient non-compliance with the ARI treatment regimen was the outcome of the process that begins with the interaction between the patient and the nurse, when diagnosis is made and medicines are prescribed. It ends with the actual taking of the medication at home. With this in mind, they answered the guiding questions:

- Who works in the process? The nurse, the pharmacist, the patient.
- Who is affected by the process? The patient, the family of the patient.
- Who makes decisions about the process? The supervisor, the patient.
- Who has technical expertise about the process? The supervisor, the community members.

They decided to create a small team comprising the supervisor, the nurse, and the pharmacist. The supervisor convinced the nurse that the causes of the problem could be best understood if the community were involved in problem solving, since in the end, it is the members of the community who must follow the treatment regimen. So they added two community representatives.

One useful tool to help to identify people involved in the problem area is a *flow chart (see page 2-20)*. A *flow chart* points out who supplies inputs to the process, who carries out specific steps, and who uses the output.

The people chosen provide special knowledge, insights, and services during the problem-solving journey. It is important to note that each person selected should have direct, detailed, personal knowledge of some part of the problem. They also must have time for meetings and between meeting assignments. As needed, the team may call upon others outside the team who have specialized knowledge and experience about the problem. These "part-time" members can be external consultants or others within the organization.

EXAMPLE 2: Prenatal Care: Waiting Times

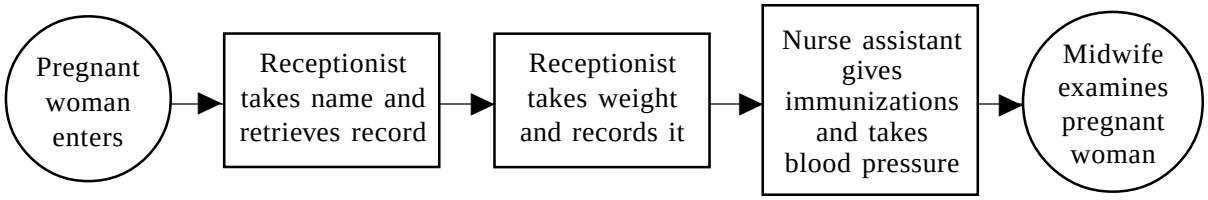
The Prenatal Care Process [high-level flow chart]

The team reviewed the problem statement:

Waiting times for pregnant women (elapsed time from when they arrive at the health center to when they are seen by the midwife) are up to three hours in duration. This has been stated as one reason that women do not make the desired four prenatal visits before delivery.

They decided to make a high-level flow chart of the prenatal care process to help to identify who was involved in that process.

The Prenatal Care Process



Given this process, the district supervisory team decided that they should include the following people on a process improvement team:

- Receptionist (works in process),
- Nurse assistant (works in process),
- Midwife (has technical expertise),
- District MCH supervisor (has technical expertise, makes decisions about the process),
- Health center manager (makes decisions about the process).

However, they realized that they could not have every receptionist, midwife, etc. within the district on the team. They decided to focus on one facility that seemed to have the most problems and complaints for their initial problem-solving efforts. The district MCH supervisor notified the manager at that facility, who agreed to convene the initial meeting of a facility team to improve antenatal care by reducing waiting time.

At the team's initial meeting, the midwife was asked to serve as team leader while the nurse assistant agreed to take responsibility for documenting the team's activities, using both a QA Storybook and QA Storyboard *(see pages 2-46 thru 2-49)*. She began by posting the problem statement, the high-level flow chart, and the names of all the members of the process improvement team on the wall, and promised to have a poster and notebook ready for the next meeting.

B. Convening a Team

A team is a group of people who make particular contributions toward achieving a common goal such as resolving a quality-related problem. As discussed in part A, including people in the problem-solving process is more likely to result in greater participation and less likely to meet resistance later when trying to implement change. If a team is needed to solve the problem or to improve the process, begin with a few team members (**not** to exceed 8). If more than 8 members are needed, it is wise to reconsider the problem statement. Perhaps the problem selected is too large. The composition of the team may need to change as more aspects of the problem, the causes, or the types of solutions are brought to light. If new group members join or replace those who left, it is important to bring the new members up to date.

Not everyone who can provide useful information needs to be a "full time" member of the team. Help should be solicited from those involved in the process on an as-needed basis. Commonly, participation of specific individuals can best be requested at specific moments to furnish information to help understand the problem or its causes.

C. Define the Team's Working Procedures

Once a team is formed, it needs to convene regular meetings. During the early meetings, the team should define the group's working procedures, e.g., roles and responsibilities, how the team will make decisions, and how often they will meet. To be efficient, the team must agree not only what is going to be done (goals) but also on how the group will work together. There are a few tips for developing effective working procedures:

1. Determine team roles and responsibilities: leader, recorder, facilitator/timekeeper, team members.
2. Determine how decisions will be made: consensus, majority voting, leadership decisions.
3. Establish ground rules for meetings: honesty, dignity, do not interrupt, etc.
4. Determine how often and for how long the group will meet.
5. Develop meeting agendas (tasks to be accomplished, topics to be covered, and methods to be used) and adhere to them.
6. Decide how to document the team's quality improvement progress: QA Storybook and QA Storyboard.

Good documentation helps to keep the team focused on the quality improvement process and allows team members to present their work to others. Many organizations have successfully employed QA Storybooks and QA Storyboards (*see pages 2-46 thru 2-49*) to tell their quality improvement "stories" in a structured and comprehensible way.

Once a team has defined its operating procedures, its first task is to review the problem

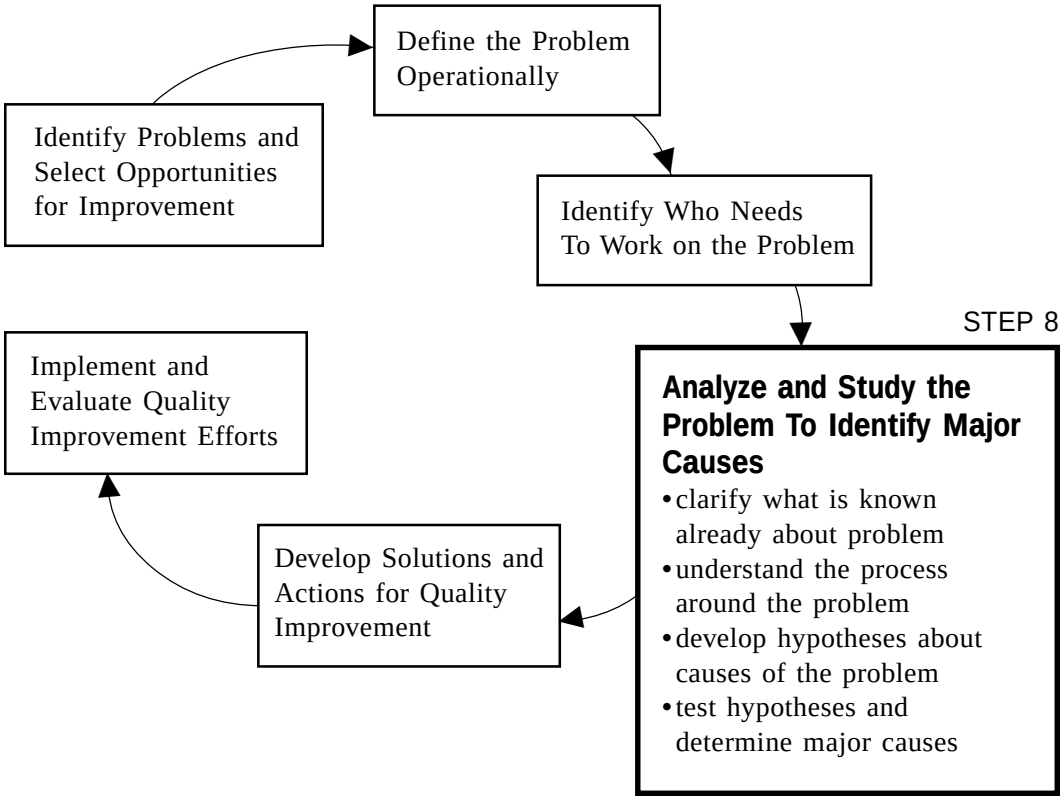
statement and to gain a common understanding. Sometimes the problem statement may need to be revised based on fresh insight or information.

D. How To Know When To Proceed to the Next Step

It is time to proceed to the next step when all those who will work on the problem have reached a common understanding of the problem statement and the team's procedures for working together.

IV. STEP 8. Analyze the Problem and Identify Major Causes

This is the step in which the team (or individual) will attempt to understand more about the problem or quality deficiency: Why does it happen? People often identify a problem, decide they already know everything about it (including the cause), and jump to a solution already in mind. When they do this, they often find that the problem has not gone away, even after the solution has been implemented. Why? They did not broaden their thinking and verify their assumptions with data. The causes of a problem are not always obvious. Good problem solving means resisting the temptation to jump to conclusions. The step described below is the crux of the quality improvement process because it addresses the question: What is really going on here?



The objective of this step is to identify the problem's major causes in order to choose an appropriate solution. This can be done very quickly if the problem is simple and the cause is obvious, or it can take longer when the problem is more complex and there are several possible causes. Problem analysis can be likened to peeling an onion: there are many layers to be removed before reaching the "heart of the matter," i.e., the major cause. It can also be thought of as a series of investigations to narrow down the problem. By exposing the problem's components, it is possible to reach the root or underlying cause. Given the diverse nature of problems, there is no single method for analyzing them. Yet the following steps will help the team to stay focused:

- Review the problem statement (Step 6) and clarify what is already known about the problem: who, what, where, when, how often.

- Understand the process in which the problem occurs.
- Develop hypotheses about the causes of the problem.
- Test the hypotheses and determine the major cause(s).
- Examine the cause and determine if the makeup of the team needs to be modified.

A. Review the Problem Statement and Clarify What Is Already Known About the Problem

Before beginning analysis and data collection, it is important to pause for a moment to review what is already known about the problem and what else must be understood. The problem statement developed in Step 6 should reflect the answers given to the four following questions. It is also useful to review the problem statement in the light of information now available from team members and other informants and, if necessary, to agree on a revised problem statement. That statement should describe the problem in terms of:

- **Who** is involved or affected by the problem?
- **Where** does the problem occur? Is it widespread or isolated?
- **When** does the problem occur? Certain days? Certain times of day? Sporadically?
- **What** happens when the problem occurs?

This does not require launching into an immediate, extensive data collection effort. The objective is to review available data to see if these questions can already be answered. If not, the team should reconsider whether a problem really exists.

EXAMPLE 1: Compliance with ARI Treatment Regimens

The supervisor, the nurse, the pharmacist, and the community representatives convened to discuss what they already actually knew about the problem.

Who: The team members felt that they represented those workers involved in ensuring patient compliance with ARI treatment regimens.

Where: They realized that they had no data that would tell them how widespread the problem was: Did it affect all the patients? Did it affect only patients from certain villages? What percentage of patients were not starting the treatment regimens? What percentage were not finishing them?

When: Team members felt that the problem was ongoing and did not seem to follow any periodicity. However they recognized that with no data to say how extensive the problem was, they could not know whether it was seasonal or year-round.

What: Evidence that patients were not finishing their treatment included the fact that they often disposed of their drugs, that they did not go to the pharmacy to have prescriptions filled, that they did not come for follow-up injections, and that some returned with worsening conditions.

Although they did not think it necessary to revise the problem statement, they asked the community representatives to see how widespread the problem was in villages in their area.

EXAMPLE 2: Prenatal Care: Waiting Times

The team reviewed what they already knew about the problem:

Who: pregnant women, receptionist, nurse assistant, midwife.

When: The problem appears to occur mostly on Mondays and, to a lesser extent, on other days. It seems to be a regular pattern, not sporadic.

Where: The problem occurs in most health centers, although the team was not sure how widespread the problem was.

What: *The pregnant women become discouraged by the long waiting time.*

B. Understand the Process in Which the Problem Occurs

Most problems or quality deficiencies relate to the way work is conducted (the process). Yet people do not always have a clear picture of the process, especially the links between their work and the work of others. Thus, one important step in the analysis of the problem is to gain an understanding of the process itself and to develop consensus among the team members about how the process actually operates. The latter is distinct from how it is "supposed" to operate. This is the start of the "peeling of the onion": identifying where the problem is located within the process.

Team members must have a common understanding of the process to save time and energy while working through the remaining steps. One way to do this is to visualize the actual flow of the process in which the problem occurs. There are two types of tools that can be applied: *system modeling (see page 2-17)* and *flowcharting (see page 2-20)*.

Occasionally while examining the process, the group discovers that it is missing facts needed to understand what is happening. Data may need to be collected. Table 1-2 presents some guidelines for determining which tools are most appropriate for beginning the examination.

Table 1-2

Tool	When to Use
System modeling	System modeling is most useful when an overall picture of the system in which the problem is occurring is needed: ▪ to see who provides resources (inputs), what the process is, what outputs are produced, and who is affected by the outputs and how, ▪ to better understand the effects of the problem, i.e., how it affects the output of the system, the immediate effects of that output on the clients, and any long term impacts).
Flowchart	Flowcharts are useful tools when the process in which the problem is located has already been clearly identified and specific steps in the process need to be examined.
Cause-and-effect analysis (preliminary)	Occasionally: If the problem statement has not yet pointed to a specific process that is responsible for the problem, a preliminary cause-and-effect analysis may help locate the process in which the problem is occurring. Cause-and-effect diagrams serve to structure brainstorming about potential causes of the problem and may therefore help to identify processes that contribute to the problem.
Force-field analysis (preliminary)	Occasionally: if the process leading to the problem is not evident from the problem statement, a preliminary force-field analysis may help to identify processes that potentially cause the problem, as well as those that might reduce it. Force-field analysis is particularly useful for narrowing down where to look when the problem deals with subjective issues, such as morale, management effectiveness, or work climate associated with specific processes.

EXAMPLE 2: Prenatal Care: Waiting Times

District team members, already understanding which process they needed to examine, decided to expand on the high level flow chart they had developed when determining team membership. They first developed a basic second level or detailed flow chart and then went back and added in points where they thought pregnant women had to wait. The detailed flow chart was posted on the Storyboard.

The team felt that it did not know which of these waiting spots was most responsible for the long time that pregnant women spent in the health center. The members decided to collect some data to determine which delay was the major cause of the long waiting time. They gave each pregnant woman a piece of paper marked with the time when she walked into the health center, and then each of the health workers wrote down what time he or she provided service. The data were collected for one week, tabulated, and posted on the Storyboard. They showed the following results:

Part of Process	Mon mean	Tues mean	Wed mean	Thurs mean	Fri mean	Weekly Average
1. Entry to receptionist	30 min	15 min	18 min	15 min	14 min	20 min
2. Receptionist to nurse assistant	32 min	18 min	21 min	20 min	21 min	26 min
3. nurse assistant to midwife	58 min	35 min	30 min	28 min	35 min	42 min
Sum of mean waiting times	**120 min**	**68 min**	**69 min**	**63 min**	**70 min**	**88 min**

These data showed them that there were two things happening: the wait from when the patient first saw the nurse assistant to when she saw the midwife was the longest, and this was worse on Mondays than on other days. Because the root cause is often not obvious, it is best to start by generating a list of as many possible causes as possible. A cause-and-effect analysis (see page 2-26) helps to look beyond the symptoms.

C. Determine if the Team's Composition Must be Modified

At this stage, it is wise to review the composition of the team to determine whether additional members are needed. The team should ask itself the following questions:

- Does anyone on our team work in the area of the process in which the problem is located?
- Is anyone on our team directly affected by the problem? Are others affected?
- Does anyone on our team have authority to make decisions related to the problem's cause?
- Do we have the technical expertise to understand the cause and what might rectify it?

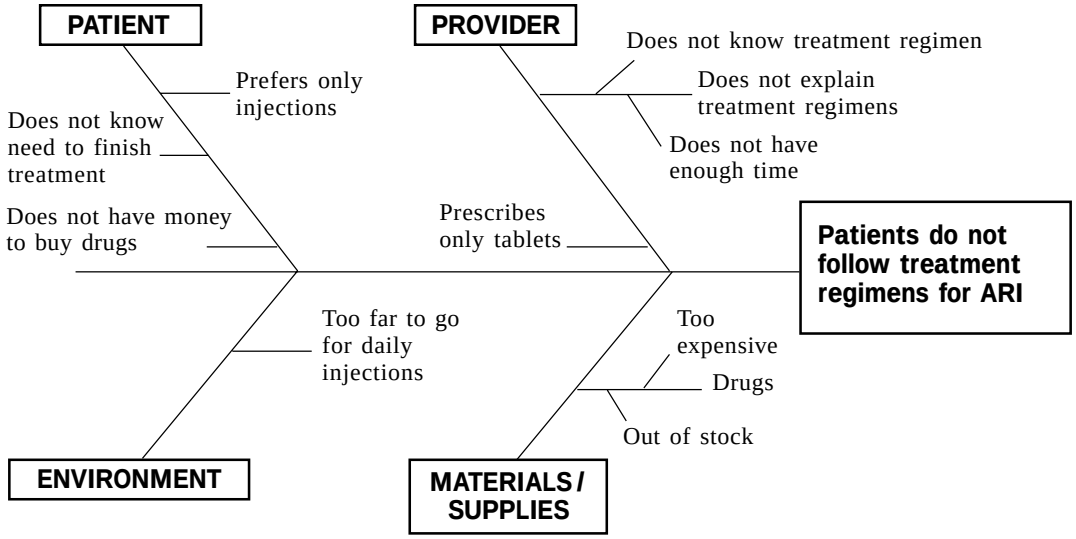
If the answer to any of these questions is "no," the team should consider changing its

membership or adding new members who meet the above qualifications. As with early changes in membership, new members need to be brought up to date on what the team has done and the results it has found. If the team has documented its activities using a Storyboard and Storybook, bringing new members up to date is much easier.

EXAMPLE 1: Compliance With ARI Treatment Regimens

Team members decided that before embarking on an analysis of the process, they would use a cause-and-effect diagram to help them see the various aspects of the problem. They first determined the possible categories of causes: the patient, the health provider, the environment, materials/supplies. Then, they used the brainstorm technique to develop the following diagram, which they posted on their Storyboard:

Cause-and-Effect Analysis for Treatment Regimens



They then discussed which causes were most probable: patients do not know that they need to finish their treatments, they prefer injections, and the providers do not explain. They decided to look at the process of care, starting from when the patient arrives, to see what happens there. They developed the following high level flow chart, again which they posted on their Storyboard:

Patient arrives → **Health provider examines patient and determines diagnosis** → **Health provider determines treatment** → **Patient goes to pharmacist** → **Pharmacist gives drugs** → **Patient takes drugs**

Following construction of the flow chart, they discussed how the counseling/explanation to the patient takes place. They discovered that the nurse thought the pharmacist performed this task and the pharmacist thought the nurse did. In reality, no one was doing it.

D. Develop Hypotheses About the Causes of the Problem

Improving quality means eliminating the problem's root cause. Diseases are cured by treating their causes, not their symptoms; this principle applies to problem solving as well. Once the problem has been located more specifically, it is time to develop hypotheses about the causes. The term "hypotheses" is used because it remains unclear whether these are the true causes. The validity of the cause will be verified later by collecting data.

It is possible that the cause(s) will be revealed while *flowcharting (see page 2-20).* Examples of causes may include a step in the process that is missing, a part where there is confusion about what to do, or the presence of unnecessary steps. Sometimes the solution is evident as well, and the process can be modified to eliminate the problem. It may be that trying to flowchart will demonstrate that no single, clear process has been established. In this case, the solution may lie in designing a standardized process. If flowcharting uncovers the obvious cause, the group may proceed to the next step: **Choosing and Designing the Solution**. If the cause remains unclear, the group should continue analyzing the problem to identify the probable *root cause(s) (see page 2-26).*

> ***Hint:*** *Be wary of concluding that you already know the cause. Think about whether it is possible to verify your theory of the cause. See* ***Testing the Theories of Cause*** *below.*

Because the root cause is often not obvious, it is best to start by generating a list of as many possible causes as possible. A *cause-and-effect analysis (see page 2-26)* helps to look beyond the symptoms of the problem. It pushes one to ask, "What causes that?" and "What is behind that?" It is also designed to broaden thinking about causes and explore other areas that might be contributing to the problem. Alternatively, other methods such as constructing a *tree diagram (see page 2-27),* asking the *five why's (see page 2-27),* or conducting a *force-field analysis (see page 2-30)* can be used.

When all possible causes have been suggested, it is common to have more causes than could possibly be investigated. The expertise of the team helps to narrow down the possible causes to the most probable. Several decision-making methods can lead to some hypotheses about root cause(s), such as expert opinion and voting. The point is to produce a few possibilities from the vast array of potential causes identified.

> ***Hint:*** *Start testing hypotheses about causes which are easiest to collect data on, thus helping to eliminate certain hypotheses quite quickly. When collecting data to verify cause, try using different information sources from the ones used to identify the problem.*

E. Test the Hypotheses and Determine the Root Cause(s)

Remember that the causes referred to above are only hypotheses. Now it is time to collect and interpret data to prove or disprove these hypotheses. Determining causes should be based on *facts*, not opinions or assumptions. A few key points about data collection are reviewed here.

> ***Hint:*** *It is quite easy to fall into the trap of collecting more data than needed, data that do not provide any real information. The key message here is that data collection should be designed to provide the information needed to answer the question: What is (are) the major cause(s)?*

Data represent the hard facts that describe the problem or process in objective, measurable terms. But the problem-solving process seeks *information*, answers to the questions about why a particular problem is occurring or why a given process sometimes leads to unwelcome results. Information questions allow us to identify what we need to know to be able to move on in our problem solving efforts. Table 1-3 provides some generic information questions to help understand the nature of the problem and verify hypotheses about possible causes.

Table 1-3

Information questions about the nature of the problem	Who is involved or affected by the problem? Where does the problem occur (all over or in certain specific areas)? When does the problem occur (certain times of day? certain times of the week? year?)? How big is the problem? What are the effects of the problem?
Information questions for verifying hypotheses about causes of the problem	Does this hypothesized cause really exist (do we experience it)? Is this hypothesized cause frequent and/or widespread enough to explain the extent of the problem? How many times does the hypothesized cause occur? Is the hypothesized cause associated with the problem (for example, do they happen at the same time or to the same client)?

The answers to these questions must be based on facts *(data)*, but the data in and of themselves do not necessarily provide answers. Data must be analyzed and the results presented in a way that translates them from mere facts into information. Although statisticians have many sophisticated methods available for analyzing and interpreting data, there are several relatively simple methods of organizing and presenting data. These methods usually help in communicating information in understandable terms.

Data presentation tools *(see pages 2-31 to 2-39)* are visual displays of data that make it easy to see what is happening. They help teams to interpret the variation that is present in

the data. Every process contains some variation, but our objective is to reduce that variation so that the process will function consistently at the same high level of quality.

To attain this level of performance, it is necessary to understand the variability in the process. However, there are some basic principles that need to be clarified first.

The first principle states that **No two things are alike.** For example, rice that is cooked today will change in consistency by tomorrow. Usually the changes are unnoticeable because they are small. Thus variations should be kept to a minimum.

Each time rice is cooked, it will vary somewhat due to the quality of the ingredients, the heat of the stove, or the person cooking the rice. Variation is natural and is found in every process. Even the best cook cannot prepare rice exactly the same every day, despite using the same ingredients or monitoring the heat carefully. Variation is common and is to be expected.

Variation becomes a problem when it becomes extreme. For example, if the cook burns the rice for the meal frequently, it becomes a problem and the cook will know because the family complains. The family expects rice that is cooked within a range of acceptability.

This leads to the second principle: **Variation is caused.** The sources of variation can be found in one or more of the following areas:

- **materials** used in the process,
- **equipment** used to perform the process,
- **methods** used in the process,
- **people** who perform the process,
- **environment** in which the process is conducted,
- **measurements** that are used in the process.

EXAMPLE

If you were to write the letter "A" five times, you would see some variation in the results. This difference, termed common cause variation, is inherent in your process of writing. If you were to break your hand and have to write the letter "A" with the other, the result of the handwriting process would be quite different. This would be called special cause variation, due to something external to the process (a broken hand).

Management makes the basic decisions about each of these areas. For example, in cooking rice, management would determine which raw rice to use, where to get the water, which pot and stove to use, the cooking steps, who would cook the rice, where it would be cooked, and what to measure to indicate that the rice is done. Inherent variation of the process is caused by these elements as originally set by management. This is sometimes called "common cause" or "chance" variation.

However, if something changes in one or more of these areas, it is not inherent in the process as it was originally designed by management. This type of variation is called "assignable" or "special cause" variation, since it can be identified and corrected.

Distinguishing between these two types of variation is important in selecting the appropriate response. For example, if the problem is due to "special cause" variation, the manager would look at the specific area or areas and respond accordingly (train the cook or get a new stove). However, if it was due to "common cause" variation, the manager would evaluate the entire process.

The third principle states that **Variation can be measured.** This requires the collection of data.

To determine what data are to be collected and how, it is helpful to examine, for each information question:

- Data needed: the specific facts we need to be able to answer the information question; these facts must be measurable (e.g., counts, percentages, time spent, reasons why patients reject a particular service).

- Source of data: where the data can be obtained (e.g. clinic records, community members, clients, providers).

- Method of data collection: how the data will be obtained from the source (e.g., record review, household survey, exit interviews, observation of provider performance).

- Who will collect the data: specific individuals who will be responsible for recording the data.

- How much data to collect: how many of each source to collect data on and/or over what time period.

- How the data will be analyzed: what kind of data analysis tool will be used (e.g., run chart, pie chart, Pareto chart).

Once the type of data needed has been determined, the following table can assist in choosing the appropriate tool to display them.

Table 1-4

To Show	Use	Data Needed
Frequency of Occurrence: Simple percentages or comparisons of magnitude	*Bar chart* *Pie chart* *Pareto charts*	Tallies by category (data can be attribute data [e.g., sex, language, etc.] or variable data divided into categories [e.g., age groups, income groups, etc.])
Trends Over Time	*Line graphs* *Run charts* *Control charts*	Measurements taken in chronological order, attribute or variable data can be used
Distribution: Variation not related to time	*Histograms*	Forty or more measurements (not necessarily in chronological order), variable data
Association: Looking for a correlation between two things	*Scatter Diagrams*	Forty or more paired measurements (measures of both things of interest), variable data

In testing hypotheses about the root cause(s), it is usually helpful to look at the same data in many different ways so that the investigator may determine, for example, whether age or marital status is more likely to have an impact on a person's use of health services. A population being studied may be divided into subgroups or strata, may be based on a single characteristic that places an individual in a clearly defined group, such as marital status or facility used for health care services. Another kind of subgrouping relies on creating discrete ranges within a scale of possible values, such as income or travel time to the clinic.

Once strata have been identified, it may become apparent that a certain characteristic is closely related to the targeted problem. Graphic displays of the results (e.g., bar charts) are usually most effective in suggesting relationships. Usually, however, additional data will be necessary in order to confirm the relationships suggested by these graphs.

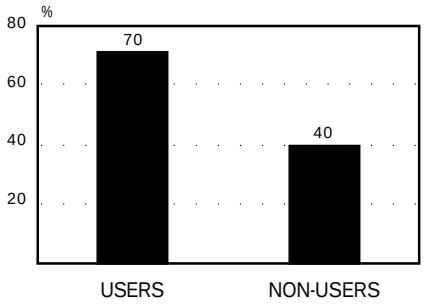
Differences among strata can suggest an association between certain characteristics and the targeted problem. Graphic displays of the results (e.g., bar charts) are usually most effective in suggesting relationships. Usually, however, additional data will be necessary in order to confirm the relationships suggested by these graphs.

An example, illustrated in the series of bar charts below, may help to clarify the use of stratification. A recent vaccination survey had indicated that immunization coverage was lower than expected in the district. Hypothesizing that low coverage was due to low use of the Maternal and Child Health (MCH) centers, the team sorted the data by whether the families had gone to an MCH center for treatment during the most recent illness. The team also calculated the percent of children immunized for each group. The results indicated that children in families who had used the MCH facility for a recent illness had higher rates of immunization than those who had not. To identify the facilities where underuse was most acute, the team looked at attendance rates at each facility. Although there were differences among the facilities, these did not seem important. However, sorting attendance by both facility and type of service (e.g., services for women and services for children

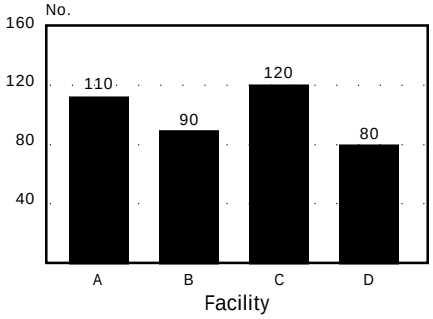
under age five) did suggest significant differences among facilities in the pattern of utilization. One facility in particular (facility C in the bar charts below), whose overall attendance rate was the highest of the four MCH centers, differed markedly from the others, both in its low attendance of children under five and its very high attendance of women. The team concluded that it should concentrate on solving the problem of underuse of child services at facility C before it could expect to increase immunization coverage. [They were also interested to learn more about the unusually high attendance by women!]

Stratification

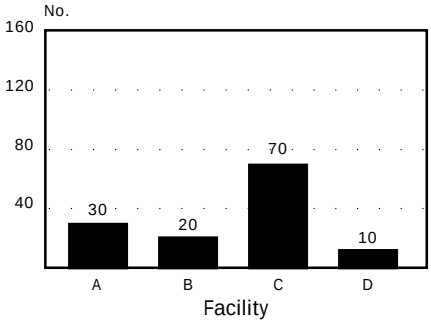
1. Percent immunized by utilization status of family (vaccination survey)



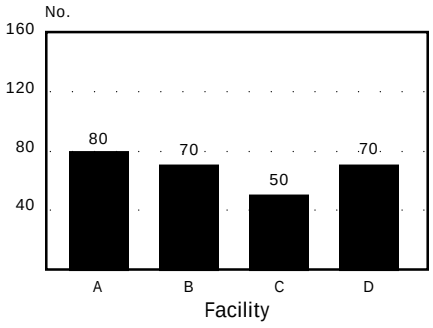
2. Visits per week by facility (service statistics)



3. Visits per week for maternal services by facility (service statistics)



4. Visits per week of children <5 years by facility (coverage survey)



F. How To Know When To Go on to the Next Step

This step contains two possible dangers: 1) spending too much time collecting data, and 2) trying to move too quickly through this step without collecting sufficient data. Therefore, it is important to know when to stop. There are no firm rules since each problem requires its own analysis, but there are a few guidelines for knowing when the major cause identified:

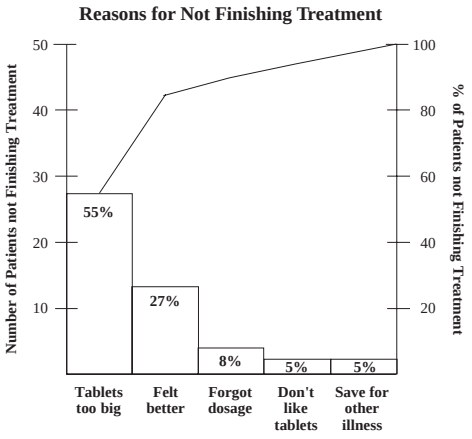
- No other causes were verified by data.
- The group members agree on the cause and feel motivated to fix it.
- The cause explains the existence of the problem from all points of view.
- The cause is logical and dispels confusion.
- The cause is something the group can influence, control, or deal with.

EXAMPLE 1: Compliance with ARI Treatment Regimens

Now that they had narrowed down the cause of client non-compliance to the lack of counseling, the team members realized that they still did not really understand **why** the patients did not finish their treatments: i.e., what would counseling need to address? Through brainstorming they came up with the following ideas:

- Patients do not like tablets.
- Patients stop taking medication when they start to feel better (even if the treatment is not finished).
- Patients forget the dosage.
- Patients use a few pills and save the rest for another illness.

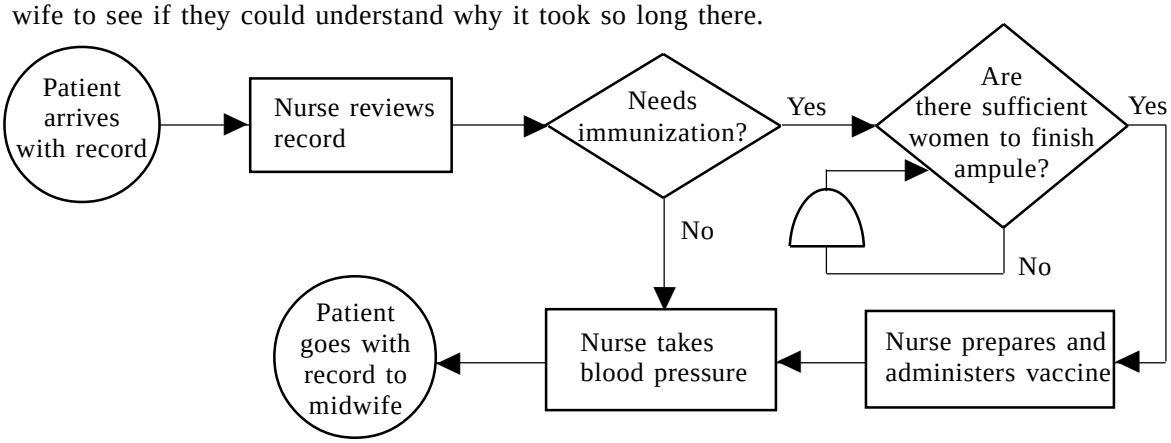
Even with this list, they realized that they did not know the real cause. So they decided to collect some data to determine which of these "hypothesized" causes was the root cause. They asked the community representatives on their team to go to the patients' homes to see whether they took all their pills, and if not, why not. (They felt the community representatives would get the most truthful answers.) The team members felt that they should not rule out any particular reason since they were not sure that their list generated by brainstorming included all the possibilities. Community representatives each took responsibility for visiting the patients in their villages, based on a list provided by the nurse each week. The data were collected over a three-week period. When the data were analyzed, they displayed them in a Pareto chart *(see pages 2-40 and 2-41)*, which they posted on the Storyboard.



From their Pareto analysis, they found that the major cause for unfinished treatments was that the tablets the patients were asked to take were big and difficult to swallow. This was a surprise to the team who had not thought of that possibility. Additional analysis also showed that patients stopped taking the medications when they started to feel better.

EXAMPLE 2: Prenatal Care: Waiting Times

Although the midwife said the delays were because she saw too many patients, the team decided to develop an even more detailed flow chart for the process from the nurse assistant to the midwife to see if they could understand why it took so long there.

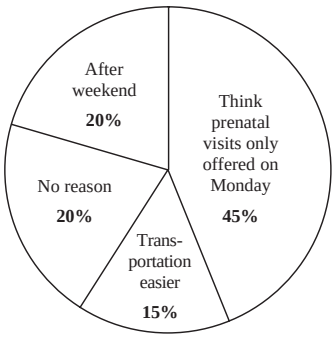


This flow chart led them to hypothesize that the delay was caused by the way they delivered immunizations (the nurse waits until 10 women are assembled before opening a vial of vaccine).

In addition, they wondered why Monday was worse than other days. They used the five why's technique to examine this issue of Mondays.

- Why do the pregnant women wait longer on Monday? Because there are more people coming on Monday.
- Why do more women come on Mondays? Because they think prenatal services are offered on Mondays only.
- Why do they think prenatal services are only offered on Monday? Because that was how we used to do it.

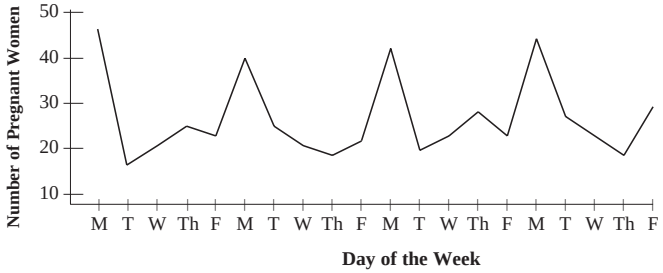
Reasons for Pregnant Women Coming on Mondays
(Exit Interviews)



Thus, they hypothesized that women did not know that they now offered prenatal care every day. To verify this, they first used a run chart on the data from their registers of the number of women attending over time. They also decided to ask the women exiting the clinic on Mondays why they chose Monday to come. The data were collected and showed the results below.

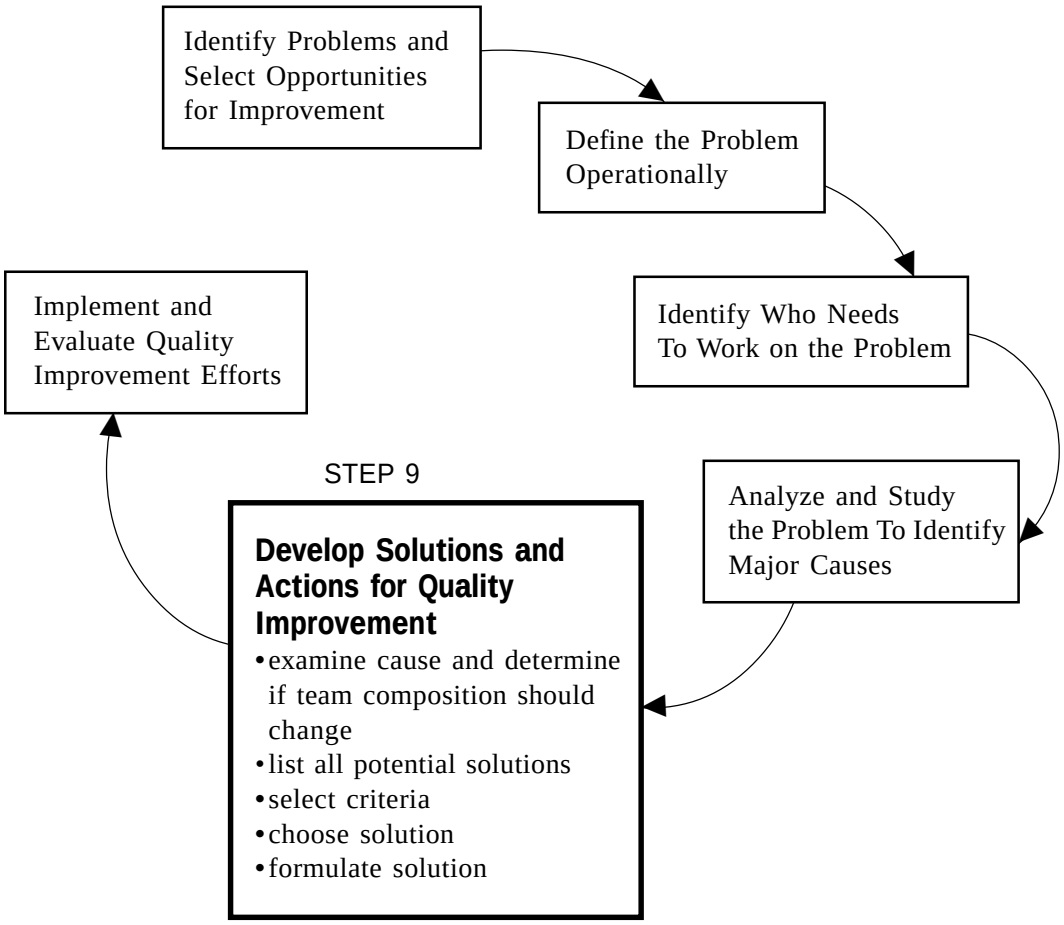
The nurse assistant posted both charts on the Storyboard.

Number of Prenatal Consultations/Day



Data	
M	45
T	10
W	15
Th	20
F	18
M	38
T	20
W	15
Th	12
F	17
M	40
T	13
W	18
Th	23
F	18
M	42
T	22
W	18
Th	12
F	26

V. STEP 9. Develop Solutions and Actions for Quality Improvement



Most teams or individuals are eager to reach this step: the solution. This is the entire reason for the quality improvement effort--to make things better. The objective of this step is to develop a solution that *solves* the problem by eliminating its cause(s). Developing solutions is not always a straightforward task, and many solutions fail because they were not carefully thought through before implementation. This is not the time to rush to a solution given all the effort that has been invested in selecting and analyzing the problem. The best approach is to be open and to think creatively, first to develop a list of potential solutions, then to review each carefully before selecting one.

Choosing and designing solutions entails several substeps:

- list all potential solutions,
- select criteria to find which solution is best,
- choose a solution to implement,
- state the solution in a practical, feasible manner.

A. List All Potential Solutions

Before listing potential solutions, the team must clarify the objective of the solution: What is the desired outcome? What are we trying to achieve? What is "success"? The group should agree on these issues before proceeding. Putting the objective of the solution in writing provides guidance throughout the selection process, as well as for planning and implementation later.

Choosing sound solutions requires a good list of options. This is where creativity is important. All too often, groups get stuck in their thinking ("This is how we have always done it"), or they let themselves get swayed by one person's ideas without exploring other options. Consider inviting others to join with the team in suggesting possible solutions. The additional members should be those who have been working on similar problems within the organization. Begin by reviewing previous successes and, more importantly, previous failures. Why did these occur? What lessons can we learn from these?

It can also be useful to examine the experience of others. *Benchmarking (see page 2-44)* combined with *brainstorming (see page 2-7)* can be a valuable way of stimulating creativity. *Benchmarking* involves exploring a similar process that works well, or considering solutions others have tried who have had similar problems or situations and examining closely what they have found successful. However, a word of warning—it is essential to have a thorough understand of one's own process before attempting any *benchmarking*. It is equally essential to understand fully the other process before using it as a *benchmark*. If this is not done, it may create more problems than are solved.

> ***Hint:*** *Be careful when benchmarking, i.e., looking at solutions that others have tried. One situation is not likely to be exactly like athers, and one group's "solution" may not work for another group. This does not mean you can never use someone else's solution, but you will need to review it carefully to see how your situation and constraints differ from theirs and see what adaptations may be needed.*

To generate ideas, the team can hold a *brainstorming* session to develop a list of both conventional and unconventional solutions. The point is to be as creative as possible: there will be an opportunity to sort through these options later. Think about what the team could substitute, adapt, combine, or rearrange.

The following are general categories of solutions that may help to generate ideas:

- reminders: administrative directives, letters, job aids, job descriptions;
- improving staff skills and knowledge to standardize the process: coaching, in-service training, formal training,
- changing policy or standards: redesigning the process, streamlining the process (making it less cumbersome, eliminating redundancies), clarifying procedures;

- changing the allocation of tasks among staff;
- changing the time when activities take place;
- improving inputs to the process,
- creating incentives to improve motivation.

> ***Hint:*** *Additional resources and improved motivation alone may not solve the problems or lead to improved quality. These solutions work best if combined with others, such as changes in processes or standards.*

B. Select Criteria To Determine Which Solution Is Best

As discussed in the section on **Identification of Problems and Selection of Opportunities for Improvement** (Step 5), selecting among options is best accomplished using clearly stated criteria. This is especially true as the team moves toward the solution implementation stage, in which consensus and support will be essential for making quality improvement efforts work.

Several possible criteria for choosing a solution can be used. The team can develop its own or choose from the suggestions below:

- affordable to implement,
- free from negative impact on other processes or activities,
- feasible to implement,
- management support,
- community support,
- efficient,
- addresses root cause,
- timely.

> ***Hint:*** *Try to limit the number of criteria to three or four, since too many criteria will make the selection process unwieldy. Identify which criteria any solution must meet to be considered seriously, as this will quickly eliminate certain choices.*

C. Choose a Solution To Implement

Before applying the chosen criteria, the team should review each of the potential solutions and discuss its advantages and disadvantages. *Force-Field Analysis (see page 2-30)* may be used to identify those forces that might be expected to help and those that might hinder implementation of a given solution. Think about how the solution could be modified to decrease the disadvantages and constraints. Then, when every team member has a clear idea of each solution, apply the criteria using one of the decision-making methods described in the first step: *expert makes decision, voting, or matrices (see page 2-14).*

EXAMPLE 1: Compliance With ARI Treatment regimens

Given the Pareto analysis (55% of patients reported finding the tablets too big to swallow), the group decided that it would start with the patients' dislike of the tablets. It also felt they should add the Regional Pharmacist to the team, since he is the one responsible for determining what kind of drugs the health centers can order. The group invited him to come for an afternoon and presented their data to him. The members brainstormed and came up with the following options as solutions:

- Change the drugs they prescribe (ones with smaller tablets).
- Tell the patients to break up the tablets to make them easier to swallow.
- Tell the patients to dissolve the tablets in water and then drink the medication.
- Explain to the patient that the tablets are large but it is important to take them anyway.
- Give every ARI case injections.

The group chose management support, cost, community support, and feasibility, as criteria. Using multivoting, they chose "changing the drugs they prescribe" as the most effective solution. However, it would require getting management support which would take time. The Regional Pharmacist suggested that the supervisor discuss with other supervisors to see if other health centers were experiencing similar problems with the ARI medication. If so, then he would support the change of drug for ARI. Otherwise, it would be too much work to do so for a single health center.

After verifying the technical appropriateness of changing how the medication was ingested, the team decided that, in the meantime, they would work on counseling of patients on how to take the tablets (suggesting breaking them up or dissolving them in water) and having the nurse provide counseling on the importance of finishing the ARI treatment. The team recorder entered these decisions in the Storybook.

EXAMPLE 2: Prenatal Care: Waiting Times

The team listed potential solutions for the causes they identified. For the first cause, waiting for 10 women before opening a vial of vaccine, they came up with the following options by brainstorming:

- provide immunizations on a separate day,
- immunize the women after they have seen the midwife,
- do not wait for 10 women,
- buy a small thermos that the vials of vaccine can be stored in once they have been opened and administer the vaccine to the women as they are seen by the nurse assistant (do not wait for 10 women).

The team debated over criteria for selecting the solution and chose cost, feasibility, and management support. For eliminating the first cause (waiting for 10 women before opening the vial of vaccine), they used a matrix to apply these criteria to each potential solution.

For the second cause (the women think that prenatal care is available only on Mondays), they decided it would be worthwhile to do some benchmarking by discussing with some other health centers how they had handled the transition from weekly prenatal delivery to daily delivery. After such discussions, they used brainstorming to come up with the following list:

- announce on the radio that prenatal care is available every day,
- put up a poster with that message in the entrance to the health center,
- ask the community leaders to announce it to their villages,
- hand out a flyer to all patients telling them the days that services are available,
- have the receptionist tell the patients that prenatal care is available every day.

Solution Options	Criteria			Total
	Low Cost	Feasibility	Management Support	
Immunize on separate day	12	6	6	24
Immunize after midwife	18	6	12	36
Do not wait for 10	6	18	12	36
Buy thermos, do not wait	6	18	18	42

For the first cause, the solution they chose was to change the policy on opening a vial only if there are 10 women waiting, to administer the vaccine to women as they are seen by the nurse assistant, and to buy a small thermos to store the open ampules. For the second cause, applying the same criteria, they simply voted to have the registrar tell patients that prenatal care is available every day. They added these solutions to the Storyboard.

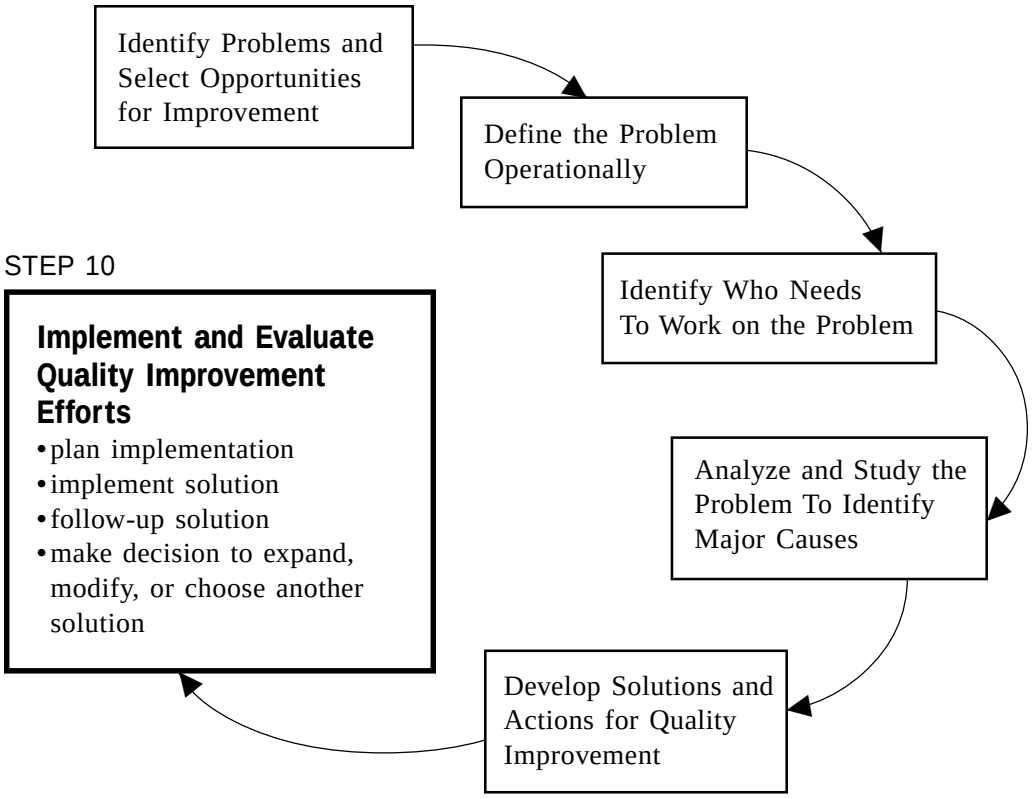
D. State the Solution in a Practical, Feasible Manner

Once the team has selected a solution, it must take a few precautions before carrying it out. First, it must review the solution and discuss with the group whether the solution can be carried out as described or whether it needs more revision to make it feasible. *Flowcharting (see page 2-20)* can help the team to determine if what it has in mind will work. Can the solution be simplified? Who will be doing what, where, and when? The team must think about who needs to be involved in the planning of the solution: Who will be implementing it? Who will be supervising it? This is the moment to think about what the solution will really look like. For each component (who, what, where, when), several options may exist. Review them and choose the most practical, feasible ones.

E. How To Know When To Go On to the Next Step

The team should ask itself these three questions: Can we do it? Do we want to do it? Will others let us do it? Once the team can answer "yes" to these questions, it is ready to proceed to the planning and implementing of the solution. Implementation should begin when the team feels confident about the solution and has developed sufficient motivation toward it. If some disagreement or uncertainty remains, the team should review the solution for ways to make it better or for alternative solutions.

VI. STEP 10. Implement and Evaluate Quality Improvement Efforts



Quality improvement depends on effectively implementing the appropriate solution. Even a well-chosen solution will not resolve the problem if it is poorly planned, implemented, and monitored. This final step, commonly known as the PDCA (or the Shewart) cycle: Plan, Do, Check, Act. It is designed to ensure that the solution is properly implemented.

This final step comprises four major activities:

- planning implementation of the solution (PLAN),
- implementing the solution (DO),
- following up to determine if the solution has had the intended results (CHECK),
- making decisions about whether to expand implementation, to modify the solution, or to choose another solution to test (ACT).

Almost every solution will require some changes in individuals' work, behavior, or roles and responsibilities. People often feel threatened by change unless they are convinced of the need for it, can envision how circumstances will be improved, and understand the changes that will occur. It is essential to recognize resistance to change and to address it

directly; otherwise, problem-solving efforts will be undermined. Some strategies to reduce resistance to change include:

- inviting people to participate in planning the change,
- providing a clear picture of the change,
- sharing information about the changes: secrecy and surprises create anxiety,
- demonstrating commitment to the change: being a positive role model,
- offering positive reinforcement for changes and early successes.

A. Planning for Implementation of the Solution

Planning for any activity, including quality improvement, involves determining the who, what, where, when, and how. Planning for solution implementation should include the following tasks:

- **Review the objective of the solution:** What are we trying to achieve? What is "success"?
- **Review the solution's design:** What are the steps in the process? Who will be doing what, where, and when? Review or develop a simple *flowchart (see page 2-20)* of the process. Identify who will be carrying out each step.
- **Identify potential resistance:** The team must think about who may be affected by each step or change in the process. Such individuals may be sources of potential resistance. Could resistance be reduced by including these individuals in the planning process? How else can resistance be avoided? A *force-field analysis (see page 2-30)* can help to identify strategies for increasing the likelihood of effective implementation.
- **Determine the prerequisites to implementation:** What needs to be done or prepared before this process can be carried out? Think about what kind of training might be required, what kind of communication is necessary, and what kind of support (material, supervisory, managerial) needs to be organized. The team members should think about everything that could go wrong and, after brainstorming, use an *affinity analysis (see page 2-9*) to group these for preventive action.
- **Develop a step-by-step list to lay the groundwork:** What needs to be done first? How long will it take? How will we know when that activity is completed. What is the product? A *Gantt chart (see page 2-45)* can help to plan the order of activities.

> ***Hint:*** *Test the solution on a small scale first. If the solution requires major changes, affects many people, or has never been tried, testing the solution on a small scale first will help:*
>
> - *Work out the kinks before large scale implementation*
> - *Generate support by showing that the solution actually works*
> - *Save resources if the solution was not as successful as assumed.*

- **Assign responsibility for each activity:** Who will see that each activity is carried out? This person(s) may not have to carry out the activity, but he or she will be responsible for seeing that it happens.
- **Determine what information is needed to follow up the solution:** What data are required to determine whether the solution was actually implemented, whether it was implemented well (according to the plan), and whether it had the intended results? Where are the data available? Who can collect the data? When and how will it be collected?

B. Implement the Solution

Putting the implementation plan into action involves carrying out the ordered steps outlined above, implementing the change itself, and collecting the information that will indicate how well it went. Teams should establish check points periodically to verify that implementation is going as planned and to communicate progress to all those involved. Teams should also be ready to provide encouragement and assistance as needed.

> ***Hint:*** *Document anything that goes wrong in the implementation phase. These bits of information can help later in assessing the solution. Every problem or error is an opportunity for improvement, and this is as valid during solution implementation as in problem identification.*

EXAMPLE 1: Compliance With ARI Treatment Regimens - First Solution

For the solution of changing the drug used for ARI, the team decided to plan how to determine whether their problem was widespread and, if so, what would need to be done to change the drug.

- **Review the objective:** The objective was to increase the percentage of patients that finish their ARI treatment in order to improve health status and reduce antibiotic resistance.
- **Review the plan for the solution:** The solution would be to change the drug for ARI to one that is easier to swallow. This drug would be prescribed by the nurse and dispensed by the pharmacist.
- **Identify people who might resist:** Resistance to this solution could come from many sides: the nurses who would be required to change their prescribing practice; the pharmacists who would have to order, stock, and dispense another drug; the community who may not like its presentation, side effects, or cost; and the Regional Pharmacy and Central Medical Stores which would have to change their current ordering patterns. Overcoming potential resistance from these sources would require considerable dialogue with the various parties, and presentation of data from more than one health facility to justify the need for such a change.
- **List steps needed before carrying out the plan**: Before carrying out such a change in drug policy, the team needed to know the extent of the problem and collect data to confirm the need for change.
- **Develop a step-by-step list to lay the groundwork:** The first thing to do would be to contact all the health facilities in the district and see who else had the problem of patients not completing ARI treatment. If others had the same problem, similar surveys should be conducted to verify the causes, as was done by this team. These data could then be presented to a larger forum (Regional Pharmacist, Regional Health Officer, Director of Central Medical Stores, etc.) for discussion and decision.
- **Assign jobs to team members:** The supervisor took charge of contacting all other supervisors in the district and asking them to discuss with the nurses at the health facilities they supervised. If the problem appeared widespread, the whole team would prepare a presentation on conducting surveys to evaluate the causes.

Again, the recorder made a careful record of each decision and entered the detailed implementation plan in the Storybook.

EXAMPLE 1: Compliance With ARI Treatment Regimens - Second Solution

The team went through the following steps to plan the solution of providing counseling to patients on how to take the drug so that it would be easier to swallow:

- **Review the objective:** To increase the percentage of ARI patients who complete their treatment, in order to improve the health of the community and reduce antibiotic resistance.

- **Review the plan for the solution:** The solution chosen was to counsel patients on how they can make the drugs used to treat ARI easier to swallow. Both the nurse and the pharmacist would provide counseling: the nurse when writing the prescription, and the pharmacist when dispensing the drugs. Wall posters in the pharmacy would also explain the various methods: breaking up the pills and dissolving them in water.

- **Identify people who might resist:** Those who would be giving the counseling—the nurse and the pharmacist—were already on the team. However, resistance could also come from the community who would still be taking the drug. The community representatives suggested that a small health education campaign to promote the pills for their effectiveness and low cost of treatment would help lower possible resistance to taking the pills.

- **List steps needed before carrying out plan**: Counseling messages would need to be developed (to ensure that the pharmacist and nurse were giving the same information). Wall posters would need to be produced, too. Finally, the health education campaign would need to be planned.

- **Develop a step-by-step list to lay the groundwork:** First the messages would need to be developed (whether spoken or for the poster). These messages would be tested by the community representatives with a few villagers first. Finally, the posters would need to be drawn and hung up. The messages for the health education campaign would be developed and tested as well.

- **Assign jobs to members of the team:** The supervisor liked to draw posters and said he would take charge of that. The community representatives would test the messages that the team would develop together. The community representatives said they would develop the messages for the health education campaign but would need assistance from the nurse to ensure that the messages were technically correct.

- **Determine what information is needed for follow-up:** The team developed the following list of indicators:

  1. The percentage of patients finishing their ARI treatment,
  2. The percentage of patients receiving counseling about how to take their medicine so that it is easier to swallow,
  3. The percentage of patients who understood the counseling messages,
  4. The percentage of patients who practiced what the nurse and pharmacist suggested.

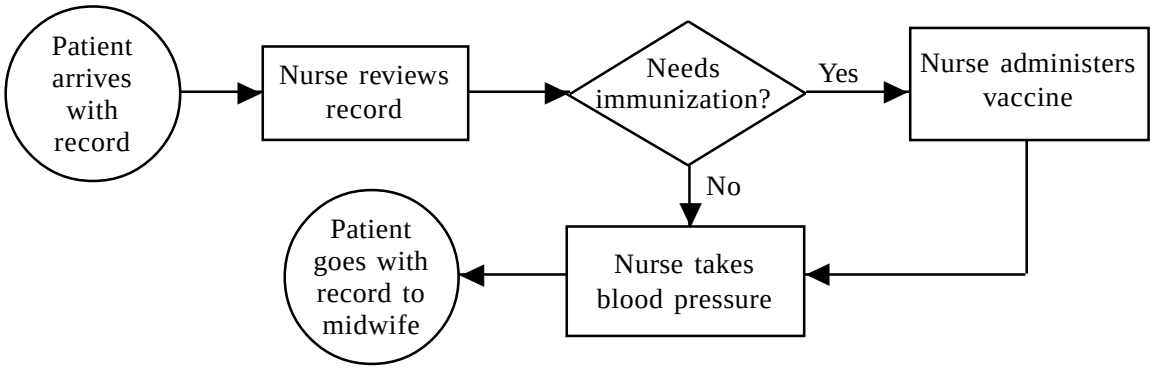
For indicators 2-3, the team decided to have the community representatives do exit interviews with the patients. For indicators 1 and 4, the community representatives would visit the patients in their homes a week after treatment.

The team recorder made a careful record of what was decided and entered the detailed implementation plan in the Storybook.

EXAMPLE 2: Prenatal Care: Waiting Times—First Solution

The team worked out the details of their two solutions and recorded them in the Storybook. For the first solution (changing the process to open a vial of vaccine even if there is only one woman), they decided to:

- **Review the objective:** The objective was to reduce waiting time for pregnant women in order to encourage them to make at least four prenatal visits.
- **Review the plan for the solution:** The team revised the flow chart to reflect the new process seen below.



- **Identify people who might resist:** Those affected by the change would be the nurse assistant who gives the immunizations, and the pharmacist who is responsible for ordering and storing of the vaccines. The members decided that they should ask the pharmacist to join them in the planning of the solution.
- **List steps needed before carrying out the plan:** Before they could carry out the solution, they would need to determine how the number of vials of vaccines consumed would change with this new strategy and to order a thermos and sufficient vaccines.
- **Develop a step-by-step list to lay the groundwork:** The first task was to find the number of vials they would need, based on the number of women they saw every day. The next task would be to plan for storage of these vials, then to order the vaccines and the thermos. They judged that it would take about 1 month to get everything in place before trying the solution.
- **Assign jobs to each team member:** The Health Center manager and the pharmacist took charge of finding the number of vials that would be needed. The pharmacist took charge of ordering the vaccines and the thermos.

continued on page 1-47

EXAMPLE 2: Prenatal Care: Waiting Times—First Solution *continued*

- **Determine what information is needed for follow-up:** The team spent time discussing what data it would need to follow up the solution. They finally came to the following indicators:

  1. percentage of women making at least four prenatal visits
  2. overall time pregnant women spend at the clinic
  3. time spent from when the pregnant woman arrives at the nurse assistant's station to when she is seen by the midwife
  4. staff satisfaction with new system
  5. amount of wasted vaccine (unfinished ampules)
  6. number of stock shortages of vaccines.

  The team decided that it would try the solution for a period of 2 months, after which it would evaluate indicators 1-4 (using the same sources that were used during problem identification and problem analysis), while data on the 5th and 6th indicators would be collected continuously by the pharmacist in his inventory records.

EXAMPLE 2: Prenatal Care: Waiting Times—Second Solution

For their second solution of having the receptionist tell the patients that prenatal care is available every day, they came up with the following plan:

- **Review the objective:** to reduce waiting time for pregnant women in order to encourage women to make at least four prenatal visits.
- **Review the plan for the solution:** The team decided that the receptionist, after taking the patient's name and finding her record, would tell the patients about the fact that prenatal care was available every day.
- **Identify people who might resist:** The change would add a task for the receptionist. She thought that it would not take too much extra effort, and if everyone did not come on Mondays, her job would be easier, too.
- **Develop a step-by-step list to lay the groundwork:** The only needed step was deciding exactly what the receptionist would say so that it would be clear. They worked on the phrasing in the three local languages so that all women could understand.
- **Assign jobs to team members:** The receptionist took charge of carrying out the solution.
- **Determine what information is needed for follow-up:** The team felt that many of the indicators for the first solution were also valid for this one, but they added two additional ones:
  - number of women attending each day of the week,
  - percentage of pregnant women leaving the clinic who knew that prenatal care was offered every day.

For the first indicator, the number of women visiting the health center was already recorded in their register. For the second indicator, they decided that the midwife would conduct a brief exit interview with the women to see if they knew when prenatal care was available. The midwife would have a check sheet on which she would mark their responses for a period of 2 weeks.

These implementation plans were recorded in the Storybook.

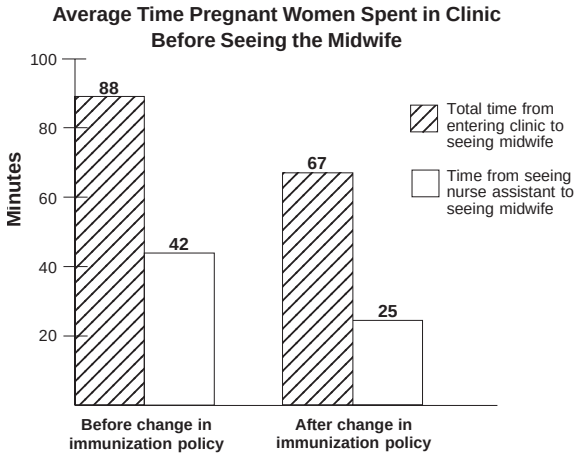
C. Follow-up To Determine if the Solution Has Had the Intended Results

At this point the team should pause a moment to determine what can be learned from the implementation process. Using the data collected and any other information (formal or informal) obtained during the implementation phase, the team should answer the following questions:

- Did we meet our criteria for success? Did the solution have the desired results? What did people think of the change?
- What aspects of implementation went well? What aspects were difficult?
- Did the solution create unforeseen problems for others or other processes?
- What kind of resistance did we encounter?

EXAMPLE 2: Prenatal Care: Waiting Times - Solution One

After two months, the team reviewed the results from the two solutions it had tried. They graphed the data to show before and after solution implementation and posted the graph on the Storyboard.



The data showed women waiting much shorter periods of time overall and at the nurse assistant's station.

When assessing staff satisfaction, the midwife and nurse assistant were very pleased with the new system. The midwife was more relaxed because she no longer had 10 women waiting at a time to see her (they were more evenly spaced out). The nurse assistant said that women complained less to her about waiting. The pharmacist was not as happy, since vaccine wastage rose from about 5 percent to 10 percent. However, they had no stock-outs in the two months of the test.

D. Make Decisions About What Action To Take

Based on what was learned from evaluating solution implementation, the team now must decide what action to take. Just because a solution was chosen and implemented does not mean that it must be adopted. Referring to the results obtained in the follow-up, determine whether it was successful as implemented, whether it merits modifications, or whether it should be abandoned altogether and another solution tried. If modifications are to be made, they should be tested as well.

Questions to ask:

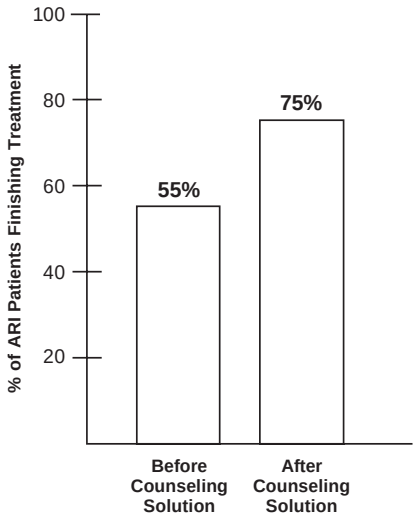
- How could we improve this solution or its implementation?
- How could we reduce resistance that we encountered?
- What parts of the process or change need to be standardized? How shall we communicate these new standards so that things do not revert back to the old ways?
- What issues must we address before implementing the change on a larger scale? What kind of resistance might we encounter? What kind of training is needed?
- What technical, logistical, and material support needs to be ensured to make it sustainable?
- How shall we continue to monitor to see that the problem does not return?

To ensure that gains are sustainable, the team will need to look for opportunities to standardize the improvement and make it permanent such as changing job aids and manuals, inserting new material into pre- and in-service training, and getting official policy statements. Additionally, sustainability requires vigilance: the team should think about what indicators it will continue to monitor to assess whether the solution continues to be successful, i.e., that the problem does not reoccur.

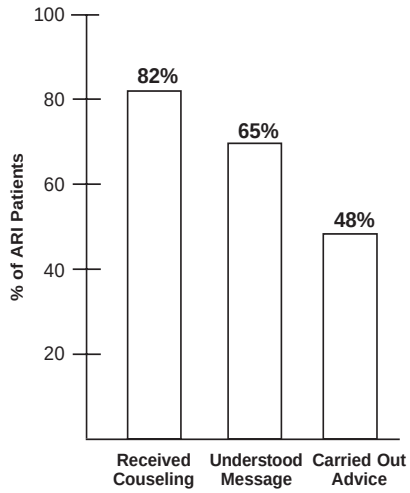
EXAMPLE 1: Compliance with ARI Treatment Regimen

Graphs of the data from the indicators the team monitored were posted on the Storyboard. They showed the following results:

Percent of Patients Finishing their ARI Treatment Regimen



Counseling, Knowledge, and Practice of ARI Patients: Making Tablets Easier to Swallow



The team felt that it had done a good job of carrying out the counseling and that it had some effect on reducing the number of patients not finishing treatments.

When the supervisor discussed with other supervisors, it appeared that the problem of patients disliking the ARI medication was quite widespread, and the Regional Pharmacist decided to lobby for changing the treatment of choice for acute respiratory infections.

The team was glad it had adopted an interim solution to improve the percent of patients finishing treatment because it had been able to increase patient compliance while the much longer process of changing the treatment regimen would be put into place.

To ensure that gains are sustainable, the team will need to look for opportunities to standardize the improvement and make it permanent such as changing job aids and manuals, inserting new material into pre- and in-service training, and getting official policy statements. Additionally, sustainability requires vigilance: the team should think about what indicators it will continue to monitor to assess whether the solution continues to be successful, i.e., that the problem does not reoccur.

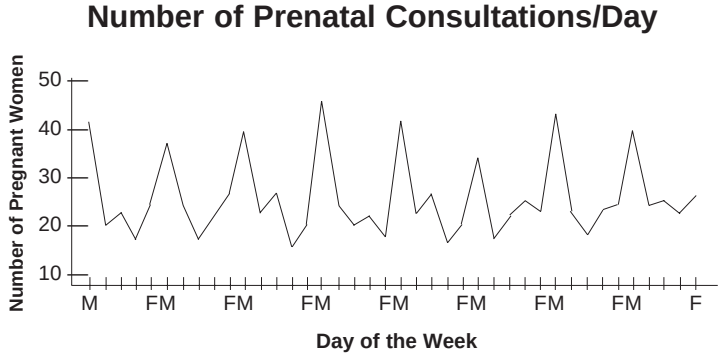
E. How To Know When the Quality Improvement Process Is Completed

Although quality can always be improved, individuals and teams must be able to say, "That was a job well done." The team can consider the quality improvement effort a success when it has evidence that the problem has been resolved: the data show that the problem no longer exists and the changes (solution) have been incorporated into routine procedures. The quality improvement efforts are complete when the team feels happy about its efforts and their effectiveness.

EXAMPLE 2: Prenatal Care: Waiting Times—Solution Two

The data on the number of women coming on each day of the week indicated that there had not been any change in the pattern; most women continued to come on Monday. The midwife's checksheet data showed that only about half the women knew that prenatal care was offered every day, and of those coming on Mondays, only a quarter knew. The receptionist, when questioned about these results, said that she was very busy and could not always remember. Instead of blaming the receptionist and accusing her of being lazy, the team felt that this solution was not a feasible one, and they decided to try another solution: putting up a poster. They agreed to continue monitoring the number of women coming on each day of the week for the next 3 months.

Because the time for the evaluation was short, the team was not able to evaluate the effect of the solutions on the percentage of women making four prenatal visits. The members decided to keep monitoring this indicator, along with vaccine wastage and stock-outs for 3 more months as well and see what the overall impact would be.



Data

Week	M	T	W	Th	F
1	40	15	18	12	20
2	35	20	12	17	23
3	38	18	23	10	15
4	45	20	15	17	12
5	40	17	22	11	15
6	31	12	17	21	18
7	42	18	13	18	20
8	38	20	21	18	22

At the end of the observation period, the team found that prenatal coverage had increased moderately, but to its surprise, coverage for tetanus toxoid immunizations increased dramatically in those women coming for prenatal care. These results convinced the pharmacist that the wastage of vaccine was a small price to pay for improved coverage. In addition, the number of women attending each day of the week became more evenly distributed over time. The nurse assistant posted these results on the Storyboard, and recorded the team's conclusions in the Storybook.

Prenatal coverage was still lower than the members would like it to be, so they decided to explore other possible causes of low coverage, and began the problem solving cycle again.

F. The Relationship Between Parts One and Two of This Monograph

Part One of this monograph has described in detail the six problem solving/process improvement steps of the Quality Assurance ten-step cycle, and has illustrated those steps throughout with two examples: 1) of improving client compliance with ARI treatment regimens, and 2) of reducing excessive waiting rimes for prenatal services. Each of the examples employs several useful tools at different steps in the problem solving process; whenever one of the tools is mentioned in Part One, a reference is given to the beginning page of the section in Part Two where that tool is described in greater detail. Part Two therefore serves as an aid for the reder of Part One, and can also be used as a separate reference by those seeking to apply these tools in solving problems and improving processes in their own settings.

♦ ♦ ♦

Part Two

Tools for Quality Improvement

TOOLS Page

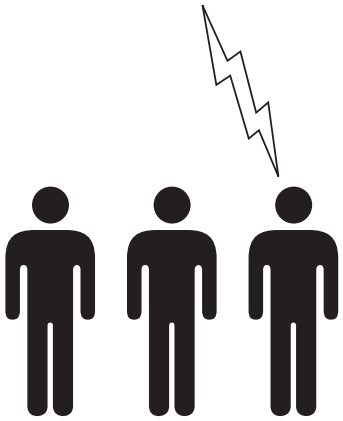
♦ ♦ ♦

Table 2-1 Application of Quality Improvement Tools

TOOLS	Step 5 Identify Problem	Step 6 Define Problem	Step 7 Identify Team	Step 8 Analyze Problem	Step 9 Choose Solution	Step 10 Carry Out Solution
Brainstorming	X			X	X	
Affinity Analysis	X			X	X	
Prioritization Tools	X			X	X	X
Systems Modelling	X			X		X
Flow Charts	X	X	X	X	X	X
Cause and Effect Analysis				X		
Force Field Analysis				X		X
Statistical Tools						
Bar and Pie Charts	X			X		X
Run Charts	X			X		X
Histograms				X		X
Scatter Diagrams				X		X
Pareto Charts	X			X		X
Client Windows	X				X	
Benchmarking	X				X	
Gant Charts				X [1]		X
QA Storytelling		X	X	X	X	X

[1] for planning of data collection

Brainstorming



Brainstorming is a way for groups to generate as many ideas as possible in a very short period of time by tapping into group energy and an individual's creativity. It was developed by A. F. Osborne in the 1930's.

When To Use It

Brainstorming is particularly useful when trying to generate ideas about problems, areas for improvement, possible causes, other solutions, and resistance to change. By bringing out many creative ideas in a short period of time and encouraging all group members to participate, this useful tool opens up people's thinking and broadens their perspectives. It allows ideas to build on one another. However, it is **not** a substitute for data.

How To Use It

- Write the question or issue to be explored through brainstorming on a flipchart or any place where everyone can see. Make sure that everyone is clear about the topic.
- Review the rules of brainstorming:
  - Do not discuss ideas during the brainstorming.
  - No judgments: criticism of another's idea is **not** allowed.
  - Every idea is acceptable: be unconventional.
  - Build on the ideas of others.
  - Quantity of ideas counts.

Brainstorming can be unstructured or structured. In unstructured brainstorming, each person voices ideas as they come to mind. This method works well if participants are outgoing and feel comfortable with each other. In structured brainstorming, each person gives an idea in rotation [a person can pass if he or she doesn't have an idea at the moment]. Structured brainstorming works well when people are unfamiliar with one another or are less talkative: the structure gives everyone the chance to speak.

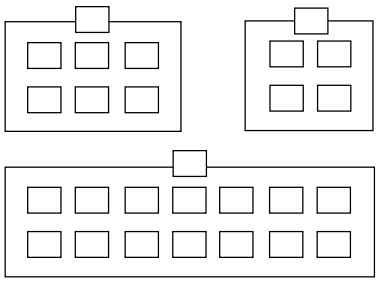
Give people a few moments to think of some ideas before starting.

- Write **all** ideas on a flipchart.
- After all the ideas have been generated (generally after about 30-45 minutes), review each one to make it clear and combine related ideas on the list.
- Agree on ways to judge ideas and use data collection, voting, matrices, or Pareto charts to choose among options. Groups often use voting techniques first to reduce the list to about 6-10 top ideas. Then they use other techniques to choose among this shorter list.

Caution

- Brainstorming is a technique for generating ideas, but each idea will need substantiating.
- Discussing or judging ideas while brainstorming will slow the exercise and limit the flow of creative ideas. Save discussion of ideas till the end.
- If one or a few individuals dominate the discussion, the leader may want to shift to a structured brainstorming format (see above).

Affinity Analysis



Affinity analysis, a tool developed by Jiro Kawakita, helps groups gather a large amount of information and organize this information on the basis of *affinities* or natural relationships. Affinity analysis lets the ideas determine the categories or groupings, rather than letting pre-determined groupings determine or constrain the generation of ideas.

When To Use It

An affinity analysis can help a team or group organize many different ideas or items in a short period of time. Groups often use affinity analysis to generate ideas about problems or areas for improvement, about causes, about alternative solutions, and about resistance to change. It is also useful for making sure that the lone idea does not get lost in the shuffle. It is chiefly useful when issues appear too large or complex, when consensus is desired, or when creative ideas are needed. Because everyone's idea is included and groupings of ideas are done by the team, it helps develop consensus.

How To Use It

- State the issue or question to be considered and make sure that all participants are clear on what is being asked.
- Generate and record ideas on slips of paper. Each idea or item should be recorded on its own slip. Post-it Notes or notecards, if available, are easier to use for this exercise.

Generate ideas:

  - through group brainstorming, where one person takes charge of writing down each idea, or
  - by having each person record his or her own ideas.

The first method works best when there are not many existing ideas and creativity is needed (people can build on the ideas of others). The second method works best when it is important to capture everyone's individual contribution, or to draw on each person's expertise.

- Place the slips of paper in any order in a manner that permits everyone to see them (e.g., on a table or wall).
- Ask the team members to sort the ideas on the slips of paper into related groups by moving the slips of paper around, but without discussion. After a while, the team members will no longer be moving items around.

If the group is large, have the members go to sort in groups of 3-4, giving each group a few minutes to do so. Then call the next group of 3-4. Let each group continue to have a turn until they are no longer moving items around.

Do not force an item into a group; it is fine to have groups with only a single item in them. If a slip of paper is constantly being moved back and forth between two groupings, either clarify the meaning or place it in both groupings by adding another paper.

- For each of the groupings, develop a name or category that reflects the meaning of that group and write it on a slip of paper. Look first among the items in the group. If none captures the idea clearly, create one that does.
- Transfer the information onto a sheet of paper, with lines around the various groups.
- Use prioritization tools to select from among categories.

Caution

- Sorting should be done as silently as possible. Discuss the items on the slips of paper only if clarification is needed.
- Do not force an item into a group. It is acceptable to have an item in more than one group, although this should be done as little as possible.
- If a slip of paper is constantly moved back and forth between two groupings, either clarify the meaning or place it in both groupings by adding another paper.

Prioritization Tools: Making Decisions Among Options

Group methods for narrowing down and ranking a list of ideas include *voting* and *prioritization matrices*. Both methods allow individuals to express their opinions or choices in order to reach a group decision. *Voting* is a relatively unstructured technique in which group members make a choice, using either implicit or explicit criteria. *Matrices* allow the team to review the options against a standard set of explicit criteria.

	A	B	C	
A	✔✔		✔	3
B		✔✔		2
C	✔			1

Voting

When To Use It

Voting is most useful when the options are fairly straightforward or when time is limited. In voting, either implicit or explicit criteria can be used.

How To Use It

Teams can structure voting in several ways, but they all have the purpose of letting each individual state his or her preferences. Regardless of the type of voting used, all group members must understand the various options being voted on.

- **Straight voting**: All options are listed and each person in the group is given one vote. All votes are weighted equally. The activity with the highest total is selected. This is the easiest method for a group to start selecting an activity.

Straight Voting

Activity	Vote	Total
Activity 1	///	3
Activity 2	////	5
Activity 3	/	1
Activity 4	/	1
Number of Participants		N=10

- **Multivoting**: All options are listed and each person is allowed to vote for a limited number of items (e.g., three or five). A general rule of thumb to determine the number of votes is:

  up to 10 options = 2 votes;
  10-20 options = 3 votes;
  20-30 options = 5 votes

Add up the votes for each item, and the one with the highest score is the top priority for the group.

This method is useful when the group wants to pick more than one item or the list of items is very long and needs to be reduced. Multivoting can be repeated several times until the list is shorter or a single priority stands out. This voting method increases the likelihood that everyone will have at least one of the items for which they voted in the reduced list.

Multivoting

Activity	Vote	Total
Activity 1	/	1
Activity 2	𝍸 //	7
Activity 3	𝍸 //	7
Activity 4	𝍸 ///	8
Activity 5	///	3
Activity 6	///	3
Activity 7	/	1
Activity 8		
Activity 9	//	2
Activity 10		

♦ **Weighted voting**: All options are listed and each person is given the possibility to give more weight to some choices than to others. One way of doing this is to give each person a fixed amount of hypothetical money to spend. They can distribute it any way they wish among the alternatives: i.e., if given $10, one could spend all $10 on a single item that one felt very strongly about, or one could distribute it evenly over five items, or any other combination. This method allows the voting to reflect the strength the individuals feel about the various choices.

Weighted Voting

Activity	Team Member										Total
	1	2	3	4	5	6	7	8	9	10	
Activity 1											
Activity 2	3	2	2	2	2	2	3	3	3	1	23
Activity 3	3	2		3	2	3	2	2	2	2	21
Activity 4	2	3	8	3	1	2	3	2	2	3	29
Activity 5									1	2	3
Activity 6	2	1		1	2	1	1	2	1		11
Activity 7		2		1		1	1	1	1	1	8
Activity 8					3	1				1	5
Activity 9											
Activity 10											

Criteria (Prioritization) Matrices

In each of the above voting options, each individual uses his or her own internal criteria to make a decision. A criterion is a measure, guideline, principle or other basis for making a decision. It is an agreed upon basis for making a group decision. Often in making decisions, more than one criterion is used at the same time. Sometimes the group may want to discuss and agree upon the criteria by which each participant should base the judgment.

A criteria or prioritization matrix is a tool for evaluating options based on a set of explicit criteria the group has determined is important for making an appropriate, acceptable decision.

When To Use It

Matrices work best when options are more complex or when multiple criteria must be considered in determining priorities or making a decision.

The matrix presented below displays the options to be prioritized in the rows (horizontal) and the criteria for making the decision in the columns (vertical). Each option is then rated according to the various criteria.

Options	Criteria				Total
	C#1	C#2	C#3	C#4	
Option 1					
Option 2					
Option 3					

How To Use It

Step 1: List the options or choices to be evaluated. Make sure that all team members understand what is meant by each of the options.

Step 2: Select the criteria for making the decision. The group can choose these criteria using brainstorming and then voting to determine the most important/relevant ones.[1] Be sure that everyone has the same understanding of what is meant by the chosen criteria. Criteria commonly used for choosing problems to work on include: importance, support for change, visibility of problem, risks if nothing is done, feasibility of making changes

[1] It is also possible to weight the criteria if the group feels that some are more important than others, but this should only be done when the added complexity will really yield a better decision.

in this area. For choosing solutions, the following criteria are often applied: cost, potential resistance, feasibility, management support, community support, efficiency, timeliness, impact on other activities. These are not the only possible criteria, and the group should develop a list that is appropriate for its situation.

No minimum or maximum number of criteria exists, but three or four is optimal for matrices. More than four criteria makes the matrix cumbersome. One way to reduce the number of criteria is to determine if there are any criteria which all options **must** meet. Use this criterion first to eliminate options. Then, use the other criteria to select among the remaining options.

Another way to make the matrix less cumbersome is to limit the number of options being considered. If the list of options to choose among is long (greater than 6 items), it may be easier to first shorten the list by eliminating some options.

For example, commonly used criteria for eliminating potential problem areas from consideration include:

- Problem is too big or complex to solve.
- Not feasible to make changes in this area (beyond the team's control or authority).
- Lack of interest among staff to work on the problem.

Step 3: Draw the matrix and fill in the options and criteria.

Step 4: Determine the scale to use in rating the options against each criterion. Ways to rate options range from simple to complex:

Examples of rating scales:

- Simple: Scores are based on whether the option meets a given criterion, e.g.,
  Are trained staff already available?
  Yes=1, No=0
- Common: Options are scored according to how well each option meets the criterion, e.g.,
  How much management support is there for this option?
  High=3, Medium=2, Low=1, (or a scale of 1-5 or 1-10, from Low to High)

> ***Note:*** Be sure that the rating scales used for all the criteria are consistent, i.e., that the ratings for each criterion all run from the "best"=highest number to the "worst"=lowest number. In this way an option's overall score may be calculated by adding together its scores on each criterion. For example, if the options were to be rated on the two criteria of feasibility and cost, each on a scale of 1 (least desirable) to 5 (most desirable), the criteria should be scored as:
>
> | | | |
> |---|---|---|
> | ♦ Feasibility: | most feasible = 5 | least feasible = 1 |
> | ♦ Cost: | lowest cost = 5 | highest cost = 1 |
> | ♦ Overall rating: | best option = 10 | worst option = 2 |

♦ Complex: Different maximum score (weights) are assigned to each of the criteria and each option is scored on each criterion, from 1 up to the maximum weight of that criterion, e.g.,

Criterion	Maximum points	Opt.#1	Opt.#2
Feasibility:	50 points	25	35
Client Acceptability:	35 points	30	20
Low Cost:	15 points	5	15
Overall Rating:	100 points	60	70

Step 5: Taking one option at a time, review each criterion and determine the appropriate rating, using one of the methods above. This ranking can be done individually and then added up. Or, if the rating method is simple, it can be done as a group discussion.

Step 6: Total the value for each option by adding the ranking for each criterion.

Step 7: Evaluate the results by considering the following questions:

- Does one option clearly meet all criteria?
- Can any options be eliminated?
- If an option meets some but not all criteria, is it still worth considering?

Caution

♦ Make sure that everyone clearly understands the options under consideration.

♦ Everyone will need to understand and to agree with the operational definitions of the criteria.

System Modeling

System modeling shows how the system should be working. Use this technique to examine how various components work together to produce some outcome. These components make up a system, which is comprised of resources processed in various ways (counseling, diagnosis, treatment) to generate direct outputs (products or services), which in turn can produce effects (e.g., immunity, rehydration) on those using them, and longer term, more indirect impacts (e.g., reduced measles prevalence or reduced mortality rates) on users and the community at large.

When To Use It

By diagramming the linkages between each system activity, system modeling makes it easier to understand the relationships among various activities and the impact of each on the other. It shows the processes as part of a larger system whose objective is to serve a specific client need. System modeling is valuable when an overall picture is needed. System modeling shows how direct and support services interact, where critical inputs come from, and how products or services are expected to meet the needs in the community. When teams do not know where to start, system modeling can help in locating problem areas or in analyzing the problem by showing the various parts of the system and the linkages among them. It can pinpoint other potential problem areas. It can also reveal data collection needs: indicators of inputs, process, and outcomes (direct outputs, effects on clients, and/or impacts). Finally, it can be helpful in monitoring performance.

Elements of System Modeling

System modeling uses three elements: inputs, processes, and outcomes.

Inputs are the resources used to carry out the activities (process). These inputs can be raw materials or products and services produced by other parts of the system. For example, with the malaria treatment system, inputs include anti-malarial drugs and skilled health workers. Other parts of the system provide both of these inputs: the drugs by the logistics subsystem and the skilled manpower by training subsystem.

Processes are the activities and tasks that turn the inputs into products and services. For malaria treatment, this process would include the tasks of taking a history and conducting a physical examination of patients complaining of fever, making a diagnosis, providing treatment, and counseling the patient.

Outcomes are the results of processes; these generally refer to the direct **outputs** generated by a process, and may sometimes refer to the more indirect **effects** on the clients themselves and the still more indirect **impacts** on the wider community.

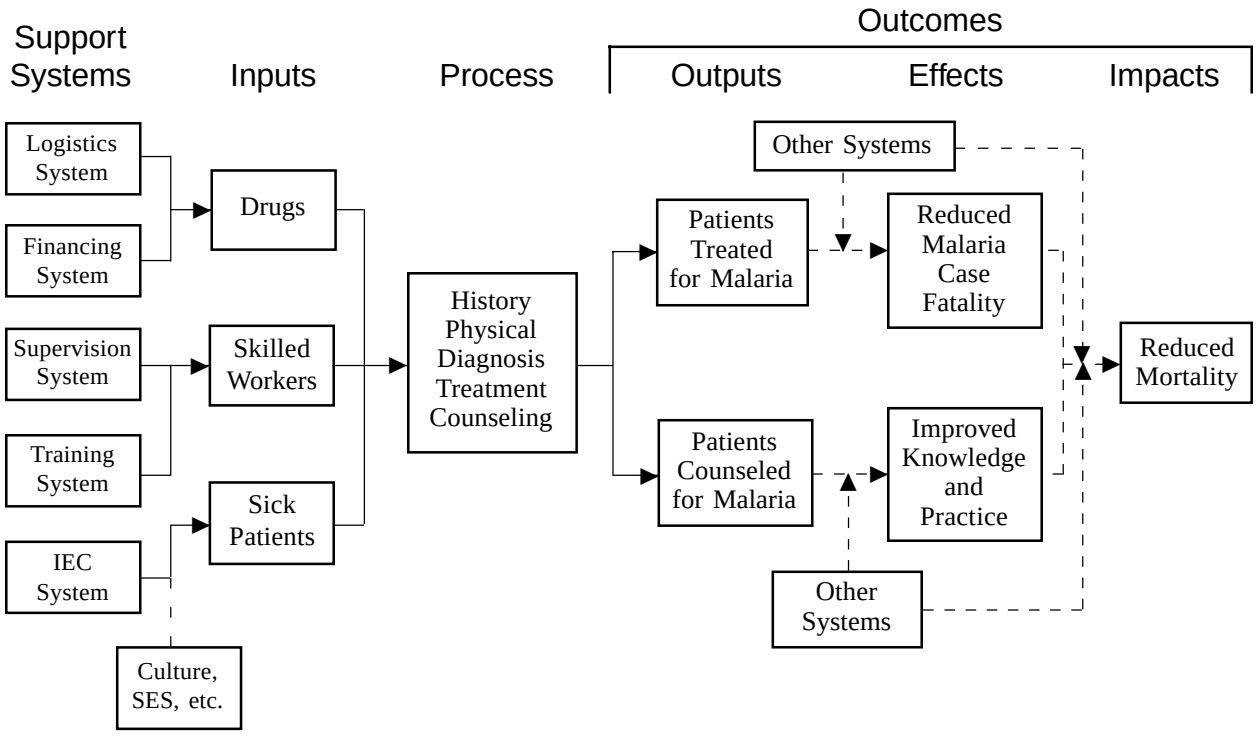
Outputs are the direct products or services produced by the process. The outputs of the malaria treatment system are patients receiving therapy and counseling.

Effects are the changes in client knowledge, attitude, behavior, and/or physiology that result from the outputs. For the malaria treatment system, this would be reduced case fatality from malaria (patients getting better) and patients or caretakers who know what

to do if the fever returns. These are indirect results of the process because other factors may intervene between the output (e.g., correct treatment with an anti-malarial) and the effect (e.g., the patient's recovery).

Impacts are the long-term and still more indirect effects of the outputs on users and the community at large. For malaria treatment, the impacts would be improved health status in the community and reduced infant and child mortality rates.

System Model for Malaria Treatment



As the figure above shows, systems contain many interconnected parts that must be woven together. The utility of system modeling is its ability to depict how parts relate. It is at these junctions that the system displays its strengths or weaknesses.

How To Use It

- Identify the major process or "system" to be modeled and the need that system is to be serving (desired impact). This can be done by starting with PROCESS or the IMPACT.

  If starting from the PROCESS of interest, identify the part of the system to be modeled: a health care intervention (such as immunizations, malaria treatment, or hospital emergency services). It is also possible to focus system modeling on a support service, such as supervision or logistics. Next, identify the needs in the community that this PROCESS is supposed to be addressing (remember that support services meet the needs of "internal" clients).

OR

If starting with the IMPACT, identify what the system is supposed to affect: e.g., what is the need in the community that the system is supposed to meet? Then, identify what PROCESS is carried out to create the services or products (OUTPUTS) that would be expected to have an appropriate EFFECT on clients, which could in turn be expected to result in the desired IMPACT (meet that need).

Draw and label the IMPACT and the PROCESS boxes.

- Work backwards through the OUTCOMES, beginning with the need (DESIRED IMPACT), and determine what EFFECTS the product or services (OUTPUTS) must produce in the clients to achieve that desired IMPACT. Think about the various groups affected by the products and services. Draw and label the OUTCOME box.

Identify other factors that can affect the IMPACT: e.g., the economy or cultural factors, and add them to the model. No system operates in a vacuum, and the IMPACT will always be influenced by factors outside the system.

- Identify the specific OUTPUTS produced by the process that lead to the OUTCOMES just identified. In many instances, there will be more than one kind of OUTPUT: for example, the vaccination system should produce vaccinated children and knowledgeable mothers.
- Identify the major task categories in the PROCESS: e.g., history, physical, diagnosis, treatment, and counseling. Write these in the PROCESS box. Review the OUTPUTS and make sure that there is an OUTPUT identified for each beneficiary of the major tasks.
- Identify the various INPUTS needed to carry out the process. These INPUTS should include manpower, material, information, and financial resources. Draw boxes for the various INPUTS and label them. Determine which support systems (such as logistics, training, supervision) produce each of these INPUTS and write the sources in the boxes.

Using the System Model for Problem Analysis

Review the various elements of the system. Determine what data are needed to know if the system is sufficiently productive or adequately functioning to achieve the outcome and impact desired. Use these data to assess whether the system is performing as it has been drawn. Identify weak or missing components of the system by seeing where in the process quality falls short.

Caution

- Involve people who know the system being modeled, either while developing the model or as reviewers when it has been completed.
- Be sure that the system model really addresses the identified problem.

Flow Charts

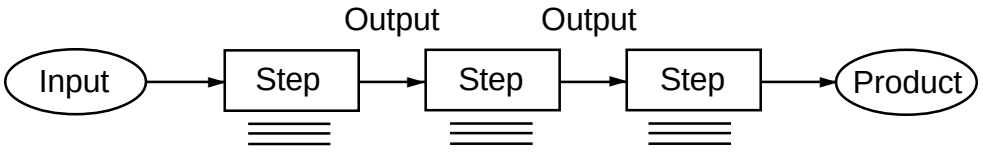
A flow chart is simply a graphic representation of how a process works, showing, at a minimum, the sequence of steps. Several types of flow charts exist: the most simple (a high-level or first-level flow chart), a detailed version (a second-level flow chart), and one that also indicates the people involved in the steps (a deployment or matrix flow chart).

When To Use It

A flow chart helps to clarify how things are currently working and how they could be improved. This tool also assists in finding the key elements of a process, while drawing clear lines between where one process ends and the next one starts. Developing a flow chart establishes communication and common understanding about the process. In addition, flow charts are used to identify appropriate team members, to identify who provides inputs or resources to whom, to establish important areas for monitoring or data collection, to identify areas for improvement or increased efficiency, and to generate hypotheses about causes. Flow charts can be used to examine processes for the flow of patients, information flow, flow of materials, clinical care processes, or combinations of these processes.

Types of Flow Charts

Several different types of flow charts can be used.



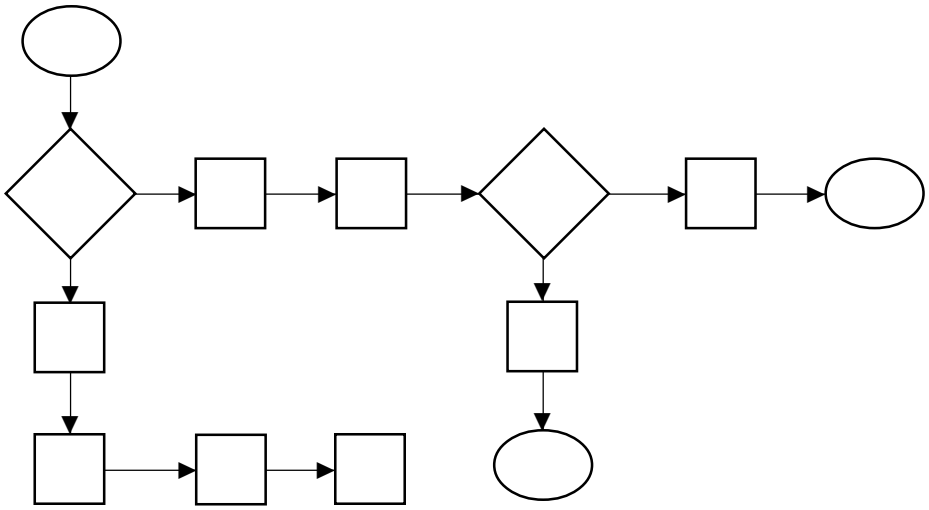
First-level or Top-down Flow Chart

A first-level flow chart shows the major steps in a process. It can also include intermediate outputs of each step (the product or service produced), and the sub-steps involved. Such a flow chart is generally used to gain a basic picture of the process and to identify the changes taking place within the process. It is significantly useful for identifying appropriate team members (those who are involved in the process) and for developing indicators for monitoring the process because of its focus on intermediate outputs.

Most processes can be adequately portrayed in 4 or 5 boxes that represent the major steps or activities of the process. In fact, it is a good idea to use only 4 or 5 boxes, because it forces one to consider the most important steps. Other steps are usually sub-steps of the more important ones.

Detailed or Second-level Flow Chart

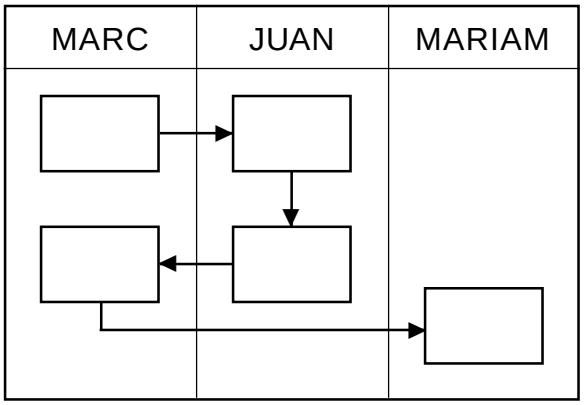
A detailed flow chart indicates the steps or activities of a process and includes such things as decision points, waiting periods, tasks that frequently must be redone (rework), and



feedback loops. This type of flow chart is useful for examining areas of the process in detail and for looking for problems or areas of inefficiency.

Deployment or Matrix Flow Charts

A deployment flow chart maps out the process in terms of *who* is doing the steps. It is in matrix form, showing the various participants and the flow of steps among these participants. It is chiefly useful in identifying who is providing inputs or services to whom, as well as areas where different people may be needlessly doing the same task.



When To Use Which Flow Chart

Each type of flow chart has its strengths and weaknesses. The first-level flow chart is the simplest to construct but may not provide sufficient detail for some purposes. In choosing which type to use, the group should be clear on their purpose for flow charting. The table on the following page gives some indications, but perhaps the best guidance is to start with the simplest method first, and if that does not do the job, go on to the more complex, time-consuming charts.

Type of Flow Chart Indicated for Various Purposes

How To Use It

Regardless of the type of flow chart, there are several basic steps to its construction.

Purpose	High Level	Detailed	Deployment
Initial understanding of the process, determining team membership	+ + +		+ +
Gaining group consensus about the process	+ + +	+ + +	+ + +
Developing areas or indicators to be monitored for process information	+ + +	+ +	
Looking for areas where efficiencies can be gained		+ + +	+ +
Identifying who provides what to whom	+ +	+ +	+ + +
Searching for specific problem areas or steps that must often be redone	+	+ + +	+ +
Task allocation			+ + +

+ + + very useful + + often useful + sometimes useful

- Agree on the purpose of the flow chart and which format is most appropriate.
- Determine the beginning and end points of the process to be flow charted. Get agreement from the group on these.
  - What signals the beginning of this process? What are the inputs?
  - How do we know when the process is complete? What is the final output?
- Identify the elements of the flow chart by asking the following questions:
  - Who provides the input for this step? Who uses it?
  - What is done with these inputs? What decisions need to be made?
  - What is the output to this step? Who uses it to do what?

Type of chart	Basic Elements
First-level:	major steps, inputs, and outputs
Second-level:	steps or activities, decision points, inputs, and outputs
Deployment:	steps, inputs and outputs, persons involved

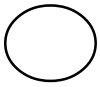
The steps and decision points put into the flow chart should reflect the *true* process (what is actually done). This is the only way to see what can or needs to be improved. If ideas

for improvement are generated while developing the flow chart, do not discuss their merits at this time, but be sure to note them down for future reference.

- Review to see whether the steps are in their logical order. Areas that are unclear can be represented with a cloud symbol (cloudy area), to be clarified later.
- After a day or two, review the flow chart with the group to see if the group is satisfied with its work. Ask others involved in the process if they feel it reflects what they do.

Basic Symbols for Any Type of Flow Chart

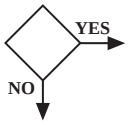
Step or activity



Start / End points in the process

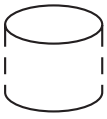
Cloudy step

Additional Symbols for Second-level Flow Charts

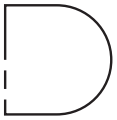


Decision or branch point

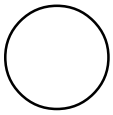
Documentation (or written information about the process)



Information into database



Wait / Bottleneck



Connector to another process

Hints for Construction of Flow Charts

Try to develop a first draft in one sitting, going back later to make refinements. Use the "five-minute rule" which says: do not let five minutes go by without putting up a symbol or box; if the decision as to the symbol or box is unclear, use a cloud symbol or a note and move on.

To avoid having to erase and scratch out as ideas develop, cut out shapes for the various symbols beforehand and place them on the table. This way, changes can easily be made by moving things around while the group is getting the process clear.

When using decision symbols, use them when those working in the process must make a decision that will affect how the process will proceed. For example, when the outcome of the decision or question is YES, the person would follow one set of steps, and if the outcome is NO, the person would do another set of steps. Be sure to what is written inside the decision symbol in a way that the response is either YES or NO, so that the flow of the diagram is logical.

In trying to decide how much detail to put in the flow chart (i.e., how much to break down each general step), remember the purpose of the flow chart. For example, a flow chart to better understand the problem of long waiting times would need to break down in detail only those steps that could have an effect on waiting times. Steps which do not affect waiting times can be kept broad (not to much detail).

Keep in mind that a flow chart may not need to include all the possible symbols. For example, the wait symbol ( ) may not be needed if a flow chart is not related to waiting times.

Analyzing the Detailed Flow Charts To Identify Problem Areas

Once the flow chart has been constructed to represent how the process actually works, examine potential problem areas or areas for improvement using one or more of the following techniques.

- Examine each decision symbol: Is this an activity to see if everything is going well? Is it effective? Is it redundant?
- Examine each loop that indicates work being redone (rework): Does this rework loop prevent the problem from reoccurring? Are repairs being made long after the step in which the errors originally occurred?
- Examine each activity symbol: Is this step redundant? Does it add value to the product or service? Is it problematic? Could errors be prevented in this activity?
- Examine each document or data base symbol: Is this necessary? Is it up to date? Is there a single source for the information? Could this information be used for monitoring and improving the process?

- Examine each wait symbol: What complexities or additional problems does this wait cause? How long is the wait? Could it be reduced?
- Examine each transition where one person finishes his part of the process and another person picks up: Who is involved? What could go wrong? Is the intermediate product or service meeting the needs of the next person in line?
- Examine the overall process: Is the flow logical? Are there fuzzy areas or places where the process leads off to nowhere? Are there parallel tracks? Is there a rationale for those?

Caution

- Flow charts should always reflect the actual process, not the ideal process. A flow chart must reflect what really happens.
- Involve people who know the process, either while developing the flow chart or as reviewers when the chart has been completed.
- Be sure that the flow chart really addresses the identified problem.

Cause-and-Effect Analysis

A cause-and-effect analysis generates and sorts ideas or hypotheses about possible causes of problems within a process. It lists items in graphic display.

When To Use It

A cause-and-effect analysis organizes a large amount of information by showing links between events and their potential or actual causes. A graphic presentation, with major branches reflecting categories of causes, stimulates and broadens thinking about potential or real causes and facilitates further examination of individual causes. Because everyone's ideas can find a place on the diagram, a cause-and-effect analysis helps to generate consensus about causes. It can help to focus attention on the process in which a problem is occurring and to allow for constructive use of facts gained from reported events. However, it is important to remember that a cause-and-effect diagram is a structured way of expressing **hypotheses** about the causes of a problem or about why something is not happening as desired. It cannot replace empirical testing of these hypotheses: it does **not** tell which **is** the **root** cause.

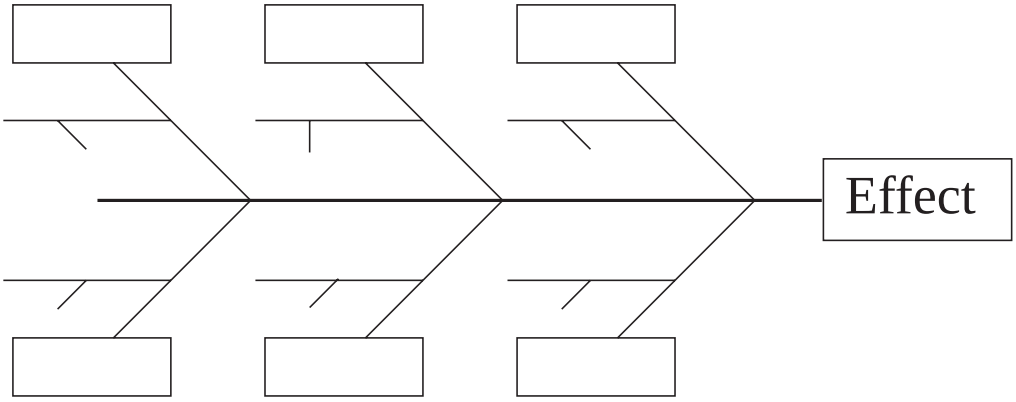
Types of Cause-and-Effect Analyses

There are two ways of graphically organizing ideas for a cause-and-effect analysis. These vary in how potential causes are organized and grouped:

- **by category:** called a fishbone diagram (because of its shape) or Ishikawa diagram (for the man who invented it), or
- **seen as a chain of causes:** called a tree diagram.

The choice of method depends on where the team gets stuck. If the team tends to think of causes only in terms of people, the fishbone diagram, organized around categories of cause, will help to broaden the team's thinking. If the team members' thinking is too shallow, a tree diagram will encourage them to look more deeply for the chain of events or causes.

Causes by Categories (fishbone diagram)



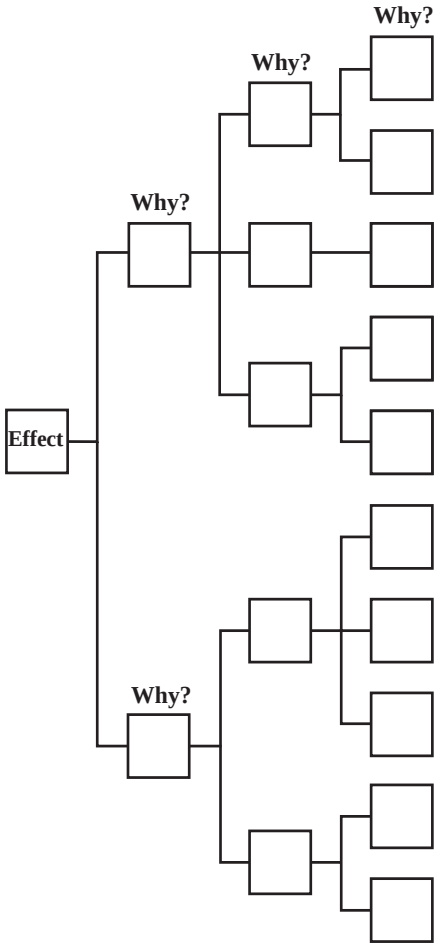
When using a fishbone diagram, several categories of cause can be applied. Below are some often used categories:

- manpower, methods, materials, measurements, and equipment;
- clients, workers, supplies, environment, and procedures;
- what, how, when, where.

Other valid categories for this type of cause-and-effect diagram exist. The group should choose those categories that are most relevant to them, and should feel free to add or drop categories as needed.

The second type of cause-and-effect analysis presented is a *tree diagram*, which highlights the chain of causes. It starts with the effect and the major groups of causes (by step or by category) and then asks for each branch, "why is this happening? what is causing this?" The tree diagram is a graphic display of a simpler method known as the *Five Why's*. It displays the layers of causes, looking in-depth for the *root* cause.

Tree Diagram



The Five Why's

One simple tool for getting at the root causes is to ask the *FIVE WHY*'s, asking "why?" to each successive response five times. Use this technique alone or with any of the cause-and-effect diagrams.

Example

Question 1: **Why** did the patient get the incorrect medicine?
Answer 1: Because the prescription was wrong.

Question 2: **Why** was the prescription wrong?
Answer 2: Because the doctor made the wrong decision.

Question 3: **Why** did the doctor make the wrong decision?
Answer 3: Because he did not have complete information in the patient's chart.

Question 4: **Why** wasn't the patient's chart complete?
Answer 4: Because the doctor's assistant had not entered the latest laboratory report.

Question 5: **Why** hadn't the doctor's assistant charted the latest laboratory report?
Answer 5: Because the lab technician telephoned the results to the receptionist, who forgot to tell the assistant.

Solution: **Develop a system for tracking lab reports.**

How To Use Cause-and-Effect Analysis

Although several ways to construct a cause-and-effect analysis exist, the steps of construction are essentially the same.

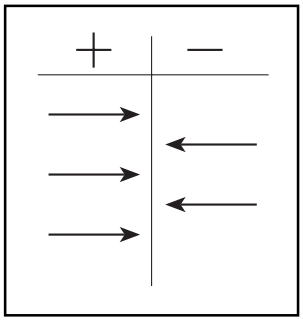
- Agree on the problem or the desired state and write it in the **effect** box. Try to be specific. Problems that are too large or too vague can get the team bogged down. [*Cause-and-effect diagrams can reflect either causes that block the way to the desired state or helpful factors needed to reach the desired state*.]
- If using a tree diagram, define the major categories of steps or causes. This technique can be used for a fishbone diagram as well. Or the team can brainstorm first about likely causes and then sort them into major branches. The team should add or drop categories as needed when generating causes. Each category (or step) should be written into the box. Generally, using three to six categories works best.
- Identify specific causes and fill them in on the correct branches or sub-branches. Use simple brainstorming to generate a list of ideas before classifying them on the diagram, or use the development of the branches of the diagram first to help stimulate ideas. Either way will achieve the same end. Use the method that feels most comfortable for the group. If an idea fits on more than one branch, place it on both. Be sure that the causes as phrased have a direct, logical relationship to the problem or effect stated at the head of the fishbone.
- Each major branch (category or step) should include three or four possible causes. If a branch has too few, lead the group in finding some way to explain this lack, or ask others who have some knowledge in that area to help.
- Keep asking “why?” and "why else?" for each cause until a potential root cause has been identified. A root cause is one that: 1) can explain the “effect,” either directly or through a series of events, and 2) if removed, would eliminate or reduce the problem. Try to ensure that these "why?s" are plausible explanations and that, if possible, they are amenable to action.

  Be sure that the causes as phrased have a direct, logical relationship to the problem or effect stated at the head of the fishbone.
- Check the logic of the chain of causes: read the diagram from the root cause to the effect to see if the flow is logical. Make needed changes.
- Have the team choose several areas they feel are most likely causes. These choices can be made by voting, based on the team’s best collective judgment.
- Use the reduced list of likely causes to develop simple data collection tools to prove the group’s theory. If the data confirm none of the likely causes, go back to the cause-and-effect diagram and choose other causes for testing.

Caution

- Remember that cause-and-effect diagrams represent hypotheses about causes, not facts. Failure to test these hypotheses, and thus treating them as if they are facts, often leads to implementing the wrong solutions and wasting time. To determine the root cause(s), the team must collect data to test these hypotheses.
- The “effect” or problem should be clearly articulated to produce the most relevant hypotheses about cause. If the “effect” or problem is too general or ill defined, the team will have difficulty focusing on the effect, and the diagram will be large and complex.
- It is best to develop as many hypotheses as possible so that no potentially important root cause is overlooked.
- Be sure to develop each branch fully. If this is not possible, then the team may need more information or help from others for full development of all the branches.

Force-Field Analysis



Force-field analysis, a tool developed by Kurt Lewin, identifies forces that help and forces that hinder reaching an outcome or the solution to a problem. It depicts a situation as a balance between two sets of forces: one that tries to change the status quo and one that tries to maintain it. This method can focus attention on ways of reducing the hindering forces.

When To Use It

Force-field analysis forces people to think together about what works for and against the status quo, helping team members to view each case as two sets of offsetting factors. It can be used to study existing problems, or to anticipate and plan more effectively for implementing change. When used in problem analysis, force-field analysis is especially helpful in defining more subjective issues, such as morale, management, effectiveness, and work climate. Force-field analysis also helps keep team members grounded in reality when they start planning a change by making them look systematically at what kind of resistance they could meet. Conducting a force-field analysis can help build consensus by making it easy to discuss objections people may raise and by examining how to address these concerns.

How To Use It

- State the problem or desired state and make sure that all team members understand. Force-field analyses can be constructed in terms of factors working for and against a desired state OR in terms of factors working for and against the status quo or problem state.
- Brainstorm on factors that move toward the desired state and those that hinder movement toward that state (or on factors that maintain the existing problem state and those that could solve it).
- Review and clarify each force or factor. What is behind these factors? What works to balance the situation?
- Determine how great the hindering forces are (high, medium, low) on the desired state (or problem state). Those that have the biggest impact should be tested as likely causes when the force-field analysis is used for problem analysis. If used while developing solutions, those factors with the biggest impact may become the focus of plans to reduce resistance to change.
- Develop an action plan to address the largest hindering forces.

Caution

- If a significant force is omitted, then its impact can negatively affect a plan of action. All significant forces or factors must be included and considered.

Statistical / Data Presentation Tools

Several types of statistical/data presentation tools exist:

- Charts displaying frequencies: bar charts, pie charts, Pareto charts.
- Charts displaying trends: run charts, control charts.
- Charts displaying distributions: histograms.
- Charts displaying associations: scatter diagrams.

Different types of data require different kinds of statistical tools. There are two types of data:

- **Attribute data:** These are countable data or data that can be put into categories: e.g., the number of people willing to pay, the number of complaints, percent who want blue/ percent who want red/percent who want yellow.
- **Variable data:** These are measurement data, based on some continuous scale: e.g., length, time, cost

The table below provides some guidance for choosing the proper tool:

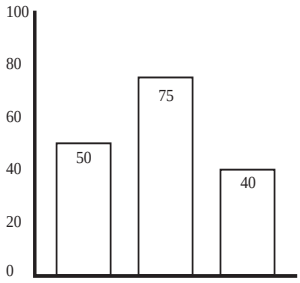
To Show	Use	Data Needed
Frequency of Occurence Simple percentages or comparisons of magnitude	Bar Chart, Pie Chart, Pareto Charts	Tallies by category (data can be attribute data or variable data divided into categories)
Trends Over Time	Line Graphs, Run Charts, Control Charts	Measurements taken in chronological order (attribute or variable data can be used)
Distribution: Variation not related to time (distributions)	Histograms	Forty or more measurements (not necessarily in chronological order), variable data
Association: Looking for a correlation between two things	Scatter Diagrams	Forty or more paired measure-ments (measures of both things of interest), variable data

Bar Charts and Pie Charts

Bar and pie charts use pictures to compare the sizes, amounts, quantities, or proportions of various items or groupings of items.

When To Use Them

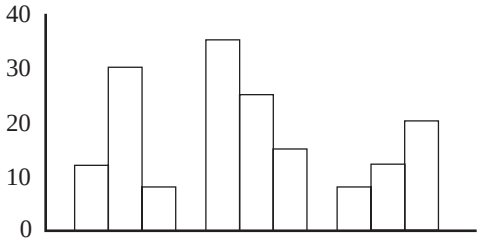
Bar and pie charts make it easier to understand data because they present the data as a picture, allowing the results to stand out. This is particularly helpful in presenting results to team members, managers, and other interested parties. Bar and pie charts present results that compare different groups. They can also be used with variable data when the data have been grouped. Bar charts work best when showing comparisons among categories, while pie charts are used for showing relative proportions of various items in making up the whole (how the "pie" is divided up). These charts can be used in defining or choosing problems to work on, analyzing problems, verifying causes, or judging solutions.



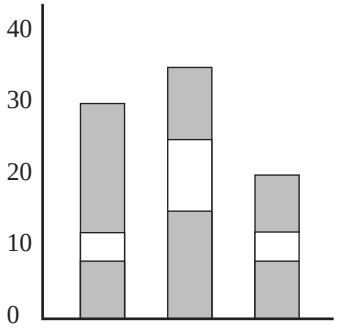
How To Use a Bar Chart

Teams may choose between three types of bar charts, depending on the type of data they have and what they want to stress:

- **Simple bar charts** sort data into simple categories.



- **Grouped bar charts** divide data into groups within each category. This type of bar chart shows comparisons between individual groups as well as between categories. It gives more useful information than a simple total of all the components.



- **Stacked bar charts,** like grouped bar charts, use grouped data within categories. They make clear both the sum of the parts and each group's contribution to that total.

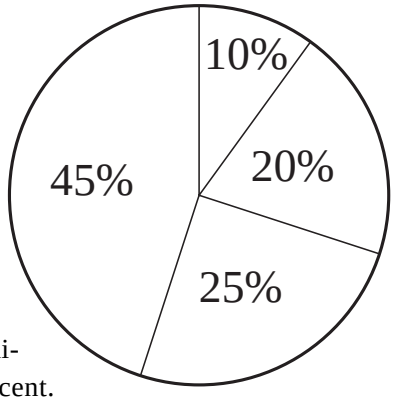
Steps in constructing the chart:

- Choose the type of bar chart that stresses the results to be focused on. Grouped and stacked bar charts will require two classification variables. If using stacked bar graphs, tally the data within each category into combined totals before drawing the graph.
- Draw the vertical axis to represent the values of the variable of comparison (number, cost, time). Establish the range for the data by subtracting the smallest value from the

largest. Determine the scale for the vertical axis at approximately 1.5 times the range and label the axis with the scale and unit of measure.

- Determine the number of bars needed. The number of bars will equal the number of categories for simple or stacked bar charts. When using grouped bar charts, the number of bars will equal the number of categories multiplied by the number of groups. This number is important for determining the length of the horizontal axis.
- Draw bars of equal width for each item and label the categories and the groups. Provide a title for the graph. Indicate the sample and the time period covered by the data.

How To Use a Pie Chart



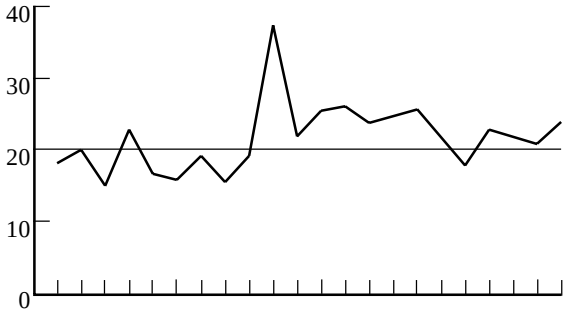
- Taking the data to be charted, calculate the percentage contribution for each category by dividing the value of each category by the total and multiplying by 100.
- Draw a circle. Using these percentages, determine what portion of the circle will be represented by each category. This can be done by eye or by calculating the number of degrees and using a compass. By eye, divide the circle into four quadrants representing 25 percent. Draw in the segments by estimating how much larger or smaller each category is. Calculating the number of degrees can be done by multiplying the percent by 3.6 (a circle has 360 degrees) and then using a compass to draw the portions.
- Provide a title for the graph. Indicate the sample and the time period covered by the data.

Caution

- Be careful not to use too many notations on the charts. Keep them as simple as possible and include only the information necessary to interpret the chart.
- Do not draw wide-reaching conclusions from the data if they do not justify them. For example, determining whether a trend exists may require more statistical tests and probably cannot be determined by the chart alone. Differences among groups also may require more statistical testing to determine if they are significant.
- Whenever possible, use bar or pie charts to support data interpretation. Do not think that results or points are so clear and obvious that a chart is not needed for clarity.
- A chart must not lie or mislead! To ensure that this does not happen, follow the guidelines:
    - scales must be in regular intervals,
    - charts that are to be compared must also use the same scale and symbols,
    - charts should be easy to read.

Run Charts

Run charts give a picture of variation in some process over time, and help detect special (external) causes of that variation. They make trends or other non-random variation in the process easier to see and understand.



When To Use Them

If data analysis focuses on statistics that give only the big picture (such as average, range, and variation), trends over time can often be lost. Thus, changes could be hidden from view and problems left unresolved. Run charts graphically display shifts, trends, cycles, or other non-random patterns over time. They can be used to identify problems (by showing a trend away from the desired results), and to monitor progress when solutions are carried out.

How To Use Them

A run is the consecutive points running either above or below the center line (mean or median). The points in a run chart mark the single events (how much occurred at a certain point in time). A run is broken once it crosses the center line. Values on the center line are ignored: they do not break the run, nor are they counted as points in the run.

The basic steps in creating a run chart follow:

- Collect at least 25 data points (number, time, cost), recording when each measurement was taken. Arrange the data in chronological order.
- Determine the scale for the vertical axis as 1.5 times the range (the smallest value subtracted from the largest). Label the axis with the scale and unit of measure.
- Draw the horizontal axis and mark the measure of time (minute, hour, day, shift, week, month, year, etc.) and label the axis.
- Plot the points and connect them with a straight line between each point. Draw the center line (the average of all the data points).

The following provide some guidance in interpreting a run chart:

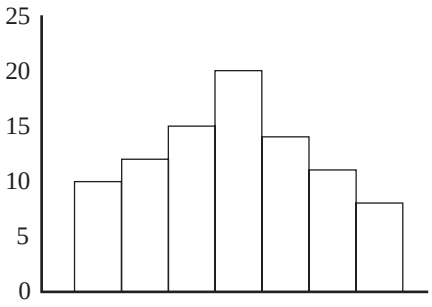
- Eight consecutive points above (or below) the center line (mean or median) suggest a shift in the process.
- Six successive increasing (or decreasing) points suggest a trend.
- Fourteen successive points alternating up and down suggest a cyclical process.

Caution

- Be careful not to use too many notations on a run chart. Keep it as simple as possible and include only the necessary information to interpret the chart.
- Do not draw wide-reaching conclusions from the data if they do not justify them. Certain trends and interpretations may require more statistical testing to determine if they are significant.
- Whenever possible, use a run chart to show the variation in the process. Do not think that the variation is so clear and obvious that a run chart is not needed.
- A run chart must not lie or mislead! To ensure that this does not happen, follow the guidelines:
    - scales must be in regular intervals,
    - charts that are to be compared must also use the same scale and symbols,
    - charts should be easy to read.

Histograms

Histograms are charts that indicate how often some event is likely to occur by showing the pattern of variation (distribution) of data. A pattern of variation has three aspects: the center (average), the shape of the curve, and the width of the curve. Histograms are constructed with variables—such as time, weight, temperature—and are not appropriate for attribute data.



When To Use It

All data show variation; histograms help interpret this variation by making the patterns clear. They tell a visual story about a specific case in a way that a table of numbers (data points) cannot. Histograms can be used to identify and verify causes of problems. They can also be used to judge a solution, by checking whether it has removed the cause of the problem.

How To Use It

- From the raw numbers (the data), find the highest and lowest values, and determine the range (the highest value minus the lowest value).
- Determine the number of bars to be used in the histogram. If too many bars are used, the pattern may get lost in the detail; if too few are used, the pattern may get lost within the bars. The following will serve as a guide in choosing an appropriate number of bars.

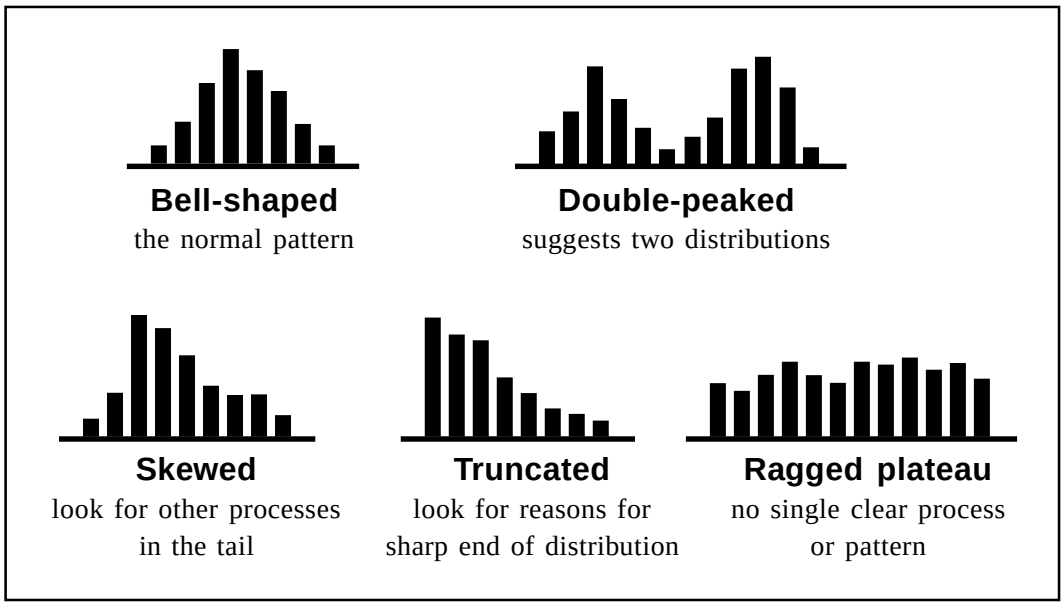
Number of data points	Number of bars
< 50	5- 7
50-100	6-10
101-250	7-12
> 250	10-20

- Determine the width of each bar by dividing the range by the number of bars. Then, starting with the lowest value, determine the grouping of values to be contained or represented by each bar.
- Create a compilation table like the one on the following page and fill in the boundaries for each grouping.
- Complete the above frequency table by counting the number of data points for each bar and calculating the total number of data points in each bar.

Compilation Table for Histogram

Bar	Boundaries	Tally	Total
1			
2			
3			
4			
5			

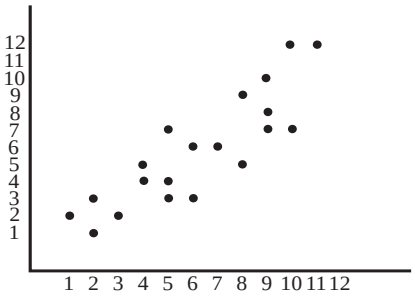
- Draw the horizontal and vertical axes, and label them.
- Draw in the bars to correspond with the totals from the frequency table.
- Identify and classify the pattern of variation. The graphs below present the possible shapes and their interpretation.



Caution

- Simple daily observations often do not tell enough about the process, and averages or ranges are not adequate summaries of the data. The potential pitfall of a histogram is not using one; it is a useful, necessary tool.
- If variation is small, the histogram may not be sensitive enough to detect significant differences in variability or in the peaks of the distribution, especially if using a small-sample data set. There are advanced statistical tools that can be used in such situations.

Scatter Diagrams



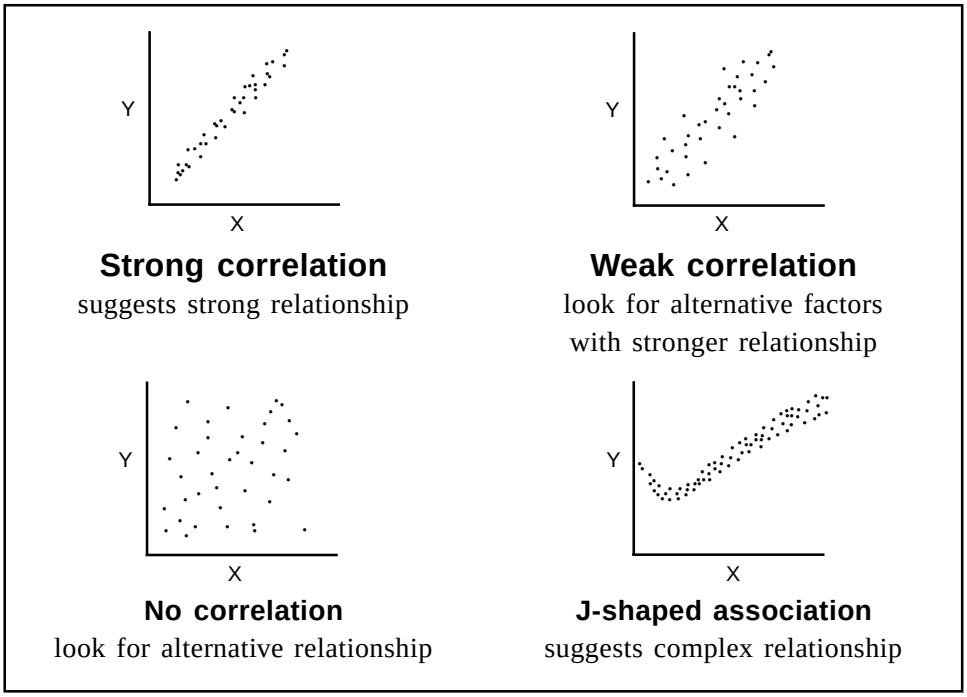
A scatter diagram gives a picture of the association between two variables. It can point to but does not prove a *causal* relationship.

When To Use It

Scatter diagrams make the relationship between two continuous variables stand out visually on the page in a way that the raw data cannot. Scatter diagrams may be used in examining a cause-effect relationship between variable data (continuous measurement data). They can also show relationships between two effects to see if they might stem from a common cause or serve as surrogates for each other. Scatter diagrams can also examine the relationship between two causes. They are easy to construct.

How To Use It

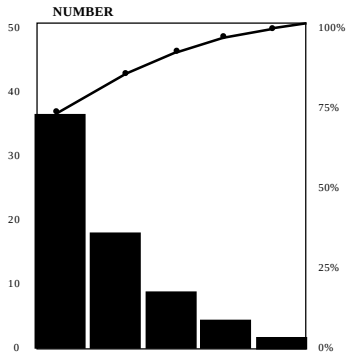
- Collect at least 40 paired data points: "paired" data are measures of both the cause being tested and of its supposed effect at one point in time.
- Draw the grid, with the "cause" on the horizontal axis and the "effect" on the vertical axis. Determine the lowest and highest value of each variable and mark the axes accordingly.
- Plot the paired points on the diagram. If there are multiple pairs with the same value, draw as many circles around the point as there are additional pairs with those same values.
- Identify and classify the pattern of association using the graphs below of possible shapes and interpretations.



Caution

- Stratifying the data in different ways can make patterns appear or disappear. When experimenting with different stratifications and their effects on the scatter diagram, label how the data are stratified so the team can discuss their implications.
- Interpretation can be limited by the scale used. If the scale is too small and the points are compressed, then a pattern of correlation may appear differently. Determine the scale so that the points cover most of the range of both axes and that both axes are about the same length.
- Be careful of the effects of confounding factors. Sometimes the correlation observed is due to some cause other than those being studied. If a confounding factor is suspected, then stratify the data by it. If it is truly a confounding factor, then the relationship in diagram will change significantly.
- Avoid the temptation to draw a line roughly through the middle of the points. This can be misleading. A true regression line is determined mathematically. Consult a statistical expert or text prior to using a regression line.
- Scatter diagrams show relationships but do not prove that one variable causes the other.

Pareto Charts



A Pareto chart provides facts needed for setting priorities. It organizes and displays information to show the relative importance of various problems or causes of problems. It is essentially a special form of a vertical bar chart, which puts items in order (from the highest to the lowest) relative to some measurable effect of interest: frequency, cost, time. The chart is based on the *Pareto* principle, which states that whenever many factors affect a situation, only a few factors will account for most of the impact. By placing the items in descending order of frequency, it is easy to discern those problems that are of greatest importance or those causes that appear to account for most of the variation. Thus, a Pareto chart helps teams to focus their efforts where they can have the greatest potential impact.

When To Use It

Pareto charts help teams focus on the small number of really important problems or causes of problems. Pareto charts are useful in establishing priorities by showing which are the most critical problems to be tackled or causes to be addressed. Comparing Pareto charts of a given situation over time can also measure whether an implemented solution reduced the relative frequency or cost of that problem or cause.

How To Use It

- Develop a list of problems, items, or causes to be compared.
- Develop a standard measure for comparison for these items:
  - how often it occurs: frequency (e.g., utilization, complications, errors);
  - how long it takes: time;
  - how many resources it uses: cost.
- Choose a time frame for collecting the data.
- Tally for each item how often it occurred (or cost or total time it took). Then add these amounts up to determine the grand total for all items. Find the percent of each item in the grand total by taking the sum of the item, dividing it by the grand total, and multiplying by 100.

Causes for Late Arrival	Number of Occasions	Percent (%)
Family problems	8	11%
Woke up late	20	27%
Had to take the bus	4	6%
Traffic tie-up	32	44%
Sick	6	8%
Bad weather	3	4%
Total	**73**	**100%**

- List the items being compared in decreasing order of the measure of comparison: e.g., the most frequent to the least frequent. The cumulative percent for an item is the sum of that item's percent of the total and that of all the other items that come before it in the ordering by rank.

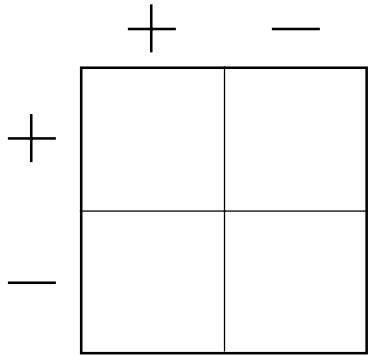
Causes for Late Arrival (decreasing order)	Number of Occasions	Percent (%)	Cumulative Percent (%)
Traffic tie-up	32	44%	44%
Woke up late	20	28%	71%
Family problems	8	10%	82%
Sick	6	8%	90%
Had to take the bus	4	6%	96%
Bad weather	3	4%	100%
Total	**73**	**100**%	

- List the items on the horizontal axis of a graph from highest to lowest. Label the left vertical axis with the numbers (frequency, time, or cost), then label the right vertical axis with the cumulative percentages (the cumulative total should equal 100 percent). Draw in the bars for each item.
- Draw a line graph of the cumulative percentages. The first point on the line graph should line up with the top of the first bar.
- Analyze the diagram by identifying those items that appear to account for most of the difficulty. Do this by looking for a clear breakpoint in the line graph, where it starts to level off quickly. If there is not a breakpoint, identify those items that account for 50 percent or more of the effect. If there appears to be no pattern (the bars are essentially all of the same height), think of some factors that may affect the outcome, such as day of week, shift, age group of patients, home village. Then, subdivide the data and draw separate Pareto charts for each subgroup and see if a clearer pattern emerges.

Caution

- Try to use objective data instead of opinions and votes.

Client Windows



A client window is a tool for gaining feedback from clients about the products and service they use. It differs from a client survey in that a survey asks clients about product or service performance, based on the survey designer's ideas about what clients want and need. A client window asks questions in very broad terms, letting the clients express what they need, expect, like, and dislike in their own terms and from their point of view.

When To Use It

A client window can be used to get information from clients, in their own terms, about what they want or what they like about the current service. However, this is really only one step in understanding what is most important to clients. Not all things listed will be of equal weight, and further discussion with clients may be needed to find which areas are true priorities. A client window can be used by itself, or as groundwork for more formal data collection through surveys; using it in this way can help design more relevant survey questions. Client windows can also be used when designing solutions, getting information that will make it easier to avoid repeating past mistakes in planning.

How To Use It

- Determine the product, area, or service for which feedback is desired. Frame what kind of feedback is being sought. Is feedback desired on the whole range of products and services provided? Is the team more interested in specific areas? For example, clients could be asked to provide feedback on all health services they receive, or the team may want to focus on specific health activities, such as MCH, immunizations, curative care.
- Gather information from clients by asking them to respond to the following questions:

  1. What are you getting that you want? What are you getting that is meeting your needs and expectations?
  2. What are you getting that you really don't want or need?
  3. What do you wish you were getting that you are not?
  4. What needs do you expect in the future?
  5. What suggestions do you have for how we can improve our products or services for you?

There are two ways to administer the client window: to a group of clients at one time, or individually.

Group Administration: Prepare a large client window framework on a piece of flip chart paper or blackboard. When the clients are gathered, explain that the goal of this activity is to get honest feedback about how their needs and expectations are being met. Write the

areas of focus on a flip chart or blackboard. Ask them to write individually the answers to the above questions. (It is best that the clients be given privacy at this point so that they may answer as honestly as possible; leave the room.) Have them place their responses on the client window.

Individual Administration: In this mode, clients are asked to fill out the client window individually, and return their responses (no names required). Prepare instructions for them, including how their feedback will be used, the areas of focus, how to fill out the client window, and where and when to return it. Clients write their responses to the above questions directly on the client window form.

- Compile the information. If the client window was administered in a group, record the answers on a separate sheet of paper as they were written for each section of the window. Review the answers and count how often the same feelings were expressed by several people.

If the client window was administered individually, place all individual responses on a master sheet, and then count how frequently similar responses were given.

Client Window

	Getting	Not Getting
Want	**Getting What You Want (#1)**	**Want But Not Getting (#2)**
Don't Want	**Getting But Not Wanted (#3)**	**Don't Want Not Getting (#4) (anticipated needs for future)**

Caution

- Be sure to have the correct people (the clients) present when completing the window.

Benchmarking

Benchmarking is a technique for learning from others' successes in an area where the team is trying to make improvements. The term *benchmarking* means using someone else's successful process as a measure of desired achievement for the activity at hand.

When To Use It

Benchmarking is most useful when trying to develop options for potential solutions. When trying to develop solutions, teams often have difficulty generating new ideas. People frequently do not know what others nearby are doing. Benchmarking helps stimulate creativity by gaining knowledge of what has been tried. It can also be used to identify areas for improvement by seeing what level of quality is possible to achieve.

How To Use It

- Identify other groups, organizations, or health facilities that serve a similar purpose and that appear to work well. These do not need to be doing exactly what the team does, as long as it can be compared. For example, if the team is dealing with problems in hospital laundry services, the team could learn from hotels and dormitories which provide similar services, although they are not in the same field.

- Visit these sites and talk to managers and workers, asking them what they are doing, if they have similar problems, what they have done about it, and what levels of performance they have achieved. Ask as well what obstacles they have run into and how they have dealt with them.

- Review how the situation and constraints for the process in question are similar to or different from theirs and determine if changes are needed in carrying out their plan.

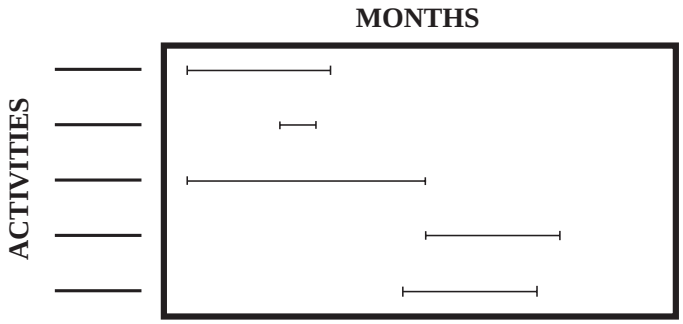
Caution

- Be sure to understand fully how the process in question works before looking at others' processes.

- Be sure that the other person's process is fully understood before adapting or adopting it to the process in question.

Gantt Charts

A Gantt chart aids planning by showing all activities that must take place and when they are scheduled to be carried out.



When To Use It

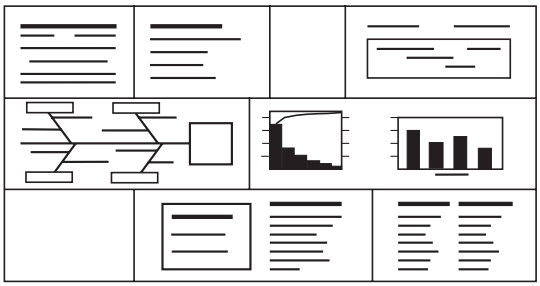
Gantt charts provide a graphic guide for carrying out a series of activities, showing the start date, duration, and overlap of activities.

Gantt charts are most useful in the planning stages, to mark when each activity should start and to draw the linkages in timing between activities. Gantt charts are also useful for keeping track of progress and rescheduling activities if progress is slowed.

How To Use It

- List all the activities that need to be carried out to implement a solution.
- Determine when each activity must start and list them in chronological order.
- Draw the framework for the Gantt chart by listing the months of implementation across the top of a sheet of paper. List the activities down the side.
- For each activity, mark its starting date. Determine the duration for each activity and, using a horizontal bar, mark the duration on the graph. Continue this process for each activity.
- Review the chart and determine if it is possible to carry out all the activities that are to be conducted simultaneously.

Quality Assurance Storytelling



Quality Assurance (QA) Storytelling is an organized way of documenting the quality improvement process of a team that is working systematically to resolve a specific problem and/or improve a given process. QA "stories" are described in detail as they unfold in QA *Storybooks*, and presented publicly through QA *Storyboards*. Initially developed as Quality Improvement Storytelling for industrial quality improvement programs, the technique has more recently been adapted and applied to quality improvement efforts in the health sector. Initially this was carried out by the Hospital Corporation of America (HCA).[1] It is increasingly used by others in health as an effective way of documenting the activities of quality improvement teams in a variety of settings.

The QA Storybook is a complete and permanent record of the improvement process, usually kept in notebook format. The QA Storyboard is a large display area (section of a wall, or a board or poster) which allows a team to display its work publicly in an ongoing, structured, and visually understandable way. It has been described by HCA's Batalden and Gillem as the team's "working minutes."

When To Use It

By systematically documenting the quality improvement progress made by a team, QA Storytelling helps to keep everyone focused on the task at hand, and allows team members to describe their work to others in a clear and comprehensible way. It is normally begun as soon as a problem statement has been drafted and a team assembled, and is continued throughout the quality improvement process, from Step 8 (analyzing the problem) through Step 10 (implementing and evaluating a solution). When used routinely, QA Storytelling can help make QA part of the ongoing life of the organization.

How To Use It

QA Storybook

One team member is usually designated as recorder to maintain a complete and detailed record of the team's activities. The record should include minutes of team meetings as well as such items as lists of persons contacted, presentations made, indicators monitored, sampling designs and analytical methods employed, data collected, etc. From time to time the recorder may use the information in this record to prepare brief summaries of the team's progress in resolving the problem in question. From this record items are selected for posting on the QA Storyboard (see next page).

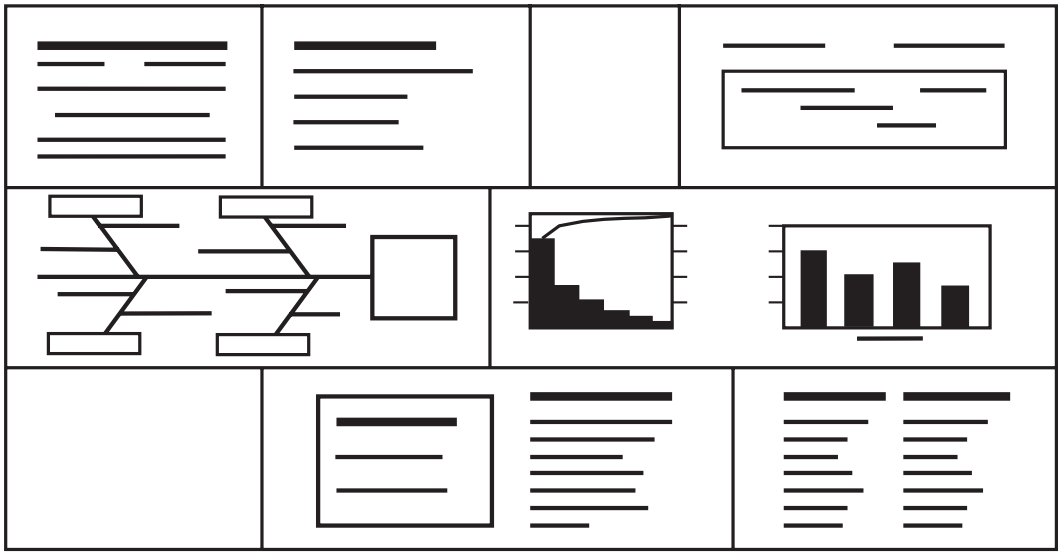
[1] Batalden, Paul and Gillem, Paul. "Hospitalwide Quality Improvement Storytelling." Quality Resource Group. Nashville, Tennessee: Hospital Corporation of American. 1989.

QA Storyboard

The QA Storyboard serves as an ongoing visual record of the team's progress, helping to keep team members focused on the task and serving as an effective way of sharing their progress with others. Storyboards use simple, clear statements as well as pictures and graphs to describe a problem, summarize the analysis process while it is under way, describe the solution and its implementation, and display the results. Steps in creating and maintaining a QA Storyboard follow:

- Reserve a section of the wall, or secure a large board or poster board (measuring at least 1.5 meters high by 2 meters in length) to serve as the QA Storyboard.
- Mark off and label different areas of the Storyboard for displaying the team's progress during each of the quality improvement steps. In the example below, the team has marked off separate areas to display the problem statement, names of team members, a workplan, activities undertaken during problem analysis and their results, root cause(s) identified, solution(s) selected, solution implemented, and the results.
- Post a copy of the initial statement of the problem and the names of the team members. A picture of the team may be added. Keep these up to date as the problem statement is refined and/or as team membership changes.
- Post a copy of the team's workplan and schedule, and modify it as changes are made during the problem-solving process.
- As work progresses, display the progress made in analyzing the problem to determine its root cause(s). Include items such as a flow chart of the process in question, a cause-and-effect diagram, the list of indicators to be monitored, the data collection forms, and graphs displaying the results.
- Post the root cause(s) identified and the solution(s) proposed and selected for implementation. Add any other aspects of the process of solution identification and selection (e.g., selection criteria or selection method) to be displayed for ready reference.
- Maintain an ongoing display of the progress of solution implementation. Show as much (or as little) detail as team members find helpful, either to focus their own work or to communicate their work to others.
- Finally, when the solution has been implemented and evaluated, post the results for all to see.

QA Storyboard



Caution

- Be sure to use it. It is a helpful tool to show the progress of a process improvement team.

Glossary

Affinity analysis

A tool to facilitate consideration and organization of a group of ideas about an issue by a team in a consensual manner. The group members take turns putting forth individual ideas about an issue; next, the ideas are written down by the individuals, one idea to a piece of paper. The individuals then group all the ideas into natural (affinity) groups, (or group the ideas in a manner that allows those with a natural relationship or relevance to be placed together in the same group or category).

Bar chart

A graphic display of data in the form of a "bar" showing the number of units (e.g., frequency) in each category. May be a compound graph or a horizontal graph. Negative numbers can be shown on a bar graph.

Benchmarking

An evaluation technique in which an organization compares its own performance on specific quality program criteria to the performance of a recognized leader in the area of quality assurance. The evaluation helps the organization identify shortcomings and establishes a baseline or standard against which to measure its progress in the development and maintenance of a quality assurance program.

Boundary

The beginning or end point in the portion of a process that will help focus the process improvement effort.

Brainstorming

A group process used to generate ideas in a nonjudgmental environment. Group members are presented with the issue and are asked, first, to be wide-ranging in their own thinking about the issue and, second, not to criticize the thinking of others. The purpose of the tool is to generate a large number of ideas about the issue.

Cause-and-effect analysis (Fishbone or Tree diagram)

A display of the factors that are thought to affect a particular output or outcome in a system. The factors are often shown as groupings of related subfactors that act in concert to form the overall effect of the group.

Cause-and-effect diagram
(see Cause-and-effect analysis)

Client

The receiver or beneficiary of an output of a process, either internal or external to a hospital or an organizational unit. A client could be a person, a department, clinic, etc.

Client window

A tool for gaining feedback from clients about the products and services they use. A client window asks questions in very broad terms, letting the clients express themselves in their own terms and from their own point of view.

Clinical guidelines

Clinical guidelines are systematically developed statements that assist practitioners and patients in making decisions about health care. This approach focuses on specific clinical situations with consideration to clinically relevant factors such as social, organizational, or community-related factors. This method is also based on outcomes and cost-effectiveness data. Different methods are used to develop the guidelines for decision making, such as pathway guidelines, practice algorithms, and appropriate criteria.

Common cause variation
(see also Process variation)

Variation in a process that is due to the process itself and is produced by interactions of variables of that process.

Consensus

General agreement reached within a group.

Constraint

Forces that hinder reaching an outcome or the solution to a problem.

Continuous Quality Improvement (CQI)

An approach to improving and maintaining quality that emphasizes internally driven and relatively constant (as contrasted with intermittent) assessments of potential causes of quality defects, followed by action aimed either at avoiding decrease in quality or else correcting it in an early stage.

Control chart

Graphical representation of the characteristics of a process using data gathered over time. The purpose of control charts is to determine, using the dispersion of points of a chart, whether processes fall within prescribed limits and whether variations taking place are random or systematic.

Counseling

To provide information and guidance to a patient or client.

Criteria

Standards against which something can be judged or assessed.

Criteria, explicit

Criteria which explicitly define expectations of, for example, treatment and outcomes of care. The criteria are based on objective, quantitative measures and are developed by a group of experts, and are used as a basis for comparison with clinical records to see how well the criteria for diagnosis and treatment have been met.

Criteria, implicit

Implicit criteria are the unwritten, internalized criteria of a group or a single expert for what represents the standard of performance for a particular medical problem. The validity of using implicit criteria is heavily dependent upon the expertise of the individual and his ability to convert his own expertise into criteria in his own mind. Use of implicit criteria may result in different qualitative judgment of the same situation by different individuals.

Data

Highly specific quantitative measurements, usually numeric, which can be compared to standards or norms directly or can be combined with other measurements to produce new information for comparison with standards or norms.

Data collection

Gathering facts on how a process works and/or how a process is working from the customer's point of view. All data collection is driven by knowledge of the process and guided by statistical principles.

Explicit criteria

(see Criteria)

External client
(see Client)

Fishbone diagram
(see Cause-and-effect analysis)

Five Whys

A simple tool for getting at root causes of a problem by asking "why?" to each successive response five times.

Flowchart

A graphical representation of the flow of a process. A useful way to examine how various steps in a process relate to each other, to define the boundaries of the process, to verify/identify customer/supplier relationships in a process, to verify or form the appropriate team, to create common understanding of the process flow, to determine the current "best method" of performing the process, and to identify redundancy and unnecessary complexity.

Focus group

A client-oriented approach for collecting information wherein a group (10-12) of participants, unfamiliar to each other, meet to discuss and share ideas about a certain issue. Focus groups are a useful qualitative analysis tool for helping to understand the beliefs and perceptions of the population represented by the group.

Force-field analysis

A systematic method for understanding competing forces that increase or decrease the likelihood of successfully implementing change.

Gantt chart

A type of bar chart used in process planning and control to display planned work and targets for completed work in relation to time.

Guidelines
(see Clinical guidelines)

Histogram

A graphical representation used to plot the frequency with which different values of a given variable occur. Histograms are used to examine existing patterns, identify the range of variables, and suggest a central tendency in variables.

Hypothesis

An "educated guess" or "scientific hunch" about the underlying cause of a problem. A hypothesis serves as a working theory that can be either confirmed or disproved through data collection and analysis.

Impact measurements

Measures of the effect of one or more outcomes, as well as the external environment of the system. They usually are indicators of the goals of the system. Impact measurements may be used as the ultimate sentinel events that indicate a likely need for improvement in care.

Implicit criteria

(see Criteria, implicit)

Incentives

Factors that motivate a person or group to behave in a certain way.

Indicator

A measurable variable (or characteristic) that can be used to determine degree of adherence to a standard or achievement of quality goals. For example: Post-operative infection rate as an indicator of adherence to aseptic surgical technique.

Information

Quantitative data and/or qualitative facts organized in such a way as to allow rational judgments to be made in light of a desired set of goals.

Input

The resources necessary to carry out a process. For example, the service or product a supplier provides to a process. Inputs to one process are the outputs from preceding processes.

Internal clients

The recipient (person or department) of the output of another person or department (product, service, or information) within an organization.

Matrix methods

A consensus development technique. A group of people who are familiar with the problem at hand are asked individually to array a list of potential responses to a problem into a preferred order based on a specified set of criteria for the solution. Through various scoring techniques, individual preferences are combined to form a group preference.

Methods

A systematic procedure, technique or mode of inquiry employed by a particular discipline.

Multi-voting techniques
(see Voting)

A group decision-making technique designed to reduce a long list to a shorter one.

Norm

A level of performance that is deemed acceptable.

Operational definition

A precise definition of an important term or procedure used by a health care team.

Outcome measurements

Measures of the effects of the outputs of the system. Outputs often represent the various objectives of the system and may be used as intermediate indicators of sub-optimal performance by the system.

Output measurements

Output measurements are direct measures of the interaction of inputs and processes in the system. They may be used as continuous monitors of system performance.

Pareto chart

A graphic representation of the frequency with which certain events occur. It is a rank-order bar chart that displays the relative importance of variables in a data set and may be used to set priorities regarding opportunities for improvement.

Participative

An approach to carrying out a program which emphasizes obtaining input or participation from the group members who will carry out the program.

Plan Do Check Act (PDCA)

The key steps involved in implementation and evaluation of quality improvement efforts.

Presentation tools

A set of charts to display different types of data. (See Run chart, Control chart, Histogram, and Scatter diagram)

Prioritization

Application of an explicit set of criteria to set the order in which each of a group of problems will be resolved.

Problem

Existence of a gap between a desired condition (or level of condition) and the condition that actually exists.

Problem solving

Action taken to close the gap between a desired condition and the actual level of the condition.

Problem statement

A concise description of a process in need of improvement, its boundaries, the general area of concern where quality improvement should begin, and why work on the improvement is a priority.

Process

A series of actions that repeatedly come together to transform inputs into outputs.

Process improvement

The continuous endeavor to learn about all aspects of a process and to use this knowledge to change the process to reduce variation and complexity and to improve the level of its performance. Process improvement begins by understanding how customers define quality, how processes work, and how understanding the variation in those processes can lead to wise management action.

Process variation
(see Common cause variation and Special cause varation)

The spread of process output over time. There is variation in every process, and all variation is caused. The causes are of two types-special or common. A process can have both types of variation at the same time or only common cause variation. The management action necessary to improve the process is different depending on the type of variation being addressed.

Protocol

A precise and detailed plan for a process, for example for the management of a clinical condition. A protocol implies a more stringent requirement than a guideline. For example: WHO protocols for diarrhea case management.

Quality

The degree to which actual performance or achievement corresponds to set standards.

Quality assurance

A set of actions taken to bring actual quality up to, or acceptably near, targeted quality.

Quality criterion
(criteria)

An aspect or characteristic of a product or service by which an internal or external customer judges whether quality is present or not. For example: The technical training received by a health care worker who cares for sick children. The characteristic(s) that define the most important aspects of inputs, processes, or outcomes.

Quality improvement

Both a philosophy and a set of guiding principles that represent the foundation of a continuously improving organization.

Rank

To determine the relative position of a problem, a cause, or a solution based on criteria.

Root cause

The underlying reason for the occurrence of a problem.

Run chart

A visual representation of data in such a way as to monitor a process to determine whether there is a systematic change in that process over time.

Scatter diagram

Scatter diagrams are used to plot the distribution of cases in two dimensions. Scatter diagrams are used to rapidly screen for a relationship between two variables.

Special cause variation
(see Process variation)

Variation in process that is assignable to a specific cause or causes. It arises because of special circumstances.

Stable process

A process that does not change or fluctuate.

Standards

Performance specifications that, if attained, would lead to the highest possible quality in the system. A standard is a statement made by an authority about expectations for a product, service, behavior, or outcome. Standards can be rules (e.g., protocols) or specifications. For example: A separate sterile needle must be used for each child being immunized.

Statistical/data presentation tools
(see Presentation tools)

System

The arrangement of organizations, people, materials, and procedures associated with a particular function or outcome. A system is usually made up of inputs, processes, and outputs/outcomes. A large system may have a number of sub-systems. For example: A management information system (MIS).

System Modeling

A means for diagramming how elements of a system relate to one another. The elements may be a sequence of events or actions or a combination of both, administrative units of an organization, the flow of some entity such as commodities, information, or authority from one place to another, or a series of actions or other causes and subsequent effects.

Team

A group of interacting individuals sharing a common goal and the responsibility for achieving it.

Tool

A tangible device used to help accomplish the purpose of a technique.

Total Quality Management (TQM)

An approach to quality assurance that emphasizes a thorough understanding by all members of a production unit of the needs and desires of the ultimate service recipient, a viewpoint of wishing to provide service to internal, intermediate service recipients in the chain of service, and a knowledge of how to use specific data-related techniques to assess and improve the quality of their own and their team's outputs.

Tree diagram
(see Cause-and-effect analysis)

Variation

Differences in the output of process resulting from the influence(s) of people, machines (equipment), materials, and/or methods.

Voting

A relatively unstructured technique in which group members make a choice, using either implicit or explicit criteria.

Weighted voting

A type of voting in which all options are listed and each person is given the possibility to give more weight to some choices than to others.

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