

A conceptual model for total quality management
in hospital support departments

by

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INTRODUCTION

According to the American Society of Quality Control, quality is defined as "the totality of features and characteristics of a product or service that bear on its ability to satisfy (a user's) given needs" (ASQC, 1983). That is, the user has certain expectations for the product/service that is being provided. Conformance of the important characteristics of a service to established standards is the concern of quality. An acceptable level of quality can be attained by performing activities in such a way that the product or service provided conforms the standards established for those activities.

This concept has been widely applied in the manufacturing sector. Quality plays a very important role in business success. By focusing on quality, companies have been able to decrease costs and increase their profit margins.

There is a large literature on the subject of quality management in manufacturing. On the other hand, the application of quality principles in the service industry has not progressed to the level of manufacturing.

This thesis is concerned with quality in the hospital industry. In the last two decades, hospitals have undergone dramatic changes such as the introduction of Diagnosis Related Groups (DRGs), a decrease in occupancy rates, and increased competition. These changes have made hospital

administrators look at a variety of means of maintaining low cost of operation while delivering the best possible service to the consumers.

The purpose of this research is to define a conceptual model for Hospital Total Quality Management (HTQM) and to create a system for defining quality requirements and measuring performance in hospital support departments.

A review of the current literature of manufacturing and service quality management is presented. A conceptual model for hospital total quality management and HTQM approach in hospital support departments are discussed. Finally, a case study is presented to demonstrate how the HTQM approach is implemented in a hospital support department.

LITERATURE REVIEW

This section presents a review of the literature found on quality management. A review of how quality is perceived in the manufacturing sector is described. A comparison is made between manufacturing and service organizations. The work done on quality by hospitals as well as some of the projects that have been successfully implemented are presented.

Quality in Manufacturing

Since the first attempts to control the quality of products, major changes have occurred in the approach to quality control (Feigenbaum, 1983). Figure 1 shows the evolution of quality in the manufacturing sector. In manufacturing, quality development originated with operator quality control. Toward the end of the nineteenth century, one worker, or a small number of workers, was responsible for the manufacture of the entire product, and thus, each worker could control the quality of his or her personal work. In the early 1900s, the quality concept was extended to foreman quality control in mass production factories. A group of individuals performing similar tasks were under the direction of a foreman who then assumed responsibility for the quality of their work.

Manufacturing systems became more complex during World War I. This involved large numbers of workers reporting to

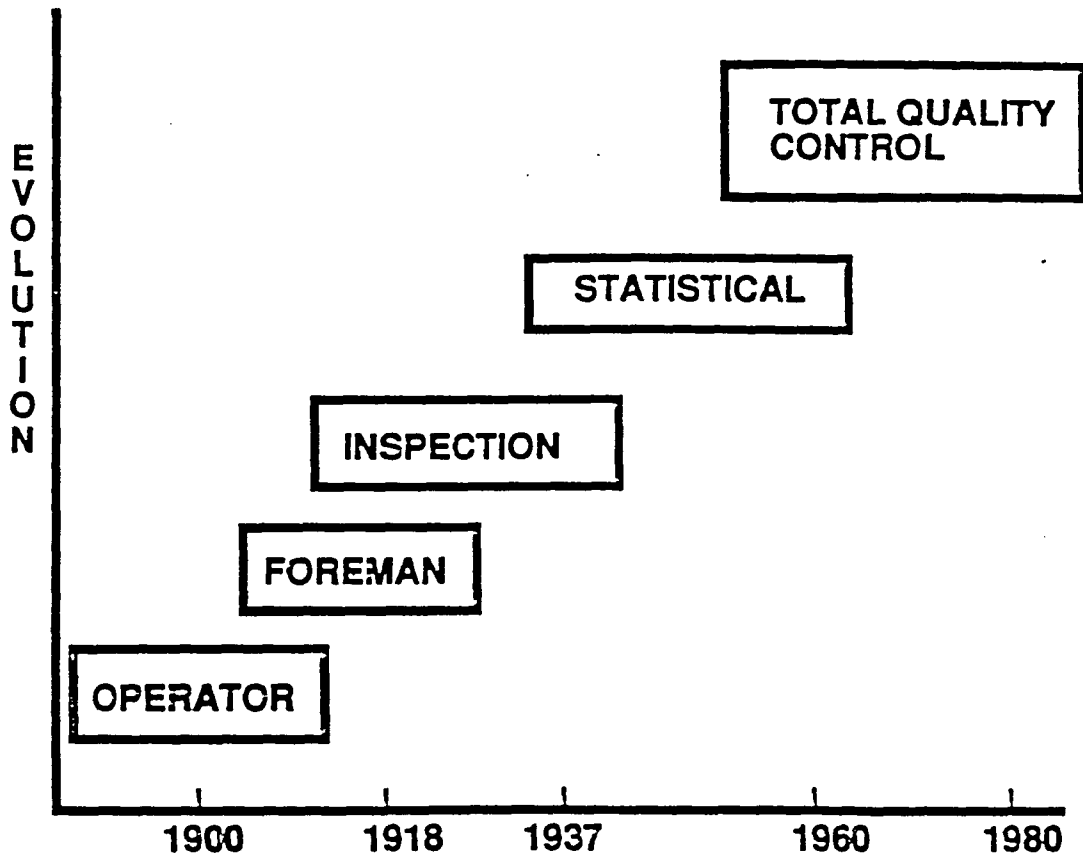


Figure 1. Evolution of quality in the industrial sector (Fiegenbaum, 1983)

each production foreman. As a result, the use of inspectors initiated what is called "inspection quality control". This system predominated until the enormous mass production requirements of World War II induced the introduction of the fourth stage of quality control development, "statistical quality control". This stage was an extension of the inspection stage and resulted in making the big inspection organizations more efficient. The most important contribution of statistical quality control was that it provided sampling inspection rather than 100 percent inspection.

"The work of quality control, however, remained restricted to production areas and grew rather slowly" (Feigenbaum, 1983). Recommendations resulting from the use of the statistical techniques frequently were not implemented by the existing decision-making structures. There was not a specific decision-making and operating framework which was effective enough to take corrective action on the quality control findings. As a result, the concept of total quality control was developed and firms began to develop a specific decision-making and operating framework to deal with product quality.

Feigenbaum (1983) defined Total Quality Control as:

"An effective system for integrating the quality development, quality maintenance, and quality improvement efforts of the various groups in an organization so as to enable production and service at the most economical levels which allow for full customer satisfaction".

It was not until this point that firms obtained important results in terms of better quality and lower operating costs.

Deming (1982) addressed in his 14 principles the need for quality to be recognized as an essential part of the operation of any organization. It is the responsibility of the top management to provide the leadership and commitment to the implementation of the following fourteen points:

1. Create constancy of purpose.
2. Adopt the new philosophy.
3. Cease dependance on inspection.
4. End the practice of awarding business on the basis of price alone.
5. Improve constantly the system of production and service, to improve quality and thus constantly decrease costs.
6. Institute modern training methods.
7. Institute modern methods of supervision.
8. Drive out fear.
9. Breakdown organizational barriers.
10. Eliminate slogans for the workforce.
11. Eliminate work standards that prescribe numerical quotas.
12. Promote pride of workmanship.
13. Educate and retrain everyone.

14. Create a structure in top management that will push everyday on the above thirteen points.

Today, many philosophies have been adopted by manufacturers to improve the quality of their products and services. One aspect they all have in common is that of commitment from management to carry out the task of assuring quality throughout the organization.

Comparison of Manufacturing and Service Industries

Knowledge of the concept of quality

Ross and Shetty (1985) conducted research to determine if there is a clear understanding of the concept of quality in service companies as well as in manufacturing. They surveyed 307 companies--45 from manufacturing and 262 from the service sector.

A conclusion from the study was that most participants could not clearly define the concept of quality. The difference between responses from manufacturing and service businesses showed that respondents from the service sector had the most difficulty in understanding the concept of quality. Another conclusion drawn from these data was that company efforts to improve service quality have not progressed to the levels of efforts in manufacturing.

In a study directly related to hospitals, Werner (1988) explained that one problem is that many health care managers confuse the word "quality" with "capacity/capabilities".

He states:

"the media reports that reductions in health care expenditures will limit or decrease access to health care services and by so doing, compromise the "quality" of the services being provided. The issue here is service capacity or service capabilities, not quality of the service provided. Services will still be provided in accordance with acceptable clinical and service delivery standards. In some cases, rather than providing these services using state of the art technology, they may be provided using "older" technology. In some cases, this older technology may not provide the same level of diagnostic information or the same degree of patient comfort. Nevertheless, this technology will be used in accordance with acceptable standards. If it is, the quality of the services provided will not be less or compromised".

Differences between the service and manufacturing industries

To comprehend why quality has not been understood in the service sector as well as in the manufacturing sector, one must take into account the differences between manufacturing and service businesses in their structure and operation. Table 1 contrasts characteristics of product and service oriented organizations. The characteristics of service organizations can be applied to hospitals. Melan (1987) discusses the principles of process management and its use in manufacturing and service areas. He states that these principles have been widely applied in manufacturing companies with continuous operations. On the other hand, these principles have not been widely applied to service-oriented firms, even though the improvements in quality and

productivity can be substantial.

Table 1. Summary of characteristics of product and service oriented organizations (Ross and Shetty, 1985)

Product-oriented	Service-oriented
. Mostly tangibles	. Mostly intangibles
. More capital intensive	. More labor intensive
. Products easy to store	. Prod. difficult to store
. Customer's participation is rare	. Customer's participation is extensive
. Product customization is limited	. Customization of service is extensive

Traditionally, compared to manufacturing, the service sector has had a captive market. For example, an individual's choice among hospitals was made within a relatively small geographical area. This resulted in limited competition, as well as lower consumer expectations for the services provided.

The concern for quality among service organizations has significantly lagged behind that of manufacturing for another important reason. Manufacturing firms produce tangible products such as radios, automobiles, and so on; on the other hand, hospitals provide intangibles, such as good care and patient comfort. In a manufacturing setting, quality is traditionally defined in a way that focuses on the physical factors of the product. Because of the intangible nature of the service provided, quality control in hospitals (or any other service business) requires a much

broader approach to quality. It may include elements such as the quality of human performance, quality of equipment performance, quality of data, quality of decisions, and the quality of outcomes.

Hospitals are generally more labor intensive, whereas manufacturing companies are more capital intensive. Labor costs in hospitals accounts for approximately 60% of the total expenses. In manufacturing firms, a great deal of expense is attributed to machines and processing equipment.

Hospitals have more interaction with customers than manufacturing companies. In manufacturing, there is rarely customer participation during the process of making the product. In hospitals, the customer is necessarily part of the service that is provided.

The products in manufacturing are easy to store while in service context they are not. Manufacturing firms can store their final products in a warehouse until they are ready for the customers. In a hospital, it is not possible to store the doctor's service in fixing an injured knee.

Finally, the degree of customization in hospitals is relatively high. Every patient is considered a specific and particular case. In manufacturing, a great number of customers receive the same output or product.

Quality in Hospitals

The evolution of quality control in hospitals has been similar to how it occurred in manufacturing. Rather than controlling product dimensions, quality control for hospitals deals with the assurance of the quality of service provided to the patients.

The term "quality" was introduced in hospitals long before it became a major factor in the industrial sector. In 1917, the American College of Surgeons (ACS) had published The Minimum Standard for Hospitals. This was the first voluntary effort to develop standards for the care to be provided to patients. One year later, the Hospital Standardization Program was developed, based on the Minimum Standard. It was the beginning of formal requirement for the review of quality of care. In 1951, the Joint Commission on Accreditation of Hospitals (JCAH) was formed by some of the major health related organizations such as the American College of Surgeons, American College of Physicians, American Hospital Association, the American Medical Association, and the Canadian Hospital Association.

The JCAH published its standards for hospital accreditation in 1953. Hospital accreditation was based on the structure of facilities, organization, and other critical components that needed to be revised, in order for high-quality care to be provided. By the mid- 1970s, JCAH began requiring, in addition to structural review, the

evaluation of both medical process and outcome. In 1979, it published a new standard which required hospitals to have a comprehensive quality assurance program. Hospitals and their medical staff were called upon to more rigorously and systematically examine whether their facilities, committees, and procedures were really doing any good to the patient.

The federal government became part of the quality assurance regulators when the Professional Standard Review Organization (PSRO) program was created. PSROs were government-sponsored organizations led by locally practicing physicians of the Department of Health and Human Services. Peer review was the basis of their evaluations, and they had a dual purpose: utilization review and quality assurance. Utilization review proved to be much easier to accomplish than quality review. Decreasing funding of PSRO operations over the years was an additional factor contributing to their inability to make significant accomplishments in quality review.

In 1982, PSRO was replaced by the Peer Review Organization (PRO). The PRO is seldom referred to by the full title it was given in the U.S. legislature: Utilization and Quality Control Peer Review Organization. The PRO looks at completeness, adequacy, quality, and appropriateness of care provided, appropriateness of admissions and discharges, and the validity of diagnostic and procedural information supplied by the provider of the

services.

In addition to objectives aimed at reducing hospital admissions, and thus costs, PROs were assigned five quality objectives:

1. Reduce unnecessary hospital readmissions resulting from substandard care provided during the prior admission.
2. Assure the provision of medical services (primarily pharmaceutical) which, when not performed, have significant potential for causing serious patient complications.
3. Reduce avoidable deaths (primarily reducing deaths from myocardial infarction through improved emergency procedures).
4. Reduce the unnecessary surgery or other invasive procedures.
5. Reduce avoidable post-operative or other complications.

At the individual hospital level, the traditional view of quality in hospitals has been "doing everything possible for the patient." That meant ordering every test, providing the latest technology and keeping the patient in the hospital longer. The approach increased hospital costs and revenues under the cost reimbursement system. However, there was little evidence that quality was improved.

Jessome (1988) explains that the present quality assurance programs in hospitals are based on the evaluation of department practices against established standards. There are several problems with this approach, however. The

emphasis has been placed on subsystems, with the hospital quality assurance program constituting the sum of all the departmental quality programs. This approach does not deal with interdepartmental issues and does not allow for evaluation of relative priority of issues. In most cases, the standards are established by the providers of the service, rather than the users, and therefore, there may be a discrepancy between the needs of the user and the service provided. Moreover, the standards that are established tend to remain static. The focus is on meeting the standards, with no thought of modifying the standard if changes are made in the system or the goals have been met.

The concept of quality management is beginning to create interest among hospital administrators (Burda, 1988). Several articles found in the literature expressed this interest of hospitals for managing quality to reduce costs of operation. The Joint Commission on Accreditation of Health Care Institutions has drawn attention to quality by formulating standards for hospitals. However, an even greater reason behind the push for quality is its relationship to profits.

Hospitals have become aware of profitability in recent years. After two decades of growth, when the proportion of the GNP spent on health care increased from 6 percent to 11 percent, for many hospitals, the age of profits has come to an end (Trafford, 1985). Hospitals have undergone dramatic

changes, such as the introduction of Diagnosis Related Groups (DRGs), a decrease in occupancy rates, and increased competition. All of these changes have made health care administrators and managers look at various ways to keep costs low and still provide the best possible care to the consumers. Table 2 shows a summary of those changes with their corresponding impact to the health care industry.

Werner (1988) compares the situation facing health care managers today to the scenario that auto makers were confronting in the mid-1970s. The market is becoming more price/cost sensitive, and quality is becoming a very important factor for the success of a business.

"The overall quality of U.S. made automobiles is significantly higher than 10 years ago. This improvement was the result of concerted effort by the automotive management to respond to a very competitive threat, the Japanese auto manufacturer. Without competition, there may not have been any improvement in U.S. made automobiles. This lesson can be successfully adapted to the U.S. health care delivery business too".

Crosby (1987) stated that:

"in health care, there are usually thought to be two separate and fairly equal parts of management: the professional care of the patient and the administration of the system (including the facilities used by the medical professionals). Physicians get to evaluate themselves and are permitted to voice opinions about the effectiveness of the administration. The administration can comment (and act) only on the nonprofessional things that happen. There is a great need to develop a system of common understanding and support".

Table 2. Changes in the Health Care Industry

Change	Description	Effects
Introduction of Prospective Payment System	Instead of Medicare reimbursement for costs incurred, regardless of amount, the federal government is starting to pay on a fixed-price basis.	Makes the hospital focus on the need to keep costs to a minimum.
Occupancy rate decreasing	The overall occupancy rate for U.S. hospitals dropped from 73% in 1983 to about 67% in 1984 (Trafford, 1985).	Experts estimate that the U.S. has at least 25% too many beds.
Increased competition	Health Maintenance Organizations (HMO) are growing rapidly as well as Preferred Provider Organizations (PPO).	Patients have more options where to go for service.
New technology and procedures	Advances in Medicine and discovery of new diseases.	

In order to overcome these roadblocks to communication and implementation, knowledge of the basics of quality management by all parties is necessary.

Donavedian (1987) describes five essential questions that frame the management of quality in health care.

1. What is quality? Much of the difficulty in defining quality occurs because patients and physicians have different points of view. Two very different skills are important for good patient care: clinical judgement and technical skills, combined with sensitivity and interpersonal skills. Patients, in general, respond more readily to the interpersonal aspects of care, which they are better able to judge than technical aspects.
2. How is quality measured? Measurement in the classical sense-- implying precision in quantification-- cannot be expected for such a complex and intangible product as healthcare. A set of reliable and valid judgement are needed:
 1. Process of care.
 2. Conditions of settings in which care is provided.
 3. Outcomes of care.

Independent of the exact method used, the assessment of quality requires two things: information and standards.

3. How is quality protected and enhanced? In the broadest sense, this involves professional training, including licensure and certification; standards of organization, staffing, equipment and operation; and rules and procedures for testing and marketing drugs. In a more narrow sense, quality assurance denotes those formal mechanisms by which clinical performance is constantly reviewed and (when found to be out of line) readjusted.
4. How is quality related to costs? If unnecessary care is included, then costs go up with no improvement in quality. If care is unskillful or includes elements that prove to be harmful, then quality is reduced while costs rise.
5. What consequences result from this relationship? There are two implications of the cost-quality relationship: the cost effects of monitoring quality and the quality effects of cost containment.

Perry (1988) describes how some hospital marketers and strategic planners are trying to build organizations that focus on quality through a three-part process:

1. Determining customers' definition of quality. This includes the external and internal customers. The

external customers include patients and insurance companies. Internal customers can be departments within the hospital.

2. Designing systems that allow each department and employee to meet the customers' expectations.
3. Designing statistical measures to periodically evaluate the hospital's performance.

Brown (1988) described four steps for defining quality requirements in a service business (see Figure 2):

1. Identify service dimensions for which quality requirements must be defined.
2. Define quality factors for each dimension.
3. Specify one or more indexes for measuring quality factors.
4. Define standards and requirements for each index.

Brown (1988) also describes three tools for defining a process. The first, Input-Process-Output analysis, is a systematic approach to defining activities and tasks within an operation. The manager defines work tasks (either by employee interviews or by participatory management techniques) with respect to outputs intended to meet customers' requirements, related work tasks to provide these outputs, and inputs needed to satisfy department activities.

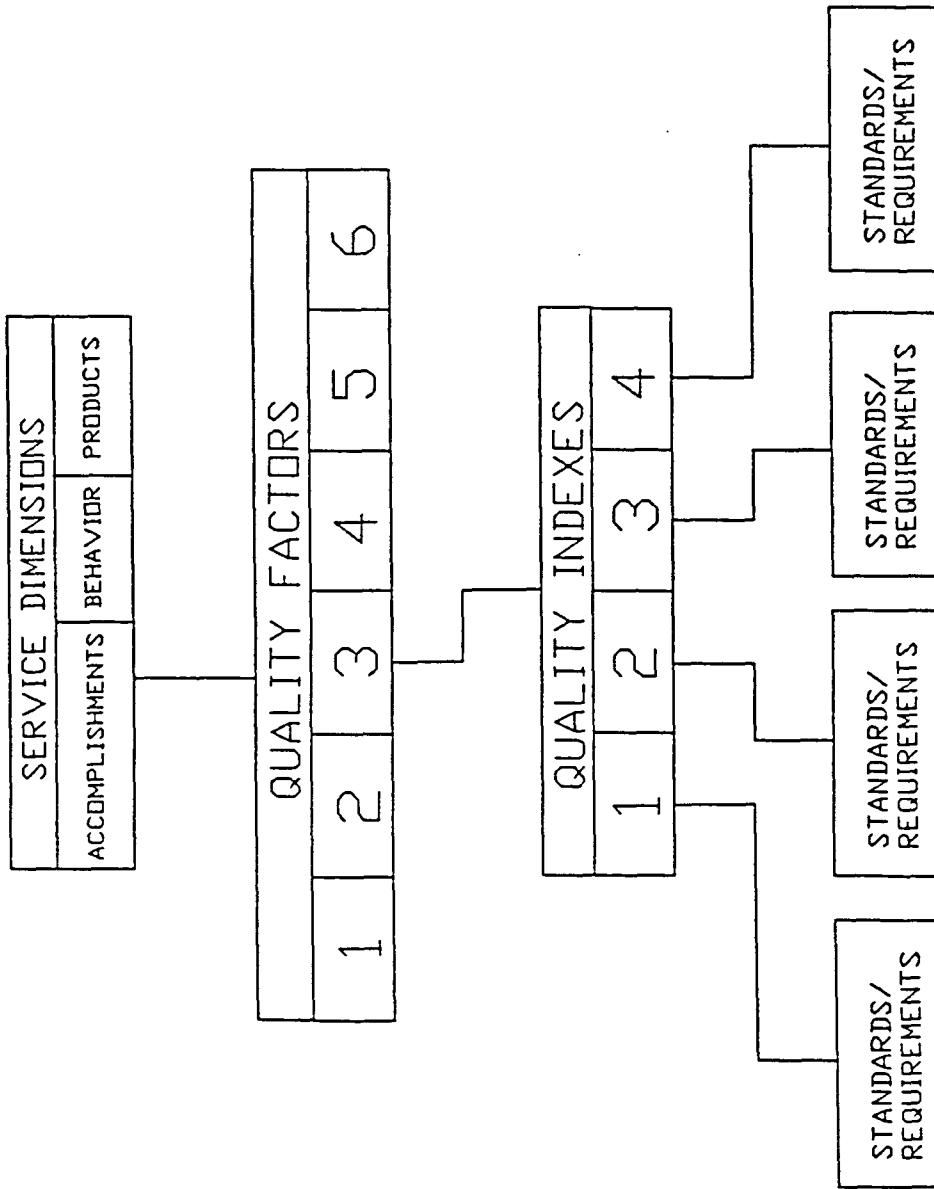


Figure 2. Steps for defining quality requirements in a service business (Brown, 1988)

Second, the process analysis technique is a step-by-step systems approach to defining all of the tasks necessary to execute a process. Where the input-process-output analysis focuses on a set of tasks within a department, the process analysis technique examines, through comprehensive interviews, a set of interrelated tasks comprising a specific process. The third tool is the Cause-and-Effect analysis (see Appendix A). This is one of most popular tools of problem solving. The cause-and-effect diagram results from brainstorming sessions conducted to identify and solve problems.

Juran (1988) describes the use of input-output diagrams in quality planning. It is comprised of several basic activities: identification of customers and their needs, development of service requirements that respond to those needs, and the development of a process able to deliver that service. He describes the roadmap for quality planning as:

1. Identify who the customers are.
2. Determine the needs of those customers.
3. Translate those needs into the company's language.
4. Develop a product/service that can respond to those needs.
5. Optimize the product/service features so as to meet the company's needs.
6. Optimize the process.

7. Prove the process can produce the product/service under the operating conditions.
8. Transfer the process to the operating forces.

Projects Successfully Implemented

Lexecon Health Service, a Chicago-based health care database and consulting firm, uses industry approaches to help hospital clients measure the quality of their care and that of their competitors (Burda, 1988). A report called the "Strategic Position Report", uncovered statistical evidence that links high-quality care with profits. Each report gives hospital patient outcome and financial information that executives can use to compare their institutions with others in the market. As an example of the use of this report, Lexecon found hospitals that had lower-than-expected mortality rates for low-risk heart surgery patients made the most money in 1986 and had the highest market share for the procedure in their service area. The 18 hospitals with mortality rates two standard deviations below expected mortality rates earned \$3,359 per discharge. The 180 hospitals with mortality rate two standard deviations above the expected mortality rates lost \$435 per discharge.

Massachusetts Respiratory Hospital learned that quality problems are best addressed by a team of people, not just one person (Burda, 1988). Team members included the

administrator, the medical director, the chief financial officer, the director of employee relations, the nurse manager, the director of nursing, and the nursing staff coordinator. The team used cause-and-effect diagrams to confirm that the reliance on agency nurses was caused by the hospital's inability to retain nurses and recruit new nurses. The hospital surveyed nurses who left the hospital for agency work. The hospital analyzed the survey results using industry "Pareto" charts (see Appendix A), which separate dominant causes from trivial causes. The data showed that nurses sought agency work for two reasons: higher salaries and flexible hours. The hospital implemented a flexible working-hours schedule developed by the nursing director and negotiated higher salaries in its contract with the local nursing union. Between November 1987, when the recommendations were implemented, and April 1988, no nurses resigned; 11 new nurses were added to the hospital's 30-member full-time nursing staff.

Burda (1988) also described a research project called "The National Demonstration Project on Industrial Quality Control and Health Care Quality", which was conducted in September 1987. The objective of the \$220,000 project was to solve a quality problem at each of the participating health care institutions. The project paired 21 health care providers with quality-control experts in general industry. Problems ranged from deficient administrative services, such

as slow hospital-discharge procedures, to flaws in clinical services, such as inappropriate use of portable x-rays. The reaction of the providers to using industry quality control techniques was favorable, although several projects were still underway at the time of the study's writing. Most of the providers who completed their projects saw improvements in quality.

For example, inaccurate Medicare bills caused as much as \$20,000 a month in Medicare payments to Massachusetts General Hospital to be delayed. Another \$10,000 a month was delayed because bills were submitted late. With the help of an industry quality control expert, the 1981-bed hospital developed a flow chart depicting how a Medicare claim is created. Using a Cause-and-Effect diagram, the hospital listed all the possible sources of inaccurate and delayed claims. To eliminate these problems, the hospital has started a quality improvement program that focuses on better communication within hospital departments and physicians. "It took the commitment of top management to bring the necessary players together to address the problem" (Burda, 1988).

ARC Ventures, the for-profit subsidiary of 1,068-bed Rush-Presbyterian-St. Luke's Medical Center in Chicago, started a Quality Improvement Program (QIP) (Burda, 1988). The QIP program is targeted at both patient outcomes and customer satisfaction with hospital services. The first

phase of the program targets patient outcomes. The hospital compares actual outcomes with expected outcomes, and the resulting information is reviewed by the physicians involved in patient care. Analysis also uncovers the use of tests and procedures that did nothing to improve quality but did raise the cost of care. To meet the second goal of QIP, some experts were consulted, and personnel started learning how to meet customer expectations and their definitions of quality. With the help of the consultants, the hospital identified the expectations of "internal" and "external" customers in each of the four clinical areas targeted in the program's first phase.

The hospital now has a systematic approach to measure expectations and design ways to meet them. The rallying point is a printed statement of the hospital's commitment to quality. By meeting the expectations of external customers, the hospital hopes to attract new patients.

Buckner (1988) describes how the management of NKC, Inc., of Louisville, Kentucky, recognized in 1986 that it had to make quality its competitive edge if it was going to continue to be Louisville's leading private hospital group and sustain financial success in years to come. The hospital developed a Total Quality Management model that defined quality as "meeting the requirement of its customers". Based both on fact (technical and professional standards) and perception (customer's subjective feelings),

these requirements ultimately are set by patients. Two kind of customers were described: internal (co-workers), and external (insurance companies, doctors, and patients). Moreover, management has the attitude that no level of error is acceptable. The principle used in their model is "management by prevention" or fixing the system that produces errors. It relies on a systematic process to define problems, to identify their causes, and to take the appropriate action needed to eliminate them. Ten steps to quality are addressed in the model:

1. Mission, values, quality policy, corporate goals.
2. Management's commitment to the quality process.
3. Organizing for Total Quality Management.
4. Education and training.
5. Customers and their requirements.
6. Improvement opportunity identification.
7. Quality review.
8. Recognition and reward.
9. Communication.
10. Integrating TQM with existing management programs.

As an example of the improvements implemented, NKC Hospital, at Louisville, estimates that it will save \$500,000 a year because of changes in its billing system. Most of the savings are a result of a reduction in errors that occur from the time a nurse make a notation on a chart

until the third-party payer receives a bill. The twenty-seven recommended changes will cost about \$200,000.

Burda (1988) describes the work that Hospital Corporation of America (HCA) has done in adopting Industry's model of Total Quality Management. The philosophy of the hospital is that it can increase profits by reducing expenses associated with poor-quality services and by attracting new business with higher-quality services.

HCA developed a quality improvement program (QIP) based on Deming's 14 points. The program was designed to improve productivity of hospital services and patient satisfaction with those services.

The strategy followed by HCA is called "FOCUS PDCA", an acronym for:

- . Find opportunity for improvement.
- . Organize a team that knows the process.
- . Clarify current knowledge of the process.
- . Uncover root causes of process variability.
- . Start an improvement cycle, based on theory.
- . Plan the process improvement.
- . Do the improvement.
- . Check the results against the theory.
- . Act on the process and theory.

HCA initiated the QIP program in 1986. Under the program, HCA conducts two-day "QIP leaders' workshops". Top hospital managers attend the workshops to learn the FOCUS

PDCA method. HCA's quality management system is based on the following major points:

1. Identifying with the customer.
2. Promoting involvement with top management.
3. Training and educating employees and physicians.
4. Changing the system so services are delivered right the first time.
5. Measuring quality improvement, including savings.
6. Developing multidisciplinary teams to make it easier to bring about change. This is because most health care services involve the work of more than one person or department.
7. Setting goals for quality.
8. Developing employee incentives.
9. Fostering constant commitment.
10. Requiring suppliers to provide quality products and services.

Connell (1967) described a quality control program and procedures which were developed to permit Blue Cross personnel to do a better, more accurate, and more effective job processing Blue Cross insurance applications and claims. The objective of their quality program was to develop an effective means to control the quality of work of the company's personnel so as to insure maximum service for subscribers. Specifically, the program was pointed towards

preventive measures during the processing procedure rather than to point out or correct errors after final disposition.

The procedure of the operation was broken into the following steps:

1. Selection and introduction.
2. Preparation.
3. Operation.
4. Reporting and corrective action.
5. Verification sampling and final report.
6. Control sampling.

Before beginning the study, it was very important to discuss with employees why quality was important. It was emphasized that it would actually make their job easier and that they would feel more confident in their work. A flow chart was prepared, indicating the step-by-step operations. An inspection plan had to be developed and the size of the sample computed. After inspection had taken place, a meeting was held with the section supervisor to summarize the results obtained. Applicable recommendations for corrective action were made and an "acceptable level of quality" agreeable to the supervisor was established. The results of verification sampling were reviewed with the section supervisor and a final report was submitted to the department.

Once the work was under control, a maintenance program was initiated. Under "control sampling", the work

of each clerk was inspected on a daily basis, using the sample size appropriate to the acceptance quality level and the total lot size. The samples were selected daily using systematic sampling from specific lots of work submitted by the operating areas.

DEFINITION OF HOSPITAL TOTAL QUALITY MANAGEMENT

Definition of Terms

This research paraphrases Feigenbaum's definition for hospital total quality management (HTQM) as:

A system that combines the efforts of all groups of a hospital for the integration of quality development, quality maintenance, and quality improvement activities. It involves the managerial and technical implementation of healthcare consumer oriented quality activities as a prime responsibility of general management and of the main-line operations of key departments, in the most practical and economical ways, to assure healthcare consumer quality satisfaction.

The JCAHO (1988) defined patient care quality as:

The degree to which patient care services increase the probability of desired patient outcomes and reduce the probability of undesired outcomes, given the current state of knowledge.

These two definitions are concerned about the healthcare consumers' needs which are continuously changing, and how the hospital organizations can adapt to the changes. The hospital industry is constantly facing changes in technology, medical procedures, and consumer demands. There has to be a system in place that continuously defines the consumers' needs, compares them to the service provided, and makes the necessary adjustments in the service process in order to keep consumers' satisfaction.

For this definition to be used consistently in all the departments of a hospital, it is important to standardize the meanings of key words. Several terms are defined at this point:

Inputs

The inputs are the means used in the process of delivering a service. They include information, materials, and human efforts. A medical record of a patient, is an example of an input the business office receives for its billing function.

Outputs

The outputs are the results or products of the service. These are physical products, goods, and services. In the case of the Medical Records department, an output would be a complete record of a patient.

Healthcare Consumers (HCC)

Anyone who is impacted by the service provided can be considered a healthcare consumer. These include external consumers, such as the patients, patients' family, physicians, third-party payers, other organizations, and internal consumers such as any internal department of the hospital.

Healthcare Providers(HCP)

The healthcare providers (HCP) are responsible for converting the inputs into the outputs; in other words, they deliver the services to the HCCs. A provider can be an individual, a department, or the entire hospital.

Process

All the units of the hospital organization are assigned responsibilities that are carried out by performing a group of activities (i.e., tasks, functions, operations). Process is the term used to describe the sequence of steps to complete any activity such as performing a lab procedure.

Processor

The processor can be defined as the organization unit that carries out the process. This can be an individual, department, or the hospital. Healthcare providers are considered processors.

Quality

Quality is defined as "meeting consumer's expectations" (Juran, 1988). The healthcare consumers (internal as well as external) and their needs must be continuously reviewed and compared to the service provided. The service process should be adjusted any time the consumers' expectations are not met.

Focus of HTQM

HTQM is an operating philosophy that uses statistical tools for continuous process improvement, resulting in meeting or exceeding consumer's expectations. Its focus is directed to four major areas: planning for improvement,

defining healthcare consumers and their requirements, ongoing monitoring of the process, and taking corrective action. Figure 3 shows these four components of HTQM.

Planning for improvement

Top management is responsible for defining all the activities necessary to achieve the quality policies and objectives. A quality management team should be formed by the top administrators in order to coordinate the organization-wide integration of activities. There should be clear personnel assignments for quality achievements and a periodic audit of the system activities should be conducted. Quality Management teams should be formed by middle managers and department employees. Their function will be implementing the changes in the process. The QM team should start out by discussing several fundamental questions:

Who are the department health care consumers?

What are their needs and expectations?

What is the service provided by the department?

Does the service meet the consumers' expectations?

What is the process for providing the service?

What needs to be done to improve the process until the consumers' expectations are met?

- 1. PLANNING FOR IMPROVEMENT**
- 2. DEFINING THE HCCs AND THEIR EXPECTATIONS**
- 3. ON-GOING MONITORING OF THE PROCESS**
- 4. TAKING CORRECTIVE ACTION**

Figure 3. The four components of HTQM

It is the responsibility of the top management of the hospital to provide the leadership and commitment for the implementation of the fourteen points of Deming. A review of those principles is presented next, along with their corresponding implications for hospitals.

Create constancy of purpose Creating constancy of purpose can be considered vital for the implementation of the quality system. The top management of the hospital is responsible for the success of introducing the quality doctrine to the rest of the organization. A management team should be created by the top administration and should have the responsibility for providing the proper tools, training, leadership, and environment to facilitate the achievement of the hospital quality goals. The president and top executives have the role of developing the hospital organization goals and philosophy. The mission statement should reflect the basic objectives to be accomplished by the hospital. Commitment by all the parties involved should be strongly encouraged. TQM should not be considered as just another program. It must become part of the daily activities performed by all hospital departments.

Adopt the new philosophy Everyone in top management should fully understand the meaning of quality and its impact on the performance of the hospital. Improvement in quality implies an increase in productivity due to a decrease in rework and waste. Hospitals are very labor intensive, and doing things over is expensive. Everyone in the hospital should understand that it is possible for jobs to be done right the first time. If things have to be done right the first time, management has to be able to tell the employees what it is they have to do. Therefore, all the jobs, tasks, and procedures must be looked in terms of specific requirements.

Cease dependence on inspection Inspection in hospitals takes the form of audits and reviews. The point at which they can be eliminated depends on the acceptance and successful implementation of the total quality management philosophy. Audits and reviews should not be used to blame employees for performances below an acceptable level. The system should be aimed at identifying opportunities for improvement. Information and measurement systems that can support people's efforts to improve their work tomorrow rather than looking for whom to blame for what happened yesterday are what the hospital will have to develop under this philosophy.

End the practice of awarding business on the basis of prices alone Hospitals must look at total cost of use, not just purchase price. For example, when looking at the cost of equipment, hospital department managers must consider other aspects such as installation, cost of delivery, setup time, and the cost of employee inefficiencies caused by machines that do not operate properly. Gillem (1988) indicated that an administrator who had recently opened a new hospital expressed that between 30% to 50% of all the new equipment did not work properly. The cost to correct the situation was tremendous, even though the initial price was low. This also applies to other items such as food, medical supplies, and drugs.

Improve constantly the service system, to improve quality and thus constantly decrease costs Deming (1982) described the Shewhart cycle for continuous improvement as plan, do, check, and act. The service process should be studied and a decision must be made whether an opportunity for improvement exists. Statistical methods should be used to provide the means for documenting the performance of the process. Tools such as sample averages, counts, control charts, pareto diagrams, and cause-and-effect diagrams can be of assistance (see Appendix A for a description of these tools).

Institute modern training methods Due to cost containment pressures and personnel shortages in some professions, hospital employees are constantly forced to do more work with fewer resources. The training for the new quality age permits redesign and improvement of the processes to help all the employees to work smarter and not harder.

The workforce must be trained in order to gain a better understanding of what the job is, why it is being done, and how to improve it. Gitlow and Gitlow (1987) describe a general model for setting up any type of training program:

- . Identify organizational objectives and goals
- . Identify organizational goals that will be met through training
- . Analyze what needs to be taught
- . Develop the training program (formal class work, experiential work, clear instructional materials, and use of statistical methods)
- . Implement the training program
- . Evaluation of training

As an example, NKC Hospital, Inc., in Louisville, Kentucky, designed and established an intensive education and training system to get the message out once the philosophy had been put in place (Buckner, 1988). Some of the strategies of the system includes total management

awareness briefings and special workshops in which the scope of service and the identity of the healthcare consumers were defined for each department. The entire organization orientation program for new employees was revised with a special emphasis on the quality process.

Institute modern methods of supervision The purpose of supervision should be: to provide advanced training, to remove barriers, to create an environment in which the worker can take pride in his/her work, to stress quality, and to help improve the work of the employee (Gitlow and Gitlow, 1987). Deming (1982) expressed that there will always be people--some below average, some average, and some above average-- that work in a system or process. To improve the performance of the whole group, the system has to be improved. If managers do not know how to describe systems in quantitative terms and do not know how to translate that information into design improvements, they cannot improve the systems. The manager must be a leader for the improvement of the system performance.

Drive out fear Employees need a consistent, supportive, non-threatening, secure environment in which to work. This can only be achieved through top management's commitment to treat people in a manner that rejects fear. For example, suppose that laboratory workers will not make

improvement suggestions because of the way that the chief technician will respond. In this case, the hospital is eliminating some of its existing potential for improvement.

Break down organizational barriers The departments in a hospital tend to be segregated by their functions. Gillem (1988) indicates that competition, not teamwork, is emphasized between hospital departments, and workers do not think about sharing resources for the benefit of the patient. For example, the billing system at the business office can be affected considerably if the information it receives is inaccurate or incomplete. This information comes from the medical records department, which receives information from physicians, nurses, and any support department involved in documenting the medical records. As a result, the business office has to hire clerks, whose job is to correct wrong bills. The impact is cost, waste, and rework. The problems in the billing system can not be solved effectively until everyone involved in the process learns to solve problems together.

Eliminate slogans for the workforce Deming (1982) states that "numerical goals set for other people, without provision for a roadmap to reach the goal, have effects opposite to the effects sought. They generate frustration and resentment". Just telling a worker to do a better job

will not improve the quality of the work. Managers should be able to tell the worker what can be done to make it easier and better for the worker to do the job. Slogans such as "Be more productive", "Improve quality", "Do things right the first time" have nothing wrong except that people have no way of meeting them, unless changes are made in the system.

Eliminate work standards that prescribe numerical quotas Work standards and quotas focus on quantity, not quality. Workers are encouraged to overlook mistakes in order to meet their quota. When management sends the message that quantity is most important, employees will deliver quantity. If the message is quality as the first concern, employees similarly will respond with quality work and thus higher productivity. Work standards have to be replaced with leadership and training that results in the organization-wide use of control charts and other statistical methods.

Hospital housekeepers are assigned several areas to be cleaned in a day. If for any reason, such as a shortage of personnel or unexpected delays in other hospital areas, the housekeeper is expected to complete his or her daily work, the effectiveness to complete the tasks will be affected.

Promote pride of workmanship Gillem (1988)

indicates that hospitals in their performance appraisals have focused on elaborate systems of compensation and recognition that do not represent the actual work for which an employee can take pride. Compensation and financial reward are important to workers, but often even more important is their sense of pride of a job well done. Corporate-wide programs should be developed to recognize and reward employees who identify areas that need improvement. There must be a climate where employees must understand their jobs and why they are so important to the hospital.

Educate and retrain everyone The hospital is an

environment that is continuously exposed to changes due to advances in technology. Therefore, the employees must be continuously retrained and educated for the new job opportunities that will be created. Gitlow and Gitlow (1987) describe several training courses and the suggested participants (see Table 3).

Create a structure in top management that will push every day on the above thirteen points People on the board of directors and top management must understand the 14 points. They have to grasp the concept that quality leads to lower costs. They have to understand that best efforts alone are not enough. Accomplishing best efforts requires

guidance and direction by management.

Table 3. Quality training courses (Gitlow and Gitlow, 1987)

Suggested Participants	Quality Philosophy		Basic Statistical Methods	Statistical Application
	4 day	2 day		
Top management	X		X	
Middle management	X		X	If appropriate
Supervisors		X	X	If appropriate
Technical personnel		X	X	X
All other employees		X	X	
Suppliers			X	If appropriate

Identifying HCCs and their expectations

Once the project team has been assigned the function to be analyzed, the next step is to identify the healthcare consumers (HCCs) and their expectations. The system should identify all healthcare consumers (HCCs) and their requirements. Externally, the HCCs can be defined as patients and other outside organizations such as insurance companies. Internally, a department may be the HCC of other departments. Written surveys and personal interviews can be used to ask consumers how to define quality and whether or

not the hospital meets those requirements. From these data, the hospital can establish the baseline for quality policies and objectives.

The following process should be carried out:

1. Document the process in order to identify the impacted healthcare consumers. The process can be documented using flow diagrams.
2. Select the HCCs based on several criteria.
3. Determine the needs of the selected HCCs.
4. Define the dimensions of the service.
5. Determine quality factors for each defined dimension.
6. Specify indexes for each quality factor.
7. Determine the service expectations for each index.

Figure 4 shows a diagram of the sequence of these activities that must take place in order to arrive at the HCCs' expectations for a specific service process. Each one of these steps will now be discussed in more detail.

Document the process To identify the HCCs, the process must be documented to see whom it impacts. Anyone impacted by the process is considered a healthcare consumer. Flow diagrams can be used to document the process. The flow diagram is a graphic means for describing the steps in a process. It provides understanding of the whole system as well as a clearer explanation of the activities involved in the process. It helps in identifying HCCs previously

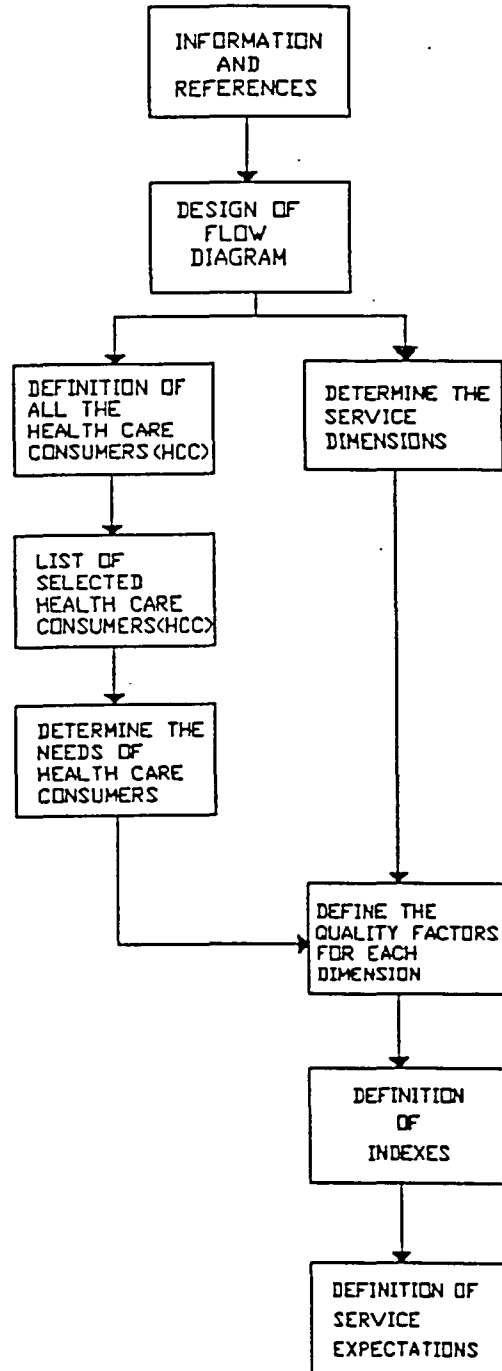


Figure 4. Steps for determining HCCs service expectations

neglected, opportunities for improvement, and makes it easier to set boundaries.

There are two methods for obtaining the inputs or information for the creation of the flow diagram of a process (Juran, 1988): the investigator approach and the team approach. The investigator approach involves a trained investigator who meets with the personnel which are directly involved in the various steps of the process. From the employees' input, the investigator prepares the flow diagram, along with an analysis and recommendations. The results are discussed and appropriate modifications are made until the final version is obtained. The team approach involves a group formed from the organization units responsible for the various steps in the process.

The team proceeds to develop the flow diagram and the associated analysis. Juran (1988) reported in his findings that the main conclusion of the teams was that participation was a key to obtaining good results. The team members enjoyed being part of a planning project that enlarged their responsibility.

Selection of HCCs Once the flow diagrams are created, a study can be performed on the process to determine all the HCCs that are impacted. There may be a large number of people and organizations that are affected by a process in a hospital. Thus, the consumers must be

by a process in a hospital. Thus, the consumers must be prioritized in order to allocate resources to those Healthcare consumers who are the most significantly impacted. Table 4 shows some categories of processors and the associated significant Healthcare consumer impacts.

Table 4. Several processors and the corresponding significant Healthcare consumer impacts

Processor	Examples of HCCs who are significantly impacted
Hospital	<p>Clients. Patients that come into the hospital (External).</p> <p>Regulators. Their rules are a form of mandated needs to be met.</p> <p>The public. They influence the climate in which the hospital operates (External HCC).</p>
Any employee	The supervisor (Internal HCC).
Accounts Receivable	Clients (External HCC).
Any supervisor	The subordinate (Internal HCC).

The healthcare consumers (HCCs) can be classified according to their impact on the processor. To distinguish the differences in importance, the Pareto principle can be of use. Under the principle, HCCs can be

classified into two basic categories: The "relative few" who have the most impact and the "useful many" who have a relative low impact (Juran, 1988).

For example, the flow diagram of a certain process of the medical records department involves thirty-five specific activities. The activities are not equally important and several of them (relative few) are more important than the sum of the remaining ones. The Pareto principle can be applied by determining what each member of the department feels is the priority of these activities. Index cards can be used to select the important activities. Each activity can be written on an index card, with a total of thirty-five cards given to each member of the team. Each member makes his selection of the relative few, e.g., six out of thirty-five. The cards must be ranked in order of importance. The results can then be analyzed to determine the team consensus. After discussion of the results, the group decides which activities will be chosen for the analysis. The remaining activities, the "useful many", can be put on hold or the team may decide to include some of them later.

Determine the needs of selected HCCs Once a list of healthcare consumers is obtained, the next step in the process involves defining their needs. Juran (1988) describes some of the methods for determining HCCs' needs: be a healthcare consumer, communicate with HCCs, and

simulate HCCs' use.

Communication with the healthcare consumers is the most commonly used means for determining their needs. Communication can be established by HCC initiative, supplier initiative, or by hospital behavior. HCC initiative can be in the form of complaints, returns, and claims. Internal HCCs also take the initiative to communicate any case of dissatisfaction. Supplier-initiated communication has the purpose of obtaining information on service satisfaction. The hospital must take the initiative to conduct the necessary marketing research. Through marketing research, answers are provided to questions like, "Which features of the service are of primary importance to the healthcare consumers?"

The contact with external healthcare consumers can be carried out in several ways: questionnaires, consumer panels, and phone calls. Juran (1988) described the survey done by Qantas Airways to 2,500 passengers, in order to discover their views on priority of their essential needs. The results showed that some needs, such as on-time departures and arrivals, that were thought by the company as of high priority, turned out to be of low priority to the customers.

Buckner (1988) discussed the system developed by NKC hospital to identify its external HCCs and their requirements. By using methods such as surveys and personal

interviews, they ask their HCCs to define quality and to judge whether or not the hospital meets those requirements. The information established a baseline for quality improvement goals and monitoring of improvements. The same information tools can be used for those internal HCCs.

Middle managers constitute approximately 10 percent of the employees in most organizations, but their influence in quality can be considerable (Juran, 1988). To determine their needs, two approaches can be used: a multidepartmental team can be formed, in which a manager of one department can express his/her needs to another department manager (who in this case is the supplier). Another approach involves the assignment of a specialist who contacts those department heads or managers and prepares a document indicating the needs found.

The employees constitute a large group of internal HCCs. To obtain information on their needs, certain conditions are of great importance for consideration. First, if an atmosphere of blame exists, the flow of communication will be limited. Second, the relationship between the supervisor and subordinate will tend to influence the answer that the latter can give. Third, there can be conflicts if the provided information can create problems for co-workers, or someone else. In any case, it is important the employees understand that the main objective of the survey or study is to provide the data for

possible improvements in the system. Thus, it is vital that the organization is operating in a climate of trust and group effort.

A very important consideration is the fact that the needs of healthcare consumers do not remain static. Some of the factors that affect those needs are new technology, market competition, and policy changes. It is important to keep in mind that changes in those factors create new HCCs needs or change the priority given to existing ones.

Juran (1988) explained that the most realistic information about HCCs' needs comes from the HCCs. If an improvement team is formed, and no HCCs are brought in, it can be risky to assume that suppliers and processors have the information complete. In hospitals, the physicians, nurses, and patients are healthcare consumers for further processing or ultimate use. If the improvement team lacks direct access to the HCCs, no guarantee exists about accurate information on the needs of those HCCs. The needs of HCCs might seem unrealistic to other hospital employees, but they must be taken seriously because they represent what those HCCs expect from the service.

To assure effective communication, the needs of HCCs must be translated into the hospital's language. This translation includes external HCCs, as well as those that are internal. The needs may be stated in any of several languages: the healthcare consumers' language, the

hospital's language, or a common language.

There are several means that can be used to maintain an effective communication of the needs and their translation. The glossary is a publication of a list of terms and their definitions. Other forms include samples, a department in charge of translating, standardization, and measurement.

Define the service dimensions The dimensions of a service can be classified as accomplishments, behaviors, and results (Brown, 1988). Accomplishments are usually the most important. They are the actions resulting from delivering a service, such as food delivered to patients, medical records transcribed, and x-ray films processed. Behaviors are the relationships between the HCCs and employees (HCPs). They include HCC-employee interactions such as the admission process or the taking of an x-ray of a patient. Results are physical outcomes produced by the service. Examples of results are lab-results, x-ray results, medical records, and a patient meal.

Define quality factors for each dimension For each service dimension of the process, quality factors can be defined. These are aspects healthcare consumers consider important regarding the service accomplishments, employee behaviors, and service results. Examples of quality factors include appearance, timeliness, thoroughness, and

cleanliness.

Identify indexes for quality factors Many quality factors can not be measured directly. For instance, cleanliness and timeliness of service are quality factors that are difficult to measure directly. One or more measurement indexes can be defined for each factor. Examples of healthcare indexes include the amount of time before a healthcare consumer is served by the admissions clerk and the amount of time a patient waits to be transported to patient room.

Determine expectations for each index Once the indexes have been identified, the expectations or requirements for each index can be defined. An example of expectations is no more than one typing error for every twenty pages of a document.

On-going monitoring and taking corrective action

Once the process has been thoroughly documented and HCCs' expectations have been determined, it must be determined if the current function meets those expectations and whether a control system should be established. The following approach should be followed to implement the control system:

1. Obtain data from the current process.
2. Compare the results relative to the established expectations.
3. Are the results satisfactory?.

If yes, monitor the process.

If no, identify the area for improvement:

Plan the improvement.

Take corrective action.

A measuring system should be established, once the important aspects of quality are defined. Measures can be counts, proportions, averages, simple measure, ratios. Other statistical tools can come handy for further evaluation of the collected data. Depending on the kind of data collected, the following tools can be used for the evaluation: control charts, Pareto diagrams, histograms, and cause-and-effect diagrams.

The standards are established after comparing the expectations of HCCs with the data collected on the process. The process is documented and a sampling approach is developed to check the system performance. If the performance is not equal or greater than the established expectations, further work will be done on the process to correct it. Figure 5 shows a diagram of the quality control cycle.

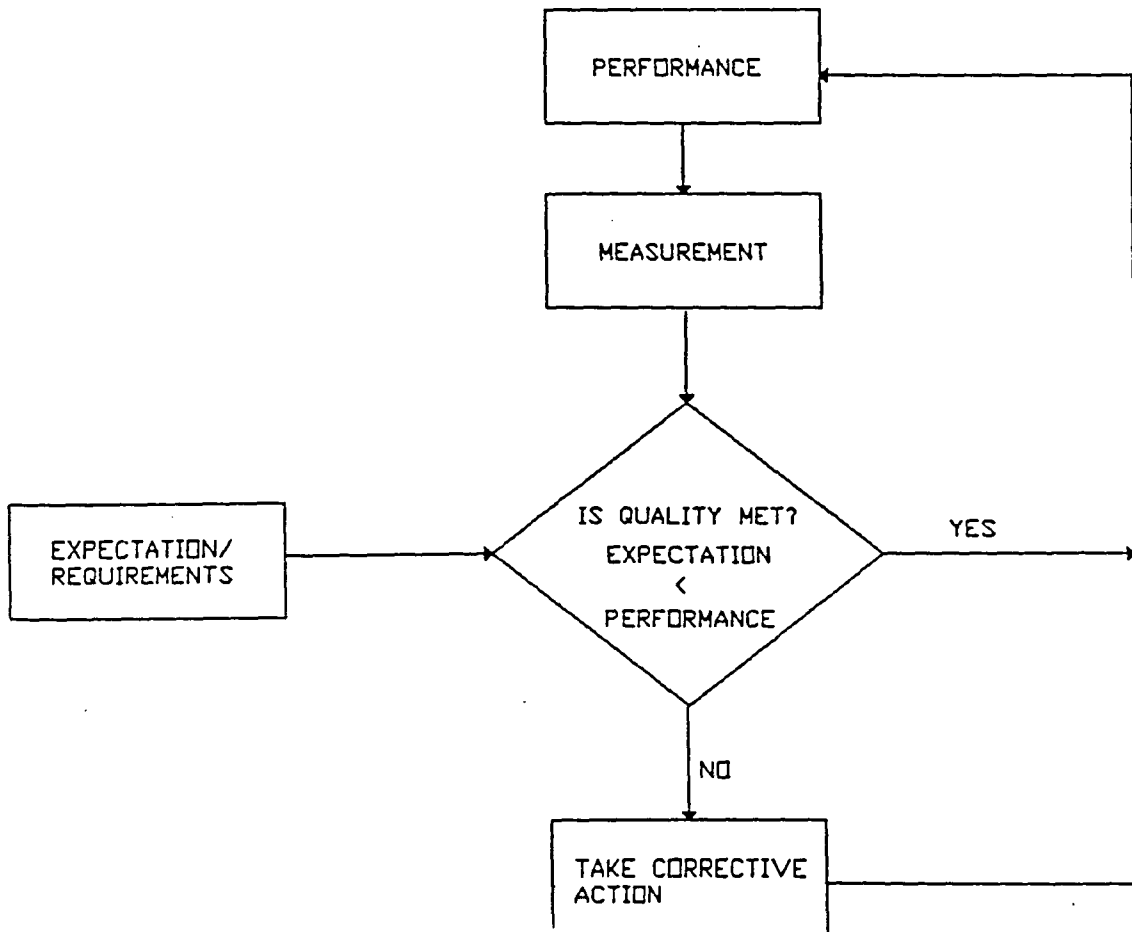


Figure 5. Diagram of the quality control cycle

Taking corrective action involves the actions taken to make changes on the process to adjust it in order to meet the customer requirements/expectations. An evaluation of the impact on results must be made by the project team. If changes are made on the process, the standards may have to be redefined.

HTQM Implementation

The implementation of TQM should be done at the three levels of the hospital organization: upper management, interdepartmental level, and departmental level.

This research focuses on the implementation of a quality management system at a hospital departmental level. The other two organization levels will be briefly discussed here and can be subject of further research.

Upper management

The top management of the hospital is responsible for leading the implementation of a systematic approach for setting and meeting quality goals throughout the hospital. A hospital quality committee formed by the president and executive vice-presidents is in charge of:

1. Establishing policies and goals for quality.
2. Establishing plans for meeting those quality goals.
3. Providing the resources needed to carry out the

plans.

4. Establishing controls to evaluate progress against goals and to take appropriate action.
5. Providing the motivation to stimulate the personnel to meet the quality goals.
6. Conducting a pilot study to use as a role model in the implementation of the system hospitalwide.

In areas where HTQM has not been put into place, the HTQM committee is responsible of creating the system by establishing quality policies and defining the framework to run the system.

Several aspects that appear to be necessary for implementing HTQM are:

1. A realization that in a marketplace, consumer satisfaction is the key to survival and success.
2. Understanding that quality improvement is key to increased customer satisfaction, increased productivity and reduced cost.
3. The commitment of the leader to the philosophy of HTQM.
4. Training within the hospital, from top to bottom.
5. The immediate beginning of improvement activities.

Interdepartmental level

It is quite frequent to encounter a situation where a service provided to a health care consumer is the result of the interaction between two or more hospital departments. For example, when a doctor prescribes a medication for a patient, the nurse has to take the prescription to a location where the unit messengers pick up and deliver to the hospital pharmacy. The medication is prepared and sent back to the nursing unit where the nurse will pick it up and deliver it to the patient. The service process should be able to provide the medication to the patient in the shortest possible time, from the moment the medication is prescribed by the doctor. In this case, good communication must exist between nursing and pharmacy, in order to provide the medication to the patient in the shortest possible time.

A group, consisting of members of the different departments involved, must be formed, in order to determine a set of alternatives to the problems the departments may be experiencing in the provision of a service. The group must be able to develop a plan and follow up with immediate implementation. Group analysis techniques can be used for the brainstorming of ideas in search of possible solutions.

Departmental level

The steps to be followed in this research are shown in Figure 6. The following sequence of activities should be carried out to establish the quality system:

1. Plan for improvement
2. Identify HCCs and their expectations
3. Establish the control system
4. Take corrective action as needed

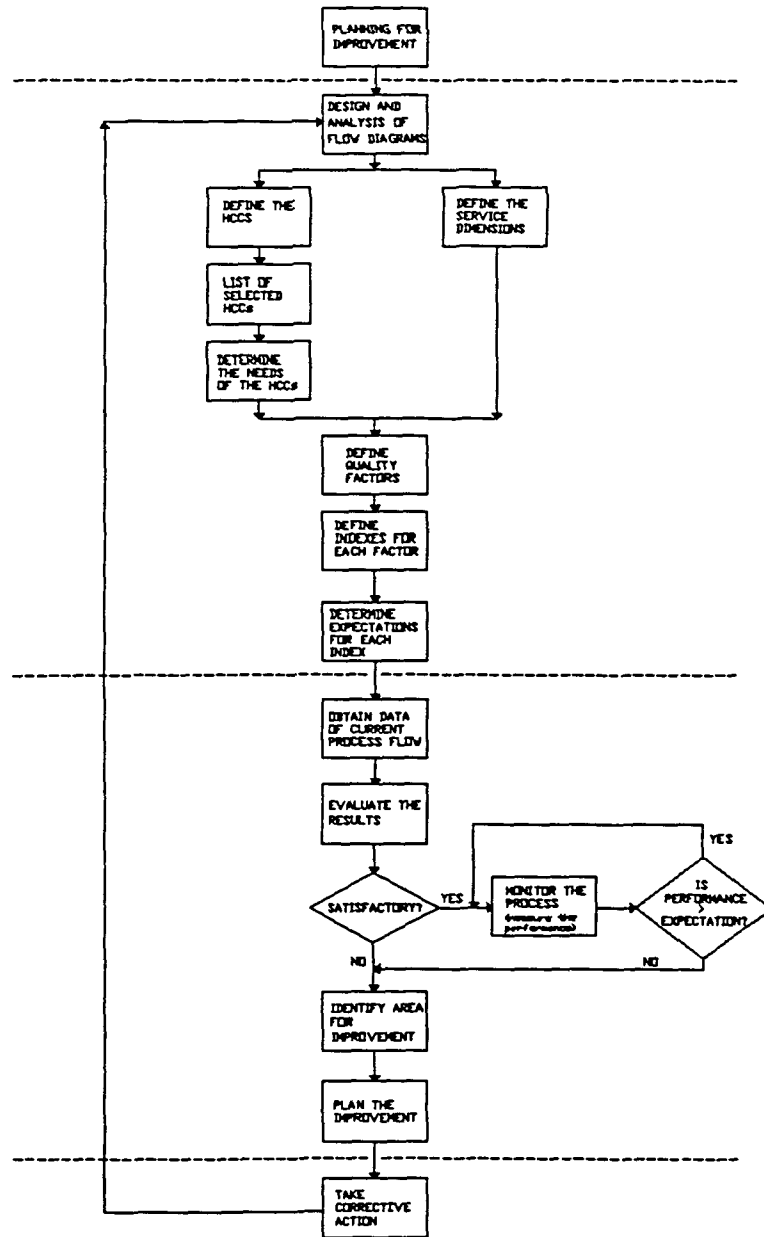


Figure 6. Steps to implement HTQM in any department

HTQM APPROACH

This research focuses on the implementation of the Hospital Total Quality Management (HTQM) approach at a hospital departmental level. The approach used in the case study is presented next.

Planning for Improvement

Quality education

The first step of the process is to teach the concept of quality to all the employees of the department. The following key aspects should be discussed with the employees:

- . Discussion of the objective of the case study
- . Definition of quality and other terms
- . Impact of quality to the hospital
- . Discussion of the basic quality management tools
- . Development or revision of mission statement

The reactions of the employees to the topics listed above should be recorded for further analysis.

Quality management team

A quality management (QM) team should be formed by the employees of the department. The QM team should define the criteria to use for the selection of the department functions to be studied. A brainstorming session should be used to determine the functions to be selected.

Once the QM team has selected the functions to be studied, it should assign a project team to a specific function. The QM team must define clearly the function to be studied and the objectives of the project to the project team.

Identify HCCs and Their Expectations

Once the project team has been assigned the function to be analyzed, the next step is to identify the healthcare consumers (HCCs) and their expectations. The following process should be carried out by the team:

1. Document the process using flow diagrams. Follow the process and identify those HCCs impacted by the process (internally and externally).
2. Select the important HCCs.
3. Determine the needs of the selected internal and external HCCs. Questionnaires and interviews can be used.
4. Define the dimensions of the service function (i.e., accomplishments, behavior, and results).
5. Determine the quality factors for each defined dimension.
6. Specify indexes for each quality factor.
7. Determine the expectations for each index, based on the needs of the HCCs.

On-Going Monitoring and Taking Corrective Action

Once the process has been thoroughly documented and HCCs' expectations have been established, it must be determined whether the current function meets those expectations in order to plan for improvement and implement a control system. The following approach should be followed to implement the control system:

8. Obtain data about the current process. Several forms should be designed to collect information about the specified indexes.
9. Evaluate the results, comparing them to the established expectations. Are the results satisfactory?:

If yes: Establish standards.

Monitor the process. The process should be monitored on a periodic basis.

If no: Identify the area for improvement.
Plan the improvement.
Take corrective action.
Go back to Step 1 in HTQM approach
(Redesign flow diagram).

CASE STUDY

A case study was conducted in the Accounts Payable (AP) department of a non-profit hospital of central Iowa. This hospital is a 200-bed regional referral center serving a multi-county area in north central Iowa. The hospital is administered by the president/chief operating officer, who is assisted by vice-presidents of finance, nursing, and professional services. The medical staff consists of more than 120 physicians holding active or courtesy staff privileges in several activities.

The Accounts Payable (AP) department was selected for the study because the number of functions to be studied was reasonable, the department represented an example of a hospital support department for the application of the HTQM approach, and the employees of the department were interested in adopting the conceptual model.

The AP department is a branch of the Materials Management department. It prepares all the payments that the hospital makes to its suppliers, as well as all the expense requisitions and reimbursement of hospital employees. The mission of the AP Department is to be able to prepare the payments the hospital makes to its suppliers at the right time for the right amount. This includes obtaining all the discounts available by the hospital vendors and suppliers as well as providing the right information for accounting purposes.

Planning for Improvement

A meeting was held with the AP staff to discuss the purpose of the case study and the procedure to be used. The purpose of the study was stated as follows:

The purpose of the case study is to provide an example of the implementation of HTQM in a hospital support department.

Definition of quality and other terms

The AP employees were asked to give their definition of quality. Their response was: "doing my job in the most efficient and fastest way possible". The employees were explained the definition used for this research: "meeting consumers' expectations".

Two more meetings were held to discuss the objective of the project and several aspects of the HTQM approach to be used. An introduction to the basic tools of total quality management was also given.

Quality management team

A quality management team was formed, consisting of the director of materials management, the accounts payable staff, and a management engineer.

The group prepared a general diagram of the AP department functions (see Figure 7). The inputs to the AP department were classified as follows:

- . General invoices (come in the mail)
- . Invoices from pharmacy

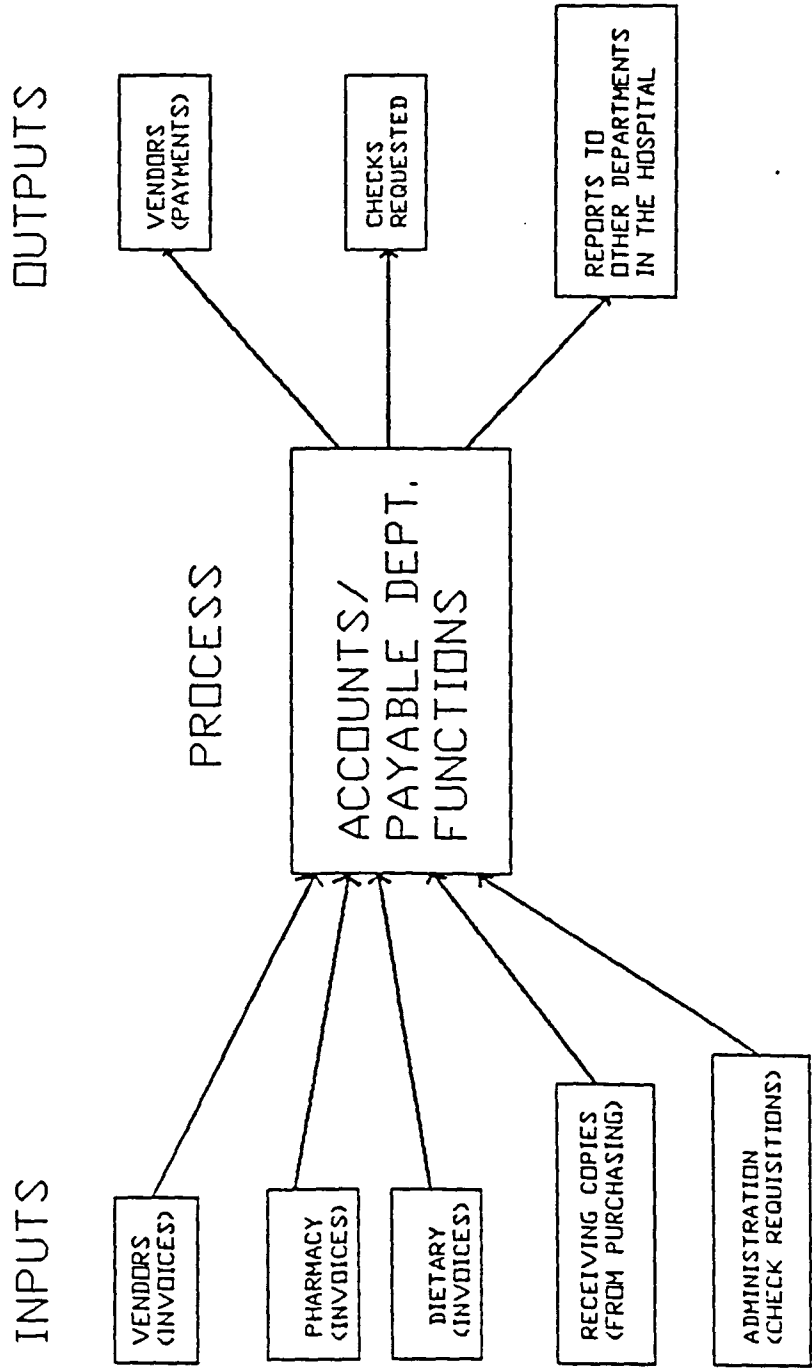


Figure 7. General Function of Accounts Payable

- . Invoices from Dietary
- . Receiving copies (from Purchasing Department)
- . Copies of purchase orders (from Purchasing)
- . Check requisitions

Figure 8 shows all the inputs the Accounts Payable Department receives, with their corresponding sources.

The functions of the AP department were defined as: the processing of invoices and check requisitions for payment, preparation of several reports, and support to those departments that need any information that the AP department can provide.

The main function of the department is the processing of invoices for payment to all the hospital suppliers. There was no need to define any criteria for the selection of the function of quality emphasis (service dimension). Everyone in the group agreed that the processing of invoices should be selected as the service dimension for quality emphasis.

The project assignment was to study the invoice processing function, from the moment the invoices arrive to the hospital to the moment all the necessary information is entered into the computer system for final payment. The objective of the project was defined as determining the HCCs and their expectations, looking at the current process and determining if it meets the defined expectations, and establishing a control system on the process.

Description	Source	Observations or comments
Alphabetizer:		
Advertising	Personnel	
Employees physical	Personnel	
Invoices from Excel Medical	Mail	Also delivered by vendor.
Invoices from vendors	Mail	
Maintenance agreement	Mail	
Microfiche services	Mail	No receiving copy. Mr. Millen signs it.
Microfilm Services	Mail	
Rentals	Mail	
Check requisitions Box:		
Advertising	Marketing	
Bills from pharmacy	Homeward	
Check requisitions	Administration	Originated by any department in the hospital
Disability Insurance	Personnel	
Fees for outside Medical care	Mail	As soon as received, send to business office
Group Insurance	Personnel	
Invoices from Reference Labs	Mail	As soon as received, send to lab
Iowa foundation for Medical care	Mail	As soon as received, send to business office
Mastercard and Visa	Mail	
Mileage	Homeward	
Outside transcription	Medical records	
Postmaster	Mail	
Prepaid invoices	Purchasing	Vendors require payment in advance(don't match)
Reimbursable expenses	Administration	Originated by any department in the hospital
Tuition reimbursed	Personnel	
Wells T.V.	Business office	
Pharmacy file:		
Invoice from Vendor	Pharmacy	The three forms are sent together to
Receiving copy of P.O.	Pharmacy	accts/payable from pharmacy
Yellow copy of P.O.	Pharmacy	
Dietary file:		
Invoice from vendor	Dietary	The three forms are sent together to
Receiving copy of P.O.	Dietary	accts/payable from dietary
Yellow copy of P.O.	Dietary	
Yellow copy of Purchase orders	Purchasing	Gets alphabetized
Receiving copy of Purchase orde	Purchasing	Gets alphabetized
Payment authorizations		

Figure 8. Inputs and sources of Accounts Payable

Identify HCCs and their Corresponding Expectations

A flow diagram of the invoice processing function was created, based on the information provided by the AP staff (see Figure 9). An explanation of the process is presented next.

All the inputs are sorted and routed to the corresponding locations. The invoices are stored in alphabetizers until the clerks are ready to match them to the receiving copies of purchase orders (POs). The receiving copies of POs are matched to the invoices and get stored until ready for processing. Once all the invoices have been matched, the clerks begin to process the invoices. They check for quantities, unit price, extensions, and totals for each item in the invoice and purchase order. After the invoice has been thoroughly checked, it is stamped and the stamp is filled out with the vendor number, account number, the invoice number, and gross and net amounts. The processed invoices are sent to the Director of Materials Management for final approval. The Director signs all the processed invoices and returns them to the department. The information on the invoices is put into the computer system (every Thursday) and a draft journal report is generated to verify that the amount on the checks to be issued by the hospital is correct. After the inspection is completed and any corrections have been made, the clerks notify the data processing department to print out the checks. Finally, the

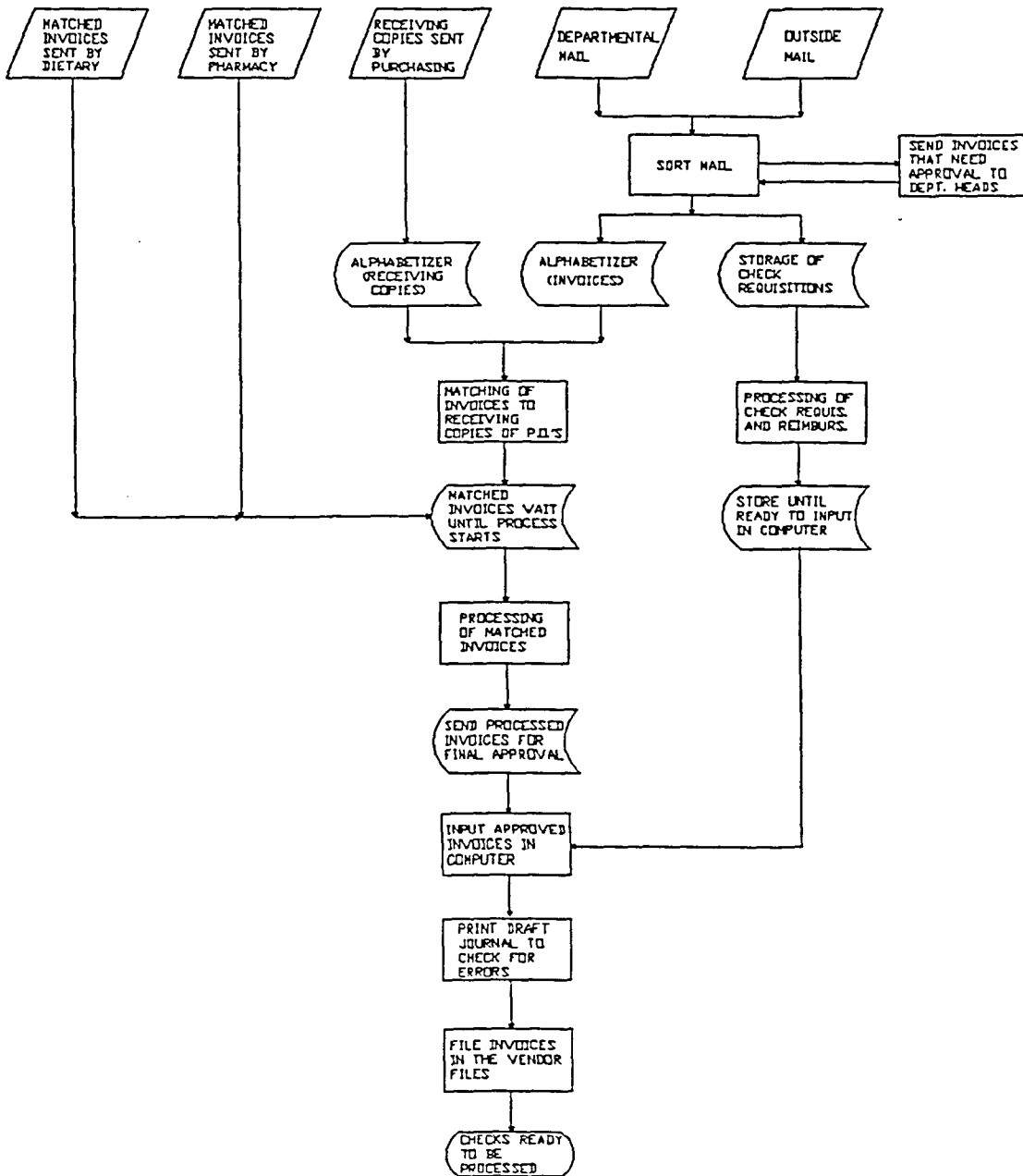


Figure 9. Flow diagram of the invoice processing function

invoices are filed in the department vendor files.

Once the flow diagram was completed, the group met to define all the HCCs of the AP department. Externally, the main consumers were the vendors and suppliers of the hospital. AP internal HCCs are the Business Office, the Director of Materials Management, and the administration of the hospital. Internally, several departments were identified as HCCs: Pharmacy, Dietary, Business and Finance Office, Director of Materials Management, Visiting Nurses, Laboratory, and the administration of the hospital.

A questionnaire was prepared, to ask the defined HCCs how they felt about the accounts payable function and what aspects they considered of importance to their respective departments (see Appendix B).

Several suppliers of the hospital were contacted to discuss their needs. They responded that their major concern was that the dispatching of payments should be done before or by the specified due date on the invoice.

The Business Office (BO) expressed several concerns about the accounts payable function. The BO would like the AP department to acknowledge the expenses at the time the transaction takes place (the moment that the hospital receives the goods or services). The AP ledger balance should be reconciled to the detail on a monthly basis. The BO would like to get a report showing how many discounts were obtained, due to early payments, and how many were

lost, due to late payment. The BO would like to have access to the AP inquiry by fiscal year (not two or more years combined). And finally, the BO would like AP to provide a brief description of purchase item included on cumulative payable inquiry.

The president of the hospital expressed several concerns about the AP function that overlapped with the concerns of the BO (see Appendix B).

The AP department is also the internal HCC of Purchasing, Pharmacy, Dietary, and administration. From Purchasing, AP would like to have consistent delivery of purchase order copies with all the necessary information. AP would like the Pharmacy and the Dietary departments to deliver their invoices sooner. Also, it is preferred by the AP staff to have the quantities and prices checked by the pharmacy and dietary departments. The AP staff reflected some concern about the time it takes to process pharmacy and dietary invoices. There have been several incidents in which the hospital is charged a fee for late payment. The AP staff felt that invoices received from these departments should already have signatures authorizing payment (or noting discrepancies) in place. Finally, AP would like to see the invoices sent by administration one full day before payment.

The group met to discuss the responses to the questionnaire and decide what course of action to take. The

following list was created, based on the importance of each issue to the HCCs:

1. Review and redesign the processing function to consistently dispatch payments before or by the due date specified on the invoices. Pharmacy and Dietary invoices must be re-examined.
2. Review and redesign the processing function so that:
 - i. AP can generate information about the number of discounts obtained due to early payment and number of discounts missed due to late payments.
 - ii. AP acknowledges the expense at the time the transaction takes place (not the moment the hospital makes the final payment).
 - iii. The AP ledger balance is reconciled to the detail on a monthly basis.
 - iv. The business office can have access to the AP inquiry by fiscal year (not two or more years combined).
 - v. AP can provide a brief description of purchased items included on cumulative payable inquiry.

The service dimension of quality emphasis was defined as the processing of invoices for payment (accomplishment). The processing of invoices must be done before or by the specified due date, in order to avoid any late or finance charges. Also, it is very important to acknowledge the right amount for payment of each invoice. Thus, the group selected as quality factors the time and accuracy of the process of dispatching invoices for payment. All the aspects that impact the dispatching of invoices were considered by the group. The indexes for each factor were defined as follows (see Figure 10):

Time to process invoices:

- . Time to match invoices to purchase orders
- . Time to do line extensions
- . Time to inspect and correct any errors

Accuracy of the process:

- . Percent of unmatched invoices
- . Percent of invoices with discrepancies
- . Percent of errors made entering data into computer

A sample of forty-four (44) invoices was selected, at random, to determine the number of days in which the hospital suppliers expect the hospital to return the payment. All of the invoices had a 30-day term for net payment from the invoice date. However, the hospital receives the invoices several days after the date shown on

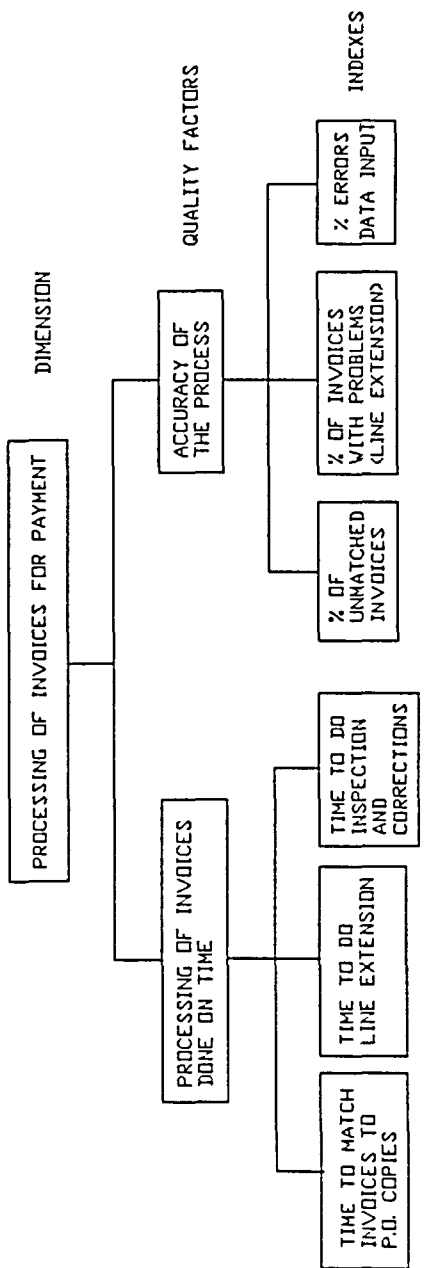


Figure 10. Dimension, factors, and indexes of quality emphasis

the invoice. This implies that the hospital has 30 days minus the number of days it takes to receive the invoices for returning the payment. The number of days between the invoice date and the date the invoices were received was calculated for each invoice. The average number of days remaining was 24 days. This number represents the number of days the vendors would allow the hospital to make the payment without penalizing it with a finance charge or late fee. It was assumed that it takes four days to mail a payment to the vendors. Thus, the hospital must have the invoices processed within 20 days of receipt. Table E1 contains the data collected from the invoices (see Appendix E).

Obtaining Data About the Process

Data collection was done over a period of three weeks. This provided data pertaining to the defined indexes, verified the information regarding the process under study, and gave the AP staff an opportunity to become accustomed to the quality control system.

Several forms were designed for the AP staff to collect data about the process (refer to Appendix C). One form was used to determine how long it takes an invoice to get dispatched for payment. The form was attached to every 5th invoice that was received by AP each day. The AP clerks filled in the date that each main task was completed. For

example, if the clerk received the invoice, she would write down on the attached form the date that she received the invoice. If the clerk was matching the invoice to the corresponding purchase order, she would write down the date that the task of matching the invoice took place.

Two other forms were designed for the AP staff to keep track of the frequency of irregularities during the matching and final processing of invoices. A cause-and-effect diagram was prepared, to help define those aspects that could delay the processing of invoices (see Figure 11).

Analysis of the Data Collected

After all the data were collected, several calculations were performed. Percentages were calculated, as well as the average and standard deviation of the sample. Table 5 shows a summary of the results obtained from the analysis of the data collected. The average total time to process general invoices was 8.7 days (see Table E2 in Appendix E). The percentage of problems when matching invoices was 8.4 % of all the invoices processed in the period (995). Thirty-two (32 %) of all the invoices had problems when the clerks were doing line extensions. The average total time to process invoices from Pharmacy was 19.3 days and the average total time to process Dietary invoices was 17.7 days (see Tables E3 and E4 in Appendix E).

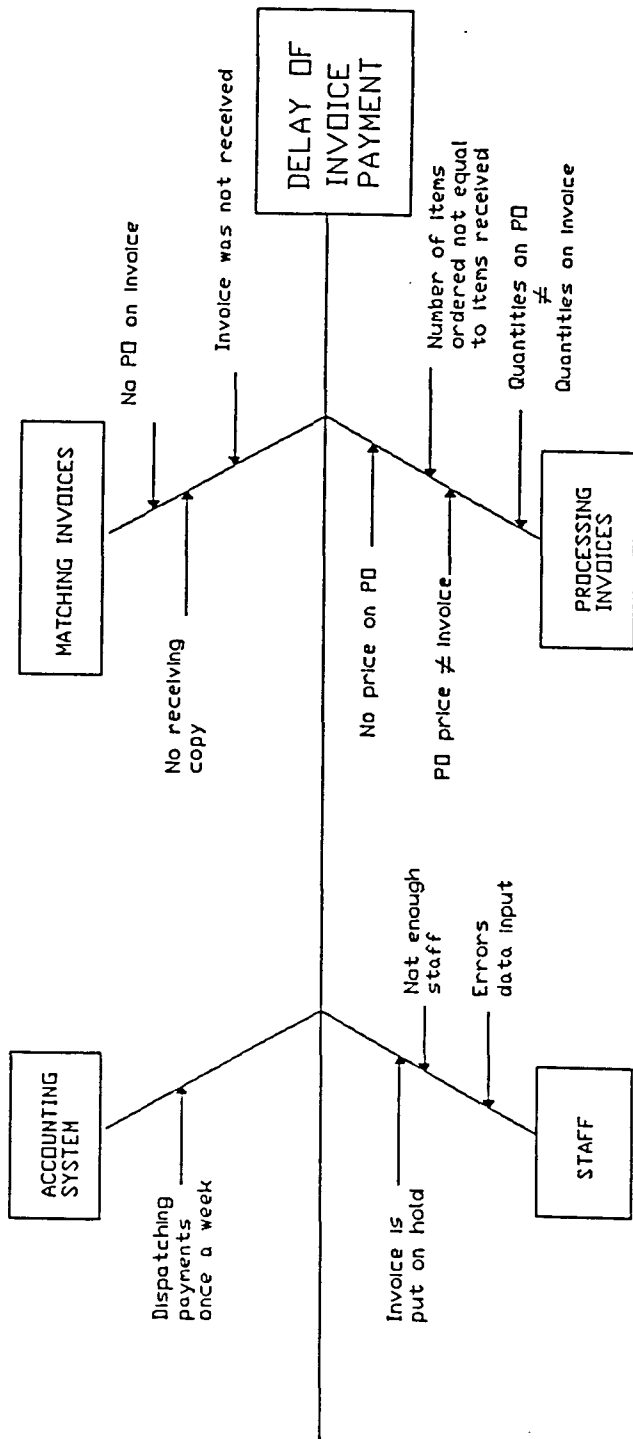


Figure 11. Cause-and-effect diagram for delay of invoice payment

Table 5. Summary of analysis of data collected

	General invoices		Pharmacy invoices		Dietary invoices	
	Avg	σ	Avg	σ	Avg	σ
Time to match	3.5	2.9	--	--	--	--
Time to process	2.7	2.1	15.1	2.1	--	--
Time to inspect	2.4	1.6	4.2	1.8	--	--
Total time to process payment	8.7	3.5	19.3	3.1	17.7	4.2
<hr/>						
% of invoices unmatched	8.4 %					
% of invoices with problems (processing)	31.8 %					
% errors made entering data into computer	0.4 %					
Discounts obtained of invoices with discounts available	69.2 %					

Identify Areas for Improvement

The QM team met to discuss the results obtained from the data collected. The group discussed the HCCs' expectations and compared them to the results obtained.

As it was determined earlier, the hospital should have any invoice processed within 20 days. The data collected indicated that it takes the hospital 8.7 days to process general invoices for payment. This means that the time it

takes to process general invoices for payment is acceptable. On the other hand, the results indicated that the time it takes to process invoices from the Pharmacy and Dietary departments is very close to the maximum number of days allowed. Thus, these areas should be definitely reviewed for improvement.

There were 39 invoices, out of 493 invoices processed the week of September 21, 1989, that had discounts available. AP was able to obtain discount on 27 of them. This represents 69.2% of all the invoices with discounts. The goal of the department is to be able to obtain all the discounts available by the vendors. According to the AP staff, the discounts range from \$5 to \$80 per invoice. On a monthly basis, the hospital is missing approximately 50 discounts with a total amount in the range of \$300 to \$4,000.

Looking closer to the possible causes of delay in the processing of invoices, a Pareto analysis was performed to determine those factors that have the biggest impact on the process. During the matching, 84.5 % of the invoices with problems were invoices that AP did not receive the corresponding PO copy. The second largest source of problems, 13.1 % of all the invoices, was that of invoices received without the purchase order number (PO number). This results in extra time spent by the clerks finding the receiving copy to match it to the invoice. The results are

summarized in Table 6.

Table 6. Data obtained during the matching of invoices

Sample	No rec. copy	NO PO# on inv.	No inv. required	Total	Total Sampled	Percent
1	13	2	2	17	224	7.6 %
2	16	0	0	16	207	7.7 %
3	23	6	0	29	256	11.3 %
4	19	3	0	22	308	7.1 %
Total	71	11	2	84	995	8.4 %
Percent	84.5 %	13.1 %	2.4 %	100.0 %		

During the processing of invoices, two problems appeared more frequently than the rest (see Table 7). The most frequent problem (69.1 %) was that of POs received without prices. The invoices could not be verified by AP and had to be sent to the corresponding department for review. Another problem of high frequency (29.7 %) was discrepancies in price between the invoice and PO. In this situation, the invoices also had to be sent to the corresponding departments for review.

Table 7. Data obtained during the processing of invoices

Sample	Diff. price	No price on PO	Diff. qty.	Qty. Rec.	Total	Total Sampled	Percent
1	30	47	1	0	78	224	34.8 %
2	22	59	1	1	83	207	40.1 %
3	11	39	0	0	50	256	19.5 %
4	31	73	0	1	105	308	34.1 %
Total	94	218	2	2	316	995	31.8 %
Percent	29.7 %	69.1 %	0.6 %	0.6 %			

Planning the Improvement

Areas of possible improvement

The QM team established a list of areas that were defined as areas for improvement:

1. The AP department should be able to obtain all the discounts available by the vendors. The current process will have to be improved to decrease the total time of processing, and therefore, increase the percent of discounts obtained from all the discounts available.
2. Reduce the percentage of invoices unmatched as well as the percentage of invoices with problems when doing the line extensions. The main sources of problems during these task were POs with no prices, POs with price discrepancies, invoices with no receiving copy and

invoices with no PO number.

3. The AP department should prepare, on a weekly basis, a report to the BO showing all the discounts available and all the discounts obtained during that period. A form can be designed for the use of the AP staff when processing the invoices.
4. A change must be made in the process so that the expenses are acknowledged the moment the transaction takes place. Currently, it takes approximately 9 days for the expense to be acknowledged by AP.
5. Another improvement in the system should involve a change in the computer system to allow the AP ledger balance to be reconciled to detail on a monthly basis.
6. A change in the computer system is necessary to allow the BO to have access to the AP inquiry by fiscal year (not two or more years combined).
7. Modifications to the current computer system should be made so that AP can provide a brief description of purchased items on the cumulative payable inquiry.
8. The current procedure to handle invoices from the Dietary and Pharmacy departments must be improved. A review of the process must be done in order to improve the time it takes to process invoices coming from those departments.
9. The administration of the hospital will be requested to

deliver invoices to AP at least one full day before payment.

10. A review of the procedure of handling purchase orders (POs) by Purchasing should be conducted, in order to increase consistency of delivery as well as the accuracy of information provided on the POs. From the data collected, the percent of POs without prices, the percent of invoices with no receiving copy, and the percent of POs with price discrepancies are areas that the purchasing department of the hospital should be responsible for improving.

On-going monitoring of the system

Data about the process performance should be collected on a periodic basis. The forms shown in Appendix C can be used for the on-going monitoring of the process. These forms should be used at least once a month, from one pay period to the next (one week). The data collected will provide objective information about the performance of the process. This data can be used as the basis for comparisons of later improvements made in the process.

Taking corrective action

Several changes that should be made on the process, in order to meet the HCCs' expectations, are changes that require the thorough knowledge of the computer system

currently in place. None of the AP staff have been trained enough to be able to make changes in the computer system. Because these changes represent major changes in the whole process of dispatching invoices for payment, it is necessary to have a strong commitment to make the changes, or otherwise nothing will be done about it. This is an area where the support from the top administration is necessary to assure that the changes will take place.

An example of having people committed is presented next. A meeting was held with the AP personnel and the director of the pharmacy to determine a feasible way for pharmacy invoices to be processed faster. Several suggestions were made, and both groups decided that the Pharmacy would design the new process flow chart and try out the new way of handling the invoices. As of October 30, 1989, Pharmacy had not implemented the changes in the process, and invoices were still taking longer to process than they should actually take.

EVALUATION AND DISCUSSION

Two criteria were used for the evaluation of the approach employed in the case study. The first was a comparison of the sources of information available to the AP department before and after the case study was conducted. The second evaluation was based on the responses to a questionnaire given to the AP staff members (see Appendix D).

Information Available

A comparison was made of the sources of information available to the accounts payable (AP) section before and after the case study.

Before the case study was conducted, there was no data available in the accounts payable (AP) section regarding the time it takes to process the invoices the department receives and the fraction of discounts obtained. Moreover, there was no quantifiable means for addressing the areas that delay the process of dispatching invoices for payment. These data can help the department obtain objective results when evaluating a possible change in the process. For example, before the case study was conducted, the AP staff felt that the invoices delivered by Pharmacy were taking more time to process than all other invoices. After the HTQM approach was applied, the AP staff had data that showed that it takes approximately 20 days to process invoices

coming from the pharmacy and that the vendors and suppliers would allow the hospital up to 20 days to pay the net amount of the invoice. If the AP department wants to increase the percentage of discounts obtained, they have to review the process of the handling of Pharmacy invoices and make changes for improvement to the point that it takes less than 10 days to process Pharmacy invoices.

Planning for improvement

The objective of this section of the HTQM approach was to introduce the department staff to the quality philosophy. At the beginning of the case study, the AP staff members were asked to define quality. They defined it as: "doing my job in the fastest and most efficient way". They were told and explained the definition of quality used in this research: "conformance to requirements" (Crosby, 1987). The requirements are what the healthcare consumers (internally or externally) expect from the service provided by the department. Both members of the accounts payable staff strongly agreed in the questionnaire that meeting consumers' expectations is the concern of service quality.

Defining the HCCs and their expectations

In the case study, the group was able to identify all the healthcare consumers (HCCs) of accounts payable with their corresponding expectations. By defining and

designing a flow diagram, it was possible to define those areas impacted by the function under study.

Once those HCCs had been defined, it was important to determine how they perceived the service provided by the AP department. The questionnaires sent to the HCCs revealed that some of their expectations about the AP function were unknown to the AP staff.

The indexes defined for data collection should be good indicators of the function under study. The choice of these indexes is the most critical element in the whole control and improvement system. Periodically, there should be a positive review of the indexes that are being measured, to eliminate those which have decreased their impact to the process and to add new indexes that have grown in importance.

The AP staff felt that the indexes defined were good indicators for measuring the performance of the processing function.

On-going monitoring of the system

The purpose of this section was to collect information about the process under study, to determine how well the process conformed to the expectations defined earlier.

A systematic and structured approach was used to obtain information about the process and to determine the areas that did not meet the needs of the HCCs.

The AP staff strongly agreed that the data defined and measured in the case study was helpful in increasing their knowledge of the performance of the processing function. Also, the measurement system can help them obtain feedback about how a change in the process can affect the defined indexes.

The AP staff strongly agreed that the methodology used in the case study helped determine, in an organized manner, the areas that need to be improved in the AP department.

CONCLUSIONS

In the past 10 years, the U.S. healthcare industry has gone through dramatic changes, such as the implementation of the prospective payment system, which have made hospital administrators become more cost conscious about the service that is provided to the consumers.

The total quality management concept has been successfully used by many manufacturing firms. This research shows how the total quality management concept can be applied in hospitals as well. The conceptual model presented in this research should help hospital administrators understand the principles involved in searching for excellence in the process of providing services to healthcare consumers. The literature reviewed indicates that few hospitals have adopted the quality management concept. All of them have obtained positive results.

This research presented a new approach to define and measure quality in any support department of a hospital. The four components of the HTQM approach are planning for improvement, defining the HCCs with their corresponding needs and expectations, on-going monitoring of the process, and taking corrective action.

In planning for improvement, the commitment of the hospital top administration for leading the organization to adopt the quality management concept is necessary.

Unless the administration has a strong commitment to maintain quality as a priority in the organization, the rest of the organization will tend to remain passive about making changes for improvement.

Defining the HCCs and their expectations must be done on a periodic basis. The case study showed that there were several needs of internal HCCs of which the AP department was not aware of. These needs may change over time, and it is important to review them on a periodic basis. Also, changes in the process may include new HCCs that have to be taken into consideration.

The on-going monitoring of the process will provide the data about the performance of the process and determine if the process is performing at an acceptable level. These data can also be used for justifying improvements in the process.

Taking corrective action depends on the climate or environment the hospital organization is confronting. If the organization is committed to using quality as a strategic weapon, the process of taking corrective action will be easy to implement.

A case study was presented to show how the HTQM approach can be implemented at a hospital support department. The proposed HTQM approach was well accepted by the employees involved in the case study. It was perceived as a good tool for determining whether or not the department

was meeting the expectations of its consumers and for indicating those areas that can be significantly improved.

AREAS FOR FURTHER RESEARCH

Quality Cost

The conceptual model presented in this research does not address a very important aspect and that is the cost of quality. A quality cost system is primarily a management information system with the objective of guiding management in their efforts to improve quality. The American Society of Quality Control (ASQC) divides quality costs into four categories (Pyzdek, 1989):

Prevention costs

These are costs that are incurred to prevent the occurrences of nonconformances in the future (i.e., quality planning, process control planning, design review, and quality training).

Appraisal costs

These are costs incurred in measuring and controlling the current process to assure conformance to requirements (i.e., inspections and quality audits).

Internal failure costs

These are the costs associated with a process that is the result of nonconformance to requirements (i.e., rework, re-inspections, and process troubleshooting).

External failure costs

These are the costs generated after a service is provided as a result of nonconformance to requirements (i.e.; processing customers' complaints, unplanned repairs, processing of returned materials).

The categories of costs allows the use of quality cost data for various purposes:

1. The data can be used for measuring progress.
2. The data can be used for the analysis of problems.
3. The data can be used for budgeting.

Evaluating the Conceptual Model

The author feels that the conceptual model presented in this research could be used as subject of further research. Some work could be done in evaluating the methodology in different departments of a hospital. Other work could be done determining the trade of the cost of quality and the savings that can be obtained from the improvements.

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APPENDIX A

Basic Total Quality Management Techniques

The most common techniques used today for quality management are: Pareto diagrams, histograms, cause-and-effect diagrams, checksheets, brainstorming, and control charts (Pyzdek, 1989).

This section describes those quality management tools commonly used by manufacturing firms and that could be used by hospitals as well.

Pareto diagram

The Pareto diagram is used to provide information about which parts of a process are the most significant in causing problems. It defines the parameters associated with the Pareto principle, which states that most problems result from a few key causes, and the remaining (majority of) causes are trivial. The problems to be solved are selected on the basis of data rather than opinion.

The following procedure should be used to construct a Pareto diagram:

1. List the problems that the group may feel are worth investigation. This can be done from a cause-and-effect study using brainstorming techniques.
2. Collect data in a time interval long enough to be

representative of a typical performance.

3. Determine the total occurrences for each problem or category and the grand total.
4. Calculate the percentage of each problem by dividing the total occurrences of the problem by the grand total and multiplying it by .100.
5. Rank order the problems from the largest total occurrences to the smallest.
6. Compute the cumulative percentage by adding the percentage of each problem to that of any preceding categories.
7. Draw a chart with the left vertical axis scaled from zero to at least the grand total. Scale the right vertical axis from 0 to 100 %, with 100 % on the right side being at the same height as the grand total on the left side.
8. Label the horizontal axis with the problem or category names. The leftmost category should be the largest, next the second largest, and so on.
9. Draw bars representing the amount of each category. The height of the bar is determined by the left vertical axis.
10. Draw a line that shows the cumulative percentage of the Pareto analysis. The cumulative percentage line is determined by the right vertical axis.

Histograms

A histogram is a bar graph that shows how variable are the measurements of a given characteristic of a process. To construct a histogram, the following must be done:

1. Find the smallest and largest value in the data.
2. Calculate the range by subtracting the smallest value from the largest value.
3. Select a number of cells for the histogram.
4. Determine the width of each cell by dividing the range by the number of cells.

$$(W = \text{Range} / \text{Number of cells})$$

5. The width should be rounded to a convenient number.
6. Determine the cell boundaries (the start and end of each cell). Cell boundaries should have one or more decimal place than the raw data values in the data set. The low boundary of the first cell must be less than the smallest value in the data set. The other cell boundaries are determined by adding the width of the interval to the previous boundary.
7. Calculate the cell midpoint by adding the lower and upper boundaries and dividing the total by 2.
8. Analyze the data and determine the cell into which each value falls.

9. Record the count of each cell. This is called the frequency.
10. Draw a graph from these values. The vertical axis of the graph will show the frequency in each cell. The horizontal axis will show the boundaries.
11. Draw bars representing the cell frequencies. The width of all bars should be equal, and the height of the bars should equal the frequency in the cell.

Cause-and-effect diagrams

Kaoru Ishikawa (1972) developed a method of graphically displaying the causes of any given problem. His method is called several names: Ishikawa diagram, fishbone diagram, or cause-and-effect diagram.

Cause-and-effect diagrams can be used to sort out and organize causes of any problem a group chooses to study. To construct a cause-and-effect diagram, the group must follow several steps:

1. Develop a flow chart of the area to be improved.
2. Define the problem to be solved.
3. Brainstorm to find all the possible causes of the problem.
4. Organize the brainstorming results in rational

categories.

5. Construct a cause-and-effect diagram that accurately displays the relationship of all the data in each category.

Checksheets

Checksheets are forms designed for organizing and collecting facts and data. A recording checksheet is used to collect measured and counted data (how many or how often).

When preparing the checksheet, the following questions can be helpful:

1. Is the data historical or new?
2. How much data will be involved?
3. What kind of a checksheet is needed?
4. Will an existing form do the job?
5. Who will be responsible for the data collection?
6. How can the tabulation best be done to avoid errors?
7. Is any training required?

Brainstorming

Brainstorming is form of creative thinking with the purpose of obtaining unrestricted ideas about a particular topic from all members of a group.

Brainstorming sessions follow three steps:

1. Each team member makes a list of ideas.
2. The team members sit down in a circle and take turns reading one idea at a time. As the ideas are read, they are displayed so that all group members can see them. This procedure continues until all the items on everyone's list have been read.
3. The process continues until no group members can think of any new items.

Control charts

A control chart is a graphic method for evaluating whether a process is in a state of statistical control. It is used to make decisions about a process. There is a variety of control charts, each designed for the type of decisions to be made, the nature of the data, and the type of statistical measure used (see Juran, 1974).

The most commonly used are the average and range charts. The average (\bar{X}) charts are statistical tools used to evaluate the central tendency of a process over a period of time. Range charts (R-charts) are statistical tools used to evaluate the dispersion or spread of a process over time.

Other charts include the p chart, which is a control chart for attributes. An example of attributes data consists of the ratio of the number of items or occurrences having some given attribute to the total number of items in the subgroup. The p chart is less sensitive than charts for variables (\bar{x} and R charts) and is not as helpful in diagnosing causes.

APPENDIX B

To:

From: Jaime Salama, Management Engineering Coordinator

Date: May 15, 1989

Subject: Quality Improvement Project-Accounts Payable

Introduction

I am currently conducting a pilot study on the implementation of a quality monitoring system in the accounts payable department.

By "Quality" I mean "Conformance to requirements". The requirements are what external/internal healthcare consumers expect from the provided services. In other words, quality has to do with meeting or exceeding the consumers' expectations.

The quality monitoring system is part of an operating philosophy that I defined as Hospital Total Quality Management (HTQM). The focus of HTQM is directed to four major areas: Planning for improvement, defining healthcare consumers (External/internal), on-going monitoring of the system, and taking corrective action.

At this point, our quality improvement team (Marilee Verstraete, Maria Groninga, and myself) has documented all the existing flows of activities that take place in the department. All the people considered as Healthcare consumers of accounts/payable have been defined. (Anyone impacted by our function is considered a healthcare consumer)

The next step involves determining the standards/expectations of the service that accounts payable provides. To accomplish this, it is necessary to determine what are the needs of all those consumers impacted by the function of the department.

Attached you will find a short form of questionnaire that we encourage you to fill out. It will provide us with information that can help us better document the expectations of the accounts/payable function.

If you have any questions about the questionnaire or its purpose, I can be reached at 232-0047. Thank you for your input.

Management Engineering Department

DEPARTMENT: _____

DATE: _____

The following form is intended to provide the accounts payable department with information that will help in the determination of expectations of all its internal and external consumers.

Please return to Jaime Salama, Management Engineering.

1. What features of the accounts/payable system are of primary importance to you?

2. Is there anything that you would like to see from the accounts/payable function?

3. Any other comment or observation?

Summary of Needs of AP Defined HCCs

Vendors and suppliers:

1. Payment should be received by the date specified on the invoice (due date).
2. The amount paid is the right amount paid.

Business office:

1. To have the department record the expenses at the moment the transaction takes place (not when the invoice is paid).
2. The AP ledger balance should be reconciled to the detail on a monthly basis.
3. BO would like a report showing how many discounts were obtained due to early payment and how many were lost due to late payment.
4. To be able to access to AP invoice inquiry by fiscal year
(not two or more years combined).
5. To have a brief description of purchase item included on cumulative payables inquiry.

Administration:

1. Dispatching of payments before or by the due date on the invoice.
2. Timely payment of invoices with payment held until the last appropriate moment to monitor cash flow.

3. A record of what is on order so materials receipt is expedited at the loading dock.
4. To maintain a system for easy validation of receipt of items to reduce the excess handling of paper in the ordering, receipt, and payment cycle.
5. To be able to track payments by vendor source.
6. Availability of retrieval of information so comparative costs may be profiled on a historical basis.
7. development of effective audit trails for tracking of expenditures and separation of purchase and payment functions for legal purposes.
8. A timely system that allows, once automated, a real time assessment of outstanding obligations and assessment of the most useful focus of personnel expenses.

Accounts payable:

1. Pharmacy and dietary invoices should be delivered sooner.
2. AP would like to have the pharmacy and dietary departments handle the quantities and price checking.
3. Purchasing should deliver consistently all the receiving copies of purchase orders (POs) with all the necessary information.
4. AP would like the administration to send invoices at least one full day before payment.

APPENDIX C

Forms used for Data Collection

Quality Management Project
Accounts/Payable

Matching of invoices

Description	Frequency	Observations	Total
No receiving copy available			
No purchase order # on invoice			
Invoice was not received			
Other:			

Date:

Total number of invoices matched:

Quality Management Project
Accounts/Payable

Processing of invoices

Description	Frequency	Observations	Total
# of items in invoice different from number in the P.O. copy			
Unit price in invoice different from unit price in P.O. copy			
# of items received different from # of items in the invoice			
No price on the P.O. Copy			
Taxes added to invoice total			
Other:			

FOR ACCOUNTS/PAYABLE USE	
SAMPLE #:	OBSERVATIONS
INVOICE RECEIVED:	
INVOICE MATCHED:	
INVOICE PROCESSED:	
INSPECTION DATE:	

APPENDIX D

Evaluation of the Case Study

The following questionnaire was created to establish an objective evaluation of the methodology employed in the case study of this research. Use the following scale to rate your answers.

Scale: 5: Strongly Agree
 4: Agree
 3: Indifferent
 2: Disagree
 1: Strongly Disagree

1. I had not heard about the use of quality as it was approached in this study 1 2 3 4 5
2. Do you agree that the definition of service quality should be meeting consumers' expectations? 1 2 3 4 5
3. The data provided by the case study was helpful to increase your knowledge of the performance of your department 1 2 3 4 5
4. You learned from the case study that you had healthcare consumers whose expectations you were unaware 1 2 3 4 5
5. The methodology used helped determine, in an organized manner, the areas that need to be improved in the AP department 1 2 3 4 5
6. Based on our discussion of the quality philosophy, what, do you consider, could be the use of data collected?

7. The case study was helpful in giving you a better understanding of the AP function and its impact to the rest of the hospital 1 2 3 4 5
8. The needs expressed by the business office regarding the availability of information in the computer system. I do not feel I have the technical knowledge to make a change in the system. 1 2 3 4 5
9. When our group met with the pharmacy director to discuss our expectations of their handling of invoices and the improvements that they could make in their process, what do you think was the reason for nothing to happen?
- A. AP did not insist enough
- B. Pharmacy did not get committed to make the change
- C. Someone from the Top Administration should have been present at the meeting
- D. Other: _____
-
10. The indexes defined for data collection are good indicators of the function under study 1 2 3 4 5
- Are there any other indicators (indexes) that you think were left out? _____
-

Evaluation of the Case Study

The following questionnaire was created to establish an objective evaluation of the methodology employed in the case study of this research. Use the following scale to rate your answers.

Scale: 5: Strongly Agree
 4: Agree
 3: Indifferent
 2: Disagree
 1: Strongly Disagree

1. I had not heard about the use of quality as it was approached in this study 1 2 3 4 5
2. Do you agree that the definition of service quality should be meeting consumers' expectations? 1 2 3 4 5
3. The data provided by the case study was helpful to increase your knowledge of the performance of your department 1 2 3 4 5
4. You learned from the case study that you had healthcare consumers whose expectations you were unaware 1 2 3 4 5
5. The methodology used helped determine, in an organized manner, the areas that need to be improved in the AP department 1 2 3 4 5
6. Based on our discussion of the quality philosophy, what, do you consider, could be the use of data collected?

To help us get invoices paid faster. To
help us get all discounts available. To get
the purchase order prices to match the
invoice prices. To get contact information
invoiced up to us so we can pay them
on a timely basis.

7. The case study was helpful in giving you a better understanding of the AP function and its impact to the rest of the hospital 1 2 3 4 5)
8. The needs expressed by the business office regarding the availability of information in the computer system. I do not feel I have the technical knowledge to make a change in the system. 1 2 3 4 5)
9. When our group met with the pharmacy director to discuss our expectations of their handling of invoices and the improvements that they could make in their process, what do you think was the reason for nothing to happen?
- A. AP did not insist enough
 B. Pharmacy did not get committed to make the change
 C. Someone from the Top Administration should have been present at the meeting
 D. Other: _____
 N/A
10. The indexes defined for data collection are good indicators of the function under study 1 2 3 4 5)
- Are there any other indicators (indexes) that you think were left out? No
-

Evaluation of the Case Study

The following questionnaire was created to establish an objective evaluation of the methodology employed in the case study of this research. Use the following scale to rate your answers.

Scale: 5: Strongly Agree
4: Agree
3: Indifferent
2: Disagree
1: Strongly Disagree

1. I had not heard about the use of quality as it was approached in this study 1 (2) 3 4 5
2. Do you agree that the definition of service quality should be meeting consumers' expectations? 1 2 3 (4) 5
3. The data provided by the case study was helpful to increase your knowledge of the performance of your department 1 2 3 4 (5)
4. You learned from the case study that you had healthcare consumers whose expectations you were unaware 1 2 (3) 4 5
5. The methodology used helped determine, in an organized manner, the areas that need to be improved in the AP department 1 2 3 4 (5)
6. Based on our discussion of the quality philosophy, what, do you consider, could be the use of data collected?

AP is always under pressure to meet deadlines, whether to pay via terms, take discounts, or to add close the Budget. This data showed how well we are meeting those deadlines. It also showed specific areas that need improvement in order that affect AP performance.

7. The case study was helpful in giving you a better understanding of the AP function and its impact to the rest of the hospital 1 2 3 4 5
8. The needs expressed by the business office regarding the availability of information in the computer system. I do not feel I have the technical knowledge to make a change in the system. 1 2 3 4 5
9. When our group met with the pharmacy director to discuss our expectations of their handling of invoices and the improvements that they could make in their process, what do you think was the reason for nothing to happen?
- A. AP did not insist enough
- B. Pharmacy did not get committed to make the change
- C. Someone from the Top Administration should have been present at the meeting
- D. Other: _____
-
10. The indexes defined for data collection are good indicators of the function under study 1 2 3 4 5
- Are there any other indicators (indexes) that you think were left out? I would like to see
- more data on Dietery - a study such as
- done for Pharmacy.

APPENDIX E

Table E1. Sample of invoices used to determine the time the hospital has to dispatch payments

Sample	Pay Terms (Days)	Received (days from invoice date)	Number of days left
1	30	2	28
2	30	3	27
3	30	2	28
4	30	4	26
5	30	2	28
6	30	6	24
7	30	4	26
8	30	5	25
9	30	4	26
10	30	6	24
11	30	7	23
12	30	7	23
13	30	2	28
14	30	5	25
15	30	10	20
16	30	8	22
17	30	5	25
18	30	4	26
19	30	5	25
20	30	5	25
21	30	6	24
22	30	8	22
23	30	6	24
24	30	6	24
25	30	8	22
26	30	7	23
27	30	7	23
28	30	14	16
29	30	5	25
30	30	6	24
31	30	3	27
32	30	6	24
33	30	6	24
34	30	7	23
35	30	3	27
36	30	6	24
37	30	6	24
38	30	5	25
39	30	3	27
40	30	4	26
41	30	5	25
42	30	3	27
43	30	7	23
44	30	7	23
Average	30	5.45	24.55

Table E2. Data used to determine time to process general invoices

SAMPLE	DATE RECEIVED	DATE MATCHED	TIME TO MATCH	DATE PROCESSED	TIME TO PROCESS	DATE INSPECT	TIME TO INSPECT	TOTAL TIME
8	19	23	4	26	3	29	3	10
13	19	21	2	26	5	29	3	10
7	19	23	4	26	3	28	2	9
17	19	21	2	26	5	28	2	9
14	19	26	7	27	1	29	2	10
13	19	26	7	27	1	28	1	9
25	19	26	7	27	1	28	1	9
18	19	26	7	27	1	28	1	9
3	19	20	1	22	2	29	7	10
18	19	21	2	26	5	28	2	10
28	19	21	2	27	6	29	2	10
41	19	26	7	28	2	28	0	10
4	19	20	1	22	2	29	7	10
8	19	20	1	23	3	28	5	10
10	19	20	1	26	6	28	3	10
14	19	20	1	26	6	28	3	10
15	19	20	1	26	6	28	3	10
25	19	27	1	27	0	29	2	10
21	26	26	0	27	1	28	1	15
24	26	26	0	27	1	29	2	15
23	26	26	0	27	1	28	2	15
5	13	20	7	27	2	28	6	18
26	20	21	1	27	6	28	1	8
27	20	21	1	27	6	28	2	9

Table E2 (continued)

SAMPLE	DATE RECEIVED	DATE MATCHED	TIME TO MATCH	DATE PROCESSED	TIME TO PROCESS	DATE INSPECT	TIME TO INSPECT	TOTAL TIME
29	27	27	0	27	0	29	2	2
32	27	27	0	27	0	29	2	2
33	27	27	0	27	0	28	1	1
11	14	20	6	26	6	28	14	14
24	21	26	5	27	1	29	8	8
22	21	26	5	27	1	28	7	7
21	21	26	5	27	1	29	7	7
3	21	23	2	26	3	29	1	8
9	15	23	8	26	3	28	3	13
13	15	20	5	26	6	29	2	14
5	15	23	8	26	3	28	3	13
12	15	20	5	26	6	29	2	14
11	15	23	8	26	3	29	3	14
17	15	23	8	26	3	29	3	14
37	16	26	4	27	3	28	1	6
1	16	26	10	27	1	28	1	12
4	16	20	4	26	12	28	6	12
9	16	23	7	26	3	28	2	12
15	16	20	4	26	6	28	2	12
16	16	26	10	27	1	29	1	13
19	16	26	4	27	1	29	3	6
31	23	27	4	27	0	28	2	5
40	23	26	3	28	2	29	1	5
2	23	23	0	26	3	29	3	6
1	23	23	0	26	3	29	3	6
12	23	26	3	26	0	29	3	6
AVERAGE			3.53		2.73		2.39	8.65
STD DEV			2.90		2.10		1.60	3.54

Table E3. Data collected to determine the time to process Pharmacy invoices

SAMPLE	DATE RECEIVED	DATE MATCHED	TIME TO MATCH	DATE PROCESS	TIME TO PROCESS	DATE INSPECT	TIME TO INSPECT	TOTAL TIME
58	6-26	7-10	14	7-10	0	7-13	3	17
57	6-29	7-10	11	7-10	0	7-13	3	14
32	6-5	6-21	16	6-21	0	6-28	7	23
34	6-5	6-21	16	6-21	0	6-28	7	23
33	6-5	6-21	16	6-21	0	6-28	7	23
56	6-23	7-10	19	7-10	0	7-13	3	22
55	6-26	7-10	17	7-10	0	7-13	3	20
62	6-26	7-10	14	7-10	0	7-13	3	17
63	6-26	7-10	14	7-10	0	7-13	3	17
60	6-26	7-10	14	7-10	0	7-13	3	17
61	6-7	6-23	14	6-23	0	6-28	5	21
26	6-7	6-23	16	6-23	0	6-28	5	26
27	6-2	7-10	21	7-10	0	7-13	3	10
75	7-3	7-10	7	7-10	0	7-13	3	10
77	7-3	7-10	7	7-10	0	7-13	3	10
	AVERAGE		15.1		0.0		4.2	19.3
	STD DEV		2.1		0.0		1.8	3.1

Table E4. Data collected to determine
the time to process dietary
invoices

SAMPLE	DATE RECEIVED	DATE INSPECT	TOTAL TIME
1	9-1	9-21	20
2	9-1	9-21	20
3	9-1	9-21	20
4	9-1	9-21	20
5	9-5	9-21	16
6	9-5	9-21	16
7	9-7	9-21	14
8	9-8	9-21	13
9	9-8	9-21	13
10	9-7	10-5	28
11	9-12	10-5	23
12	9-12	10-5	23
13	9-15	10-5	20
14	9-15	10-5	20
15	9-19	10-5	16
16	9-19	10-5	16
17	9-22	10-5	13
18	9-22	10-5	13
19	9-22	10-5	13
		AVERAGE	17.7
		STD DEV	4.2