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**AN EMPIRICAL INVESTIGATION OF TOTAL QUALITY
MANAGEMENT (TQM) EFFECTIVENESS IN
HEALTHCARE ORGANIZATIONS**

by

Lokesh S. Basappa

**A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Science
Department of Industrial Engineering**

**Western Michigan University
Kalamazoo, Michigan
June 1994**

DEDICATION

To

My Father, B. Sadashiva Murthy

and

My Mother, Sharada Sadashiva Murthy

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Lokesh S. Basappa

**AN EMPIRICAL INVESTIGATION OF TOTAL QUALITY
MANAGEMENT (TQM) EFFECTIVENESS IN
HEALTH CARE ORGANIZATIONS**

Lokesh S. Basappa, M.S.

Western Michigan University, 1994

American hospitals are implementing quality programs to offer higher quality service at reduced cost. However, the results of these programs in many hospitals have often not met expectations.

This research analyzed the effectiveness of Total Quality Management (TQM). The objective of the study was to better understand how TQM strategies can best be applied by hospitals. An empirical survey was distributed to Michigan hospitals and an analysis was performed to meet this objective.

The survey results show that hospitals involved indirectly with quality programs haven't realized that they are implementing TQM strategies. On the other hand some hospitals say that they are involved in quality programs, though were not practically implementing TQM strategies. There is a significant difference between a hospital's score of before and after TQM implementation.

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CHAPTER I

INTRODUCTION

Background

In recent years, the term “quality” has become a magic word thought to reduce operating costs. This is due to the fact that most organizations in either the manufacturing or service sector are exploring new ideas/efforts to improve the quality of service delivered at the lowest possible cost. As health care is an important part of the service sector, having the advantage of serving people from all walks of life, health care organizations have started initiating quality programs to offer higher quality of service at a reduced price to their customers. Additionally, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) is extensively supporting the idea of making quality improvement efforts as an active part of American hospital’s culture (O’Leary, 1992). Quality improvement process is referred to by different names such as, Total Quality Improvement (TQI), Continuous Quality Improvement (CQI), Total Quality Management (TQM), Quality Improvement Team (QIT). This concept will be referred to as TQM in this research document.

The transition of adopting TQM to the healthcare is not easy. This

is due to the internal structure which includes professionals from medical staff, nursing staff and ancillary support staff, which could be characterized as independent professional associations within an organization. As they include intangible contributions of many individuals from various departments at various stages it is hard to point out an individual's role while serving a customer.

The evaluation of any process is very crucial as the TQM concept demands everyone's active participation towards achieving a common goal, irrespective of their amount of contribution. The Majority of the health care organizations face a basic question of where and how to start the quality program. Before initiating quality programs, health care organizations should understand, the concept of TQM, how it works and what are its requirements.

Research Problem

One of the difficulties with starting a TQM program is that there aren't any standard procedures for implementing TQM strategies. TQM requires the full commitment of management to analyze and understand the various processes involved in the system and to perceive the quality definition from the customer's point of view before attempting to initiate quality efforts. Also, management must realize that the improved performance is not just satisfying an accrediting body or any outside agencies but should be from their own interest. TQM, if it

works, must be internally driven (O'Leary, 1992).

Most of the quality related problems arise in health care environment during implementing TQM strategies. As the health care sector is the second largest industry in America and involves billions of dollars in providing services, it is extremely important that medical care is provided in the most efficient way possible. This research is intended to provide information as to how hospitals are approaching TQM implementation and to identify how they can more efficiently use TQM to improve the efficiency of the care they deliver.

Organization of the Study

This research will be presented in the following order:

Chapter II will provide an overview of the health care efforts in quality programs as currently presented in the literature and discuss the key concepts of quality gurus.

Chapter III will present the narrative discussion of this research work, its hypotheses, and research methodology involved to carry out the analysis. Also discusses the analysis about the design of the survey questionnaire.

Chapter IV will present the data analysis from responses received and discusses results about hypotheses testing.

Chapter V will present conclusions and recommendations for future research work.

CHAPTER II

LITERATURE REVIEW

General Discussion

Today, more than any other time in this century, healthcare organizations are more concerned about issues such as quality of service, cost, and competitiveness. The eagerness of being competitive in this multi-billion dollar industry is pushing a hospital whose current status is poor in offering its service to improve rapidly to survive. The hospital whose status is superior must improve on a continuous basis to maintain its competitive edge, and a hospital which is average in its performance must keep up with the quality improvement efforts to attain superior status (Omachonu, 1991). There is always a chance for an organization to improve the quality of service delivered to the customer.

Quality Gurus

Three individuals are generally recognized as leaders of the quality efforts movement. They are Phillip B. Crosby, W. Edwards Deming, and Joseph M. Juran. The key concepts to improve quality of service by each of these leaders are summarized below.

Crosby (1979) defines quality as conformance to requirements with these ideas:

1. The system should emphasize rather than checking and inspecting. Inspection is a wasteful exercise.
2. Prevention involves identifying areas where errors can occur, and once identified, the processes should be modified/improved to eliminate the causes forever. The system should focus on prevention rather than appraisal.
3. The cost of quality is the cost of doing things wrong.
4. The final goal in quality improvement is to reach zero defects.
5. Prevention costs include the cost of educating and training employees in quality concepts, process change, and preventive maintenance.

Crosby's (1984) quality improvement process strongly supports the commitment of top management and has developed a systematic 14-step process to provide quality within an organization.

Dr. Deming (1986) advocates a strong commitment on the part of management toward a long-term perspective in quality improvement efforts including clearly defined objectives of the organization. Training and retraining of everyone involved is critical to the success of the organization. Deming believes that it is management's responsibility to educate employees; education and training are investments in people. They help to avoid employee turnover and give a message to employees

that management considers employees to be a valuable resource to achieve total quality environment. Deming believes that an organization will be served best by developing a long term relationship with a few vendors rather than changing from one supplier to another, based on the low bids. A long term relationship allows vendors to become actively involved in understanding various processes, to achieve reduced cost, and put necessary resources into improving their functions. Deming proposed a 14-point plan, which will help management either in manufacturing or healthcare to improve quality of service, competitive position, and stay in business.

Dr. Juran (1988), like other two quality experts, suggests that over 80% of quality defects are caused by factors controllable by management. Juran stresses the need for organizations to continually seek quality improvements with the help of "Quality Trilogy": (a) planning, (b) control, and (c) improvement. Juran defines quality improvement as a process which begins with identifying areas having inherent quality problems. Once identified, the need for change and improvement must be conveyed to others to obtain support for change. Next, alternative solution(s) should be identified and analyzed. The solution(s) having the best potential for continuous improvement should then be implemented. Juran asserts that annual improvement, hands-on management, and training are fundamental to achieve excellence in quality (Omachonu, 1991, Vinod, 1991).

The differences and similarities of these three quality experts is that, although there are differences among the philosophies, many of the concepts presented by these leaders are common to all three (Vinod, 1991). The key concepts common among them in making TQM strategies effective in healthcare are: (a) Top management commitment in quality improvement efforts, (b) Training employees in quality concepts, (c) Vendor involvement in quality process, and (d) Ability to define outcome indicators.

Current Study Efforts

In general, the goal of a decision about a healthcare practice is to choose the action that is most likely to deliver the outcomes patients find desirable. This helps in identifying the outcomes of the alternative practices, then the desirability of the outcomes of each option must be compared. This involves collecting and processing whatever evidence exists about the benefits, harms, and costs of each option. To define quality in terms of outcome indicators assumes that the process is under control and predictable. Although outcome indicators are important, it is even more important to understand that the process generates the outcome.

To monitor the quality of important aspects of care in the hospital, the outcome indicators identified by the researcher to test the correlation among outcome measures and TQM strategies are: (a) Average length

of stay, (b) Employee turnover, and (c) Average cost per case (room rent, surgical costs, etc.,).

TQM Strategies to Accomplish the Required Output Indicators

Suggested TQM strategies that help health care practitioners to accomplish the above stated outcome indicators are, to: break down barriers between departments, fix the process, not the people, and quality is meeting or exceeding customer expectations.

Break Down Barriers Between Departments

The healthcare processes are multidisciplinary in nature and draws upon the expertise and support of several disciplines. Areas in which barriers continue to exist are between physicians, nurses, and ancillary services. Healthcare organizations need a model of collaborative practice. According to the National Joint Practice Commission (1977), the definition of collaborative or joint practice in hospitals is nurses and physicians collaborating as colleagues to provide patient care. Bradford (1989) notes that the younger physicians and residents perceive the nurse as providing all care, including medical tasks, with no understanding of the nursing processes and nursing diagnosis. They do not see the necessity of the nurse and physician collaborating to effect high quality patient care by a combined treatment plan composed of the medical care plan and the nursing care plan.

Barriers such as lack of communication destroy the spirit of cooperation and lead to lower quality. One way to eliminate barriers is to use cross functional teams. A cross functional team can be formed by including people from various departments such as, nursing, medicine, pharmacy, laboratory, record keeping, information systems, and house keeping. Bradford (1989) summarizes that the attitude of younger physicians and residents towards the nursing responsibilities would improve by involving them in TQM training.

Fix the Process, not the People

An essential belief in a TQM environment is that most people want to do a good job, and that the job of management is to provide an atmosphere in which that is possible. Therefore, it's not the people who need fixing. This is very important in the health care environment, where professional people are committed to saving and enhancing lives (Rowen, 1992).

A suggested technique of TQM philosophy to reduce employee turnover is, management must "drive out fear" (Deming, 1986) among workers. One common fear that nurses and other healthcare professionals face is the fear of making mistakes such as, giving wrong drug, or incorrect dosage, ordering the wrong tests, etc. Deming (1986) notes that people on the job can't work effectively if they dare not offer suggestions for simplification and improvement of the processes.

Employees should not be blamed for the problems inherent in the system but should be encouraged to improve the system.

To improve performance by improving the process, management should encourage everyone involved to include the following five step process in their jobs (Deming, 1986):

1. Set the direction and establish standards.
2. Define the process.
3. Measure the process.
4. Intervene at some point in the process.
5. Measure again, at an appropriate interval, to determine the effects of the intervention.

Quality is Meeting or Exceeding Customer Expectations

TQM is the process of creating continuous quality improvement, for the long term. The important thing is to keep the process dynamic. The first step in achieving this objective is to define who is the customer. TQM defines the customer as any person who receives the service provided by the organization. Using this definition, the patient is the primary customer in healthcare environment. Secondary customers include the patient's family, medical staff, physicians, third party payers, and so on. Those who successfully implement TQM take the time to carefully identify the customers in a particular situation and then ask, either personally or through surveys, what they expect, and

how well those expectations are met. The dynamic nature of the process requires a commitment to follow up. Quality costs are defined as all costs incurred to help the employee to do the job right every time and the cost of determining if the output is acceptable, plus any cost incurred by the organization or the customer because the output does not meet specifications and/or customer expectations (Labovitz, 1991). It is possible to reduce operating costs when everyone in a hospital is committed to insuring that processes work (Labovitz, 1991). This helps in bring down costs and at the same time improve performance to increase customer satisfaction.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

Background

Currently most quality efforts in health care focus on management's approach to deliver a higher quality of service at a reduced price such as:

1. Looking for ready made solutions for the problems inherent in the system.
2. Seeking outside consultants help.
3. Not spending necessary time and effort to understand quality concepts.
4. Implementing quality improvement programs with out proper basic preparation.

Most of the time these approaches are just quick fix solutions which neglect long term planning to achieve their objectives over a period of time on a continuous basis.

Inspection is not considered a method of assuring product of quality, but considered as the process to react only after an error has been detected. The only way to reduce the inspection is to include quality at the beginning of the planning and designing process. In either

manufacturing or health care, the costs associated with inspection are very high, considering the rework and rejections at the end of a process. As health care deals with the lives of human beings, a defective process might result in complications in a patient's life or sometimes even death. Interestingly, both manufacturing and health care organizations feel that quality cannot be considered as the sole responsibility of a particular department but, it must become an integral part of the entire organization in its routine activities. Indicating that everyone in the organization must be actively involved in understanding how other departments/processes function so as to work towards achieving a common objective.

This understanding and involvement requires an awareness that quality service is an end result of all independent contributions each done effectively and efficiently on a continuing basis. Once the new concept is introduced, it should be constantly improved in order to maintain a high quality of service on a long term basis. Healthcare organizations operate in an environment where there is real competition — competition that will ultimately be driven by value (O'Leary, 1992). Each organization in health care must understand that performance improvement is primarily to improve patient care.

Research Concentration

The research presented in this document will examine the

commitment of hospitals towards making a quality program effectively. This involves TQM strategies such as, hospital's involvement in quality improvement strategies such as, training and educating employees, communication among departments, vendor involvement, utilization of staff/resources, and utilization of employee suggestion system.

The primary step is to launch an extensive program to educate and train employees in quality concepts. Involvement of everyone in quality improvement effort irrespective of their contribution internally or externally. This provides an opportunity for the management to show their true and strong commitment in educating employees and their active participation to achieve total quality environment. If employees have the knowledge of their process details as well as what is expected of their contribution in making quality efforts successful then their suggestions would be worth considering to improve the process. The employee suggestion system works well if the management drives out the fear among employees. If employees are afraid to report any incidents that can have implications on quality or try to cover up the mistakes, it is the organization's responsibility to create an atmosphere where fear among employees does not exist. As healthcare processes are multidisciplinary in nature demanding expertise and support of several departments and people, it is essential to have a good communication environment. If barriers exist in the system, it leads to destroy the spirit of cooperation resulting in delivery of lower quality

service. The level of utilizing employees and the ability to achieve outcome indicators effectively depends on the level of communication between various departments. An important thing to consider while buying drugs, equipment, instruments, and other utility supplies is not to settle for the vendor with low price tag as these items are used everyday in life and death situations. To overcome this is by involving vendors in the quality process to make them understand healthcare processes to deliver quality supplies/products. Being a responsible accrediting body for American hospitals, JCAHO which itself is into its sixth year of TQM initiatives, is now insisting hospitals to measure and evaluate every processes and continuously improve the performance (O'Leary, 1992).

Research Hypothesis

The research design employed in this study is a cross-sectional field survey using the questionnaire data gathering method. Based on the literature review discussed in Chapter II, the following research hypothesis was formulated:

H₁: TQM strategies affect the quality of service.

This hypothesis will be evaluated by comparing the level each hospital reports its involvement in TQM strategies to actual expected TQM behaviors, and correlating TQM strategies to test the level of significance between before and after implementation time periods. This is to test

the authenticity of a healthcare organization's reply. This identifies a hospital which says that it is in the process of implementing TQM strategies without fully understanding its basic concept or on the other hand, if an organization that thinks that it is not involved in any of these quality efforts but is indirectly implementing TQM strategies under a different name to achieve customer satisfaction and reduce operating costs. The bottom line should be to identify the critical areas to improve quality of service provided to customers.

Correlation is to test the significant relationship between TQM strategies. In other words, in determining the strength of the relationship between TQM strategies, we are measuring how well the knowledge of one strategy can be achieved on the basis of a knowledge of the other strategies.

Based on the above research hypothesis, the following null hypothesis (H_0) and alternative hypothesis (H_a) were formulated:

H_0 : There are no significant differences between quality strategies of before TQM and after TQM implementation.

$$H_0 : \mu_{\text{After TQM}} = \mu_{\text{Before TQM}}$$

H_a : There is a significant difference between quality strategies of before TQM and after TQM implementation.

$$H_a: \mu_{\text{After TQM}} > \mu_{\text{Before TQM}}$$

[Note: Statistical analysis will be done using SPSS software]

Research Methodology

Survey Questions (Appendix B) were selected after going through the literature of the three important quality experts regarding TQM concepts. Questions can be grouped according to the following TQM strategies:

1. Employee education and training (Crosby, 1984, Deming, 1986): Q1
2. Goal Setting (Crosby, 1984) , Creating constancy of purpose for improvement of product and service (Deming, 1986): Q2
3. Quality planning and Quality control (Juran, 1988) : Q3 and Q9
4. Quality improvement team (Crosby, 1984):Q4
5. Recognition (Crosby, 1984), Drive out fear (Deming, 1986): Q5, Q6, Q8, and Q14
6. Break down barriers between staff areas (Deming, 1986): Q7 and Q10
7. Quality awareness (Crosby, 1984): Q11
8. End the practice of awarding business on the basis of price tag alone (Deming, 1986): Q13

To convert the response data into a linear data, as explained under the section on questionnaire analysis, individual weights were assigned to 32 questions (16 before TQM and 16 after TQM) of the survey questionnaire (Appendix B).

Questionnaire Design

The questionnaire consist of two sections, one regarding information about the hospital before TQM implementation and one after. A copy of the cover letter and the questionnaire are contained in Appendix A and Appendix B respectively. Mailed questionnaires were addressed and mailed to the Quality Assurance Department, the cover letter was directed to the Quality Assurance Director, and asked that the questionnaire be completed by the person most knowledgeable about the organization's quality improvement efforts. It was assumed that the Quality Assurance Director would have the best knowledge about any and all of the quality programs taking place in the hospital; however, in some hospitals this responsibility is divided and there are separate TQM offices or departments. However, since all hospitals have a Quality Assurance Director it was felt even if the Quality Assurance Director was not the individual responsible for implementing TQM, they would know who to include in the survey process.

The questionnaire was pretested with a Management Systems Consultant, who is responsible for TQM implementation in one of the local area hospitals. Of specific interest was obtaining feedback about the clarity and understandability of the questions, the completeness of the questionnaire, clarity of instructions for completing the questionnaire and identification of any structural problems (words, omissions, etc.) The questionnaire was felt to be comprehensive and

understandable.

The survey was sent to Michigan State hospitals with 50 or more beds. A total of 167 hospitals were selected from the American Hospital Association's 1992 Guide to the Health Care Field. A reminder was sent to the non-respondent hospitals.

Assumptions

The following assumptions were made while designing the survey questionnaire.

1. All hospitals were assumed to have same facilities.
2. The average length of stay (days) was assumed to be the time spent by all patients, irrespective of the nature of their disease.
3. Average cost per case (\$/case) was assumed to be the cost of medical care provided by the hospital, irrespective of the nature of the medical care received.
4. Cost per discharge was assumed to be the average cost that the hospital incurred towards relieving a patient from its system.

Each question was assigned a weight (one to ten) by the researcher depending on his knowledge on each question's role in making implementation of TQM strategies a success in any hospital.

Analysis of the Questionnaire

1. Questions 1 and 1a (weight: 5) asked whether employees were

trained in TQM concepts (Crosby, 1984, Deming, 1986). This is a basic step while implementing quality movement in any hospital. Training is an way of developing an implementation plan to educate all employees within the organization about quality improvement concepts and tools for quality improvement.

2. Questions 2 and 2a (weight: 10) asked about the ability to define outcome indicators (Sloan, 1992). TQM is the process of creating continuous quality improvement for the long term. The important thing is to keep the process dynamic. In order to achieve the objective, the first step is to define what the organization wants to achieve by implementing quality strategies. Organizations might be tempted to borrow indicators and measures from other organizations. The problem is that most indicators and measures don't transfer well. A key point in TQM is the development of measures by those who use them (Gopalakrishnan, 1992). The indicators should reflect performance changes as well as performance levels.

3. Questions 3 and 3a (weight: 10) asked about the assessment of patient requirements (Omachonu, 1991). This is one of the areas where hospitals do not concentrate their resources to collect feed back from patients regarding the problems or any inconvenience they had while availing the hospital services. If health care organization identifies itself with quality improvement strategies to achieve customer satisfaction, then there lies the responsibility of assessing patient

requirements (Koska, 1992).

4. Questions 4 and 4a (weight: 5) asked about efficient staff/supplies utilization (Vinod, 1991). Implementation of total quality management strategies through quality improvement teams and empowering individual is not the only responsibility of any organization, so as to achieve its objective. In addition, by participating with quality improvement teams, sharing and communicating results of those teams, providing necessary feed back would help in collaborative approach to process improvement.

5. Questions 5 and 5a (weight: 10) asked about the utilization of employee suggestion systems (Vinod, 1991). A good environment for the employee suggestions makes employees feel free to provide necessary suggestions/corrective actions, at the lowest possible organization level (McConnell, 1992). This is one effective way of tapping the improvement potential that exists at all levels of the workforce and is present especially with the people who do the hands-on work.

6. Questions 6 and 6a (weight: 10) asked about the implementation of employee suggestions (Vinod, 1991). By recognizing employees and teams who make significant quality improvement, its possible to create a feeling of empowerment and improve employee morale and esteem substantially (Gopalakrishnan, 1992). Implementing an employee suggestion system provides motivation within the work force to be creative so as to continuously improve processes.

7. Questions 7 and 7a (weight: 5) asked about the effective staff meetings (Vinod, 1991). The staff meetings will be held on a regular basis and include representatives from all departments providing an opportunity to discuss the quality related issues. These meetings provide an opportunity to get feedback from employees regarding ongoing quality efforts.

8. Questions 8 and 8a (weight: 7.5) asked about how the hospital responded to employee opinion surveys (Vinod, 1991). Opinion surveys provide an opportunity for eliciting employee input for improving the process within which they work. Also, there will be more interaction between the management and employees in encouraging employee leadership and involvement in quality activities. Conducting regular surveys within the organization helps in getting fearless and unbiased responses/comments as the respondent will be anonymous.

9. Questions 9 and 9a (weight: 7.5) asked about meeting patient's needs (Godfrey, 1992). Leebow (1988) identifies four primary reasons why healthcare organizations should focus on meeting patients requirements such as, (a) Patients deserve excellent quality of care and service as they come with anxiety about their physical, emotional, and economic well-being; (b) Patients are customers and have more options and are expecting value for their money; (c) Patients can be good or bad for public relations depending upon the experiences they have while receiving services; (d) Satisfied patients are easier to serve, whereas

dissatisfied patients consume more valuable staff time that could be used for serving others. By considering these factors, it is necessary to utilize the available resources to satisfy the customer needs to survive in the competition.

10. Questions 10 and 10a (weight: 10) asked about the communication among departments (Deming, 1986). The health care process is multidisciplinary in nature as it draws upon the expertise and support of several departments and people (Omachonu, 1991). If barriers exist among various departments in the hospital, it will destroy the spirit of cooperation and lead to lower quality. By incorporating cross functional teams involving employees from ancillary services, medicine, nursing, laboratory, etc., barriers could be removed.

11. Questions 11 and 11a (weight: 2.5) asked about awareness of JCAHO 10-steps (JCAHO, 1980). It is known among U.S. health care organizations that the process improvement represents a potential challenge for those associated with the Joint Commission on Accreditation of Health Care Organizations (JCAHO). JCAHO historically supports quality control through its 10-step quality assurance model. At present, JCAHO is studying various teachings on quality. This study has led JCAHO to turn to TQM principles and develop its Agenda for Change. The new agenda, which will be fully implemented into the accreditation process by 1995, calls on health care organizations to develop new managerial approaches to respond to the

challenges they are facing. (Craig, 1992, JCAHO, 1980).

12. Questions 12 and 12a (weight: 2.5) asked about sharing information with other hospitals (Koska, 1992). When the information shared between two physicians from different hospitals would be more effective as being able to speak the language and understand the art versus the science of medicine. This kind of sharing information between the organizations helps to understand different ways of solving problems that might be encountered during the implementation of quality strategies.

13. Questions 13 and 13a (weight: 10) asked the hospital about its level of vendor involvement in the quality process (Lumsdon, 1992). The relationship of hospital-vendor is like trying to manage functions, not organizations. Suppliers must be sensitive to the concerns of the hospitals. Healthcare organizations should track the outcomes for patients who have received or used supplies from different suppliers. Tracking enables them to develop vendor-specific outcomes for comparable supplies. Mendenhall (1991) argues that, as the manufacturers provide technological solutions, they should play a key role in defining indicators of quality or appropriate use of their products. This collaborative approach results in staffs working together to improve services and the quality of products delivered to physicians and patients (Lumsdon, 1992).

14. Questions 14 and 14a (weight: 10) asked about the level of

employee turnover (Godfrey, 1992). Rapid turnover in staff confounds the constancy of purpose that TQM demands and makes long-term quality planning difficult. If employees involved with any level of the organization serve a short time, then this change hampers the quality efforts of the organization. Each time a new employee is hired, he/she has to be trained, educated in quality concepts, and get acquainted with the ongoing processes.

15. Questions 15 and 15a (weight: 5) asked about cost per discharge (William, 1992). While discharging a customer, communication between various departments should be excellent as it involves gathering information about the patient's medical records, prescriptions, laboratory's test reports, etc. The communication system plays an important role in minimizing costs involved with of duplication work.

16. Questions 16 and 16a (weight: 5) asked about the number of cases forwarded to Risk Management (Blumberg, 1986). This is a way to remove or reduce the effects of confounding factors in studies where the cases are not randomly assigned to different treatments. Risk Management classifies patients into risk homogeneous groups at the time of intervention and calculates outcome rates based on a referent or baseline group. The rates are then used as a basis for developing expected outcomes for a particular group and are then compared with what actually occurred in a given health care setting (Demouy, 1990).

Using risk adjustment allows hospitals to compare outcome data with other organizations using a similar baseline, if outcomes are higher or lower than the calculated expectation, it should indicate to the hospital that this may be an area of below average or better than average care.

It can be seen from the above questionnaire analysis that each question seem to contribute significantly towards the effective implementation of TQM strategies. Testing the hypotheses as discussed in this chapter provided information about whether TQM strategies are significantly effective. Chapter IV will present and discuss these results.

CHAPTER IV

RESULTS

This chapter will present the results and analyze the information obtained from the returned surveys. The number of responses received were 50 out of 167 hospitals that were surveyed (Appendix D), which results in a 30% rate of response for this research work. Among the 50 responses, eight hospitals were not interested in participating with the survey, so 42 (25.2%) cases were considered while conducting the statistical analysis.

As discussed in Chapter III, research hypotheses were evaluated by (a) comparing each hospital's claim towards its total quality efforts, and (b) testing the significant relationship among TQM strategies.

Involvement in TQM Strategies

The procedure involved was to compare the information provided in the basic descriptive information section of the survey questionnaire (Appendix B) which asks the respondents to mark either "yes" or "no" about their involvement in quality improvement programs. In order to classify an health care organization as a TQM-hospital, it should have at least a total score of 765 points (382.5 points each before and/or after TQM involvement) from the returned survey questionnaire. This

number was calculated as follows (Table 1):

1. Each question has been allotted a cut-off point (column a) from the seven point scale in the questionnaire, which indicates that a particular respondent should have marked at least that point in order to qualify as a TQM -hospital.

Note: For questions 14, 14a, 15, and 15a (Appendix B) scaling has been reversed while entering the data from the returned material. This is because on these questions a lower response indicated a higher quality effort.

2. Then that point was multiplied with the respective weight (column b) marked for that particular question. As discussed in Chapter III, depending on each question's significance in achieving quality improvement efforts the weight ranging between points one to ten has been assigned to each question contained in the survey questionnaire (Appendix B).

3. Finally, the multiplied score (column c) for all 32 questions was added (Σc), which was used as an indicator to differentiate between TQM and Non-TQM hospitals. The calculated total score was, $\Sigma c = 765$ points.

Table 1
Calculation of Cut -off Point

Question Number	Average Each Hospital Should get From the 7- Point Scale (a)	Weight Assigned (b)	Multiplied Score (c)
1	5	5	25
1a	5	5	25
2	3	10	30
2a	3	10	30
3	3	10	30
3a	3	10	30
4	5	5	25
4a	5	5	25
5	3	10	30
5a	3	10	30
6	3	10	30
6a	3	10	30
7	5	5	25
7a	5	5	25
8	4	7.5	30
8a	4	7.5	30
9	4	7.5	30
9a	4	7.5	30
10	3	10	30
10a	3	10	30
11	6	2.5	15
11a	6	2.5	15
12	3	2.5	7.5
12a	3	2.5	7.5
13	3	10	30
13a	3	10	30
14	2	10	20
14a	2	10	20
15	2	5	10
15a	2	5	10
16	3	5	15
16a	3	5	15

By performing the weighted score analysis (Appendix E), the following results (Table 2) were obtained.

Table 2
Weighted Score Analysis Results

Case I (D1=1)		Case II (D1=2)	
Hospital	Score	Hospital	Score
01	280.00	04	555.00
02	385.00	08	475.00
03	160.00	11	492.50
05	480.00	13	457.50
07	397.50	18	405.00
10	672.50	30	250.00
12	475.00	31	410.00
14	320.00	33	405.00
16	477.50	36	430.00
17	470.00	37	292.50
20	317.50	39	310.00
21	367.50	42	472.50
22	457.50	44	570.00
25	340.00	47	450.00
26	500.00	Number of Cases: 14	
27	322.50		
28	290.00		
29	498.50		
32	452.50		
35	447.50		
38	345.00		
40	455.00		
41	582.50		
43	390.00		
45	447.50		
46	290.50		
48	462.50		
50	405.50		
Number of Cases: 28			

These scores show that though 28 hospitals claim to be involved in implementing TQM strategies in reality only 19 hospitals are involved with the concept of quality improvement efforts in their organizations. On the other hand, nine hospitals say that they are involved in quality efforts, though were not practically implementing TQM strategies.

Fourteen hospitals claim that they are not involved in TQM strategies, while only three of these hospitals aren't actually involved in quality improvement efforts. In reality, 11 hospitals which are involved with TQM strategies practically haven't realized that they are implementing TQM strategies in their organizations.

Table 3
Classification of Hospitals

	Hospital Reports		Total
	(Implementing)	(Not Implementing)	Hospitals
Score Indicates			
(Implementing)	19	11	30
(Not Implementing)	9	3	12
Total Hospitals	28	14	42

Relationship Between TQM Strategies

To test the correlation among TQM strategies in the survey questionnaire (Appendix B), the procedures involved were factor analysis to identify the variables that were correlated, correlation analysis to test the significance among the variables selected, to test the difference between means T-TEST and descriptive analysis were performed.

To identify the correlation among a set or group of variables, factor analysis (Appendix F) method was used. Factor analysis is a statistical tool used to identify a relatively small number of factors that can be used to represent relationships among sets or groups of many interrelated variables (Norusis, 1985).

Correlated variables selected from the factor analysis were, Q1, Q2, Q3, Q5, Q6, Q7, Q9, Q10, Q11, Q13, Q15, and Q16 (Table 4). Correlation analysis was performed between the above selected variables (Appendix G).

Factor 1 (Table 4) indicates TQM strategies of utilizing the available resources to meet customer expectations. Factor 2 (Table 4) indicates TQM strategy of including people involved in quality efforts externally with the organization. Factor 3 (Table 4) indicates TQM strategy of educating people regarding the quality concepts.

Table 4
Factor Analysis Results

	FACTOR 1	FACTOR 2	FACTOR 3
Q1			.45350
Q2	.80766		
Q3	.80888		
Q5		.40502	
Q6	.80501		
Q7	.81885		
Q9	.86903		
Q10	.85611		
Q11			.42774
Q13		.45449	
Q15			.42548
Q16		.44624	

Following set of variables were found to be significant at 0.05 level (Table 5), (a) Q1 and Q2, (b) Q1 and Q7, (c) Q2 and Q3, (d) Q2 and Q7, (e) Q2 and Q10, and (f) Q2 and Q11.

The correlation of questions Q1 and Q2 ($r = .5652$, $p < .05$) indicates that by educating and training employees in quality concepts, the possibility of identifying outcome indicators would be higher. This provides an opportunity for employees to understand their processes and discover ways to improve them.

The correlation of questions Q1 and Q7 ($r = .3883$, $p < .05$) indicates that in order to conduct efficient staff meeting all participating members should have knowledge about the quality programs as well as the

organization's objective. The staff attending these routine meetings should be comprised of middle- and top-level management who will have the responsibility to lead their subordinates in carrying out the quality programs. So as to get positive results out of these meetings, everybody should be able to talk and understand the quality language. This can be achieved by training and educating employees in quality concepts.

Table 5
Correlation Analysis Results

	Q2	Q7		
Q1	.5652	.3883		
	(28)	(28)		
	$p = .001$	$p = .037$		
	Q3	Q7	Q10	Q11
Q2	.3703	.4815	.3995	.5031
	(28)	(28)	(28)	(28)
	$p = .048$	$p = .008$	$p = .032$	$p = .005$

The correlation of questions Q2 and Q3 ($r = .3703$, $p < .05$) indicates that with the prior knowledge about the outcome indicators, it would be easier to assess the patient requirements. By defining the outcome indicators the management should be able to convey to its employees that

they should be creative in their regular work to assess patient requirements so as to eliminate the occurrence of any discomfort or delays.

The correlation of questions Q2 and Q7 ($r = .4815$, $p < .05$) indicates that effective staff meetings would result in identifying outcome indicators. Regular staff meetings provide the feedback about on-going quality programs among employees from different departments and helps in resolving bottlenecks which might be present in the quality efforts.

The correlation of questions Q2 and Q10 ($r = .3995$, $p < .05$) indicates that with a good communication system among all departments will help in defining the outcome indicators. Outcome indicators identified by the people involved with processes can result in realistic objectives. To make this happen there should be a good communication network within the organization to involve every individual and department to accomplish the organization's objectives.

The correlation of questions Q2 and Q11 ($r = .5031$, $p < .05$) indicates that with awareness of the JCAHO's quality guidelines it would be possible to identify the outcome indicators. The JCAHO strongly recommends its accredited hospitals to define quality improvement on key processes, rather than on the people involved in those processes.

To test the significant difference between TQM strategies

(Appendix B) before and after its implementation, matched pair T-TEST was performed (Appendix I). T-TEST compares sample means by first calculating a student's t to test the significance difference between two means. The results obtained (Table 6) were analyzed according to the values obtained for student's t and two-tailed probability for a comparison of two means.

From Table 6, it can be seen that the paired samples means of Q1-Q14 with Q1a-Q14a have significant difference in their means at $p < 0.05$. This indicates that there is a significant difference between a hospital's score before and after TQM implementation. The paired sample means of Q15-Q16 with Q15a-Q16a do not show a significant difference, indicating there is not a relationship between these two strategies sample means between the pre- and post-TQM strategies time periods. This may be due to the fact that there is very few responses for these strategies.

As discussed in Chapter II, data were collected on TQM strategies to understand the relationships these strategies have with outcome indicators. To test the relationship between these strategies and outcome indicators, a correlation analysis (Appendix J) was performed.

Table 6
T-TEST Results for Paired Samples

Variables	<i>t</i> Value	Two-Tailed Probability	Cases
Q1 and Q1a	-7.03	.000	27
Q2 and Q2a	-4.47	.000	28
Q3 and Q3a	-5.11	.000	28
Q4 and Q4a	-4.67	.000	28
Q5 and Q5a	-6.16	.000	28
Q6 and Q6a	-5.73	.000	28
Q7 and Q7a	-5.22	.000	28
Q8 and Q8a	-4.67	.000	28
Q9 and Q9a	-3.20	.000	28
Q10 and Q10a	-8.60	.000	28
Q11 and Q11a	-2.65	.013	28
Q12 and Q12a	-4.42	.000	28
Q13 and Q13a	-5.41	.000	28
Q14 and Q14a	-2.52	.019	25
Q15 and Q15a	-1.10	.287	20
Q16 and Q16a	-.76	.090	20

Most of the returned surveys did not provide data on the three outcome indicators requested. Twenty-two hospitals provided length of stay data, nine hospitals provided staff turnover percentages. Therefore, these data provide an indication of trends for these relationships, not conclusive results (Table 7).

The correlation of Q2 and D2 ($r = .5279$, $p < 0.05$) indicates that with the ability to identify the outcome indicators it increases the patient's average length of stay. The correlation of Q10 and length of stay (D2) ($r = .5325$, $p < 0.05$) indicates that by breaking down barriers it may increase the patient's average length of stay.

Table 7

Correlation Results of TQM Strategies and Outcome Indicators

	D2	D3
Q2	.5279 (22) $p = .012$.4068 (9) $p = .277$
Q10	.5325 (22) $p = .011$	-.3789 (9) $p = .315$

Descriptive variable analysis (Appendix H) computes univariate summary of statistics. By performing the descriptive variable analysis, the following results obtained (Table 8).

The conclusion that can be drawn from the correlation analyses is that with the knowledge of one TQM strategy it's possible to achieve the other TQM strategies. These results indicate that more research is wanted to test the assumptions that TQM improves the "bottom line" for the hospital. Improved quality of service may mean improved care, which may not mean less cost.

Table 8
Descriptive Variable Analysis Results

Variable	Mean (μ) (Before TQM)	Mean (μ) (After TQM)
Q1	2.59	5.56
Q2	4.03	5.26
Q3	4.32	5.56
Q4	3.79	4.96
Q5	3.24	5.04
Q6	3.21	4.89
Q7	3.76	4.81
Q8	3.10	4.56
Q9	4.72	5.37
Q10	3.38	5.04
Q11	4.79	5.37
Q12	3.55	5.04
Q13	2.28	3.74
Q14	4.07	5.04
Q15	4.23	4.26
Q16	3.48	3.35

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Issues Related to Research

The research presented in this document focusses on an area of considerable importance to the healthcare environment – effective implementation of TQM strategies. As discussed in Chapter II there are many efforts taking place to improve the quality of service provided to the customer at a reduced price.

The results from the survey conducted for this research indicate that there is a serious effort by most of the healthcare organizations to implement TQM strategies. Thirty hospitals out of 50 respondents seem trying to implement quality improvement programs. This number is growing, as some of them reported to have plans to implement TQM during 1994/1995.

As discussed in Chapter IV, the organizations which claim to be involved with TQM programs, but are not in reality implementing it, must realize that to make quality programs successful they need to have a feedback system. This helps in receiving and providing information to people involved in quality programs. Healthcare organizations which claim to be, and in reality are, involved with TQM should maintain

regular feedback systems as well to updating the efforts to keep the program dynamic. Healthcare organizations which do not claim to be involved with TQM but may actually be involved in TQM should be able to identify their process outcomes to maintain the effectiveness of ongoing quality programs. Regardless of the terms used to refer to a quality program, the objective should be to provide improved quality of service to the customer. Organizations planning to implement TQM programs must understand its basic concepts and make proper arrangements to convey their objectives to everyone in the organization before attempting to launch quality efforts.

As discussed in Chapter IV, TQM strategies are correlated and to make these strategies effective, management must create an environment to educate every individual about the whole concept of TQM. This allows employees to understand the new concept and facilitates in implementing quality improvement programs to fulfill the organization's objectives towards serving the customer with improved quality of service.

As discussed in Chapter IV, the statistics results of T-TEST (Table 6) and descriptive variable analysis (Table 8) support the alternative hypothesis which states that, there is a significant difference between means of before TQM strategies implementation and after TQM strategies implementation, $H_a: \mu_{\text{After TQM}} = \mu_{\text{Before TQM}}$. As this meets the alternative hypothesis criterion, H_a was accepted and the

null hypothesis H_0 was rejected.

Recommendations for Further Research

Research needs to be conducted into how to identify the outcome indicators within the healthcare organization. Once identified, efforts to collect and perform further analysis on those indicators must be carried out. Special attention needs to be focused on arriving at an acceptable definition of measures and understanding the relationship between quality and processes to accomplish the outcome indicators.

Research also needs to be conducted into test the relationship between quality improvement strategies and the outcome indicators identified for this research. This research is necessary because people involved in quality improvement efforts need to understand the significant level of relationship between the outcome measures and quality improvement strategies.

Healthcare organizations have a responsibility to provide the best quality of service possible to the customer with the effective utilization of the available resources.

APPENDICES

Appendix A
Cover Letters

Dear Quality Assurance Director,

Your cooperation is requested in gathering data for educational purposes, a Master's thesis on "Total Quality Management (TQM) Effectiveness in Healthcare Organizations". The purpose of this study is to understand how TQM strategies can be applied in hospitals and get insight into the bottlenecks faced by these organizations in quality improvement initiatives.

Some hospitals have a separate TQM office or department that includes the managerial, administrative, and clinical aspects of hospital operations; if your hospital has such an office or team would you please pass a copy of this questionnaire to them (their input would be very important in obtaining an accurate picture of ongoing efforts in the area of total quality management).

The data will be held in strict confidence. Any information collected will be used strictly for purpose of this study and will not be provided to anyone not involved with the research. Only aggregate and summarized information will be reported. When the questionnaire is completed please put it into the pre-addressed envelope. These return envelopes have been coded only for the follow-up process.

If you have any questions or comments concerning the questionnaire or it's use, please feel free to call me (616-387-7558) or Dr. Liwana Bringelson (616-387-3742), my thesis advisor.

Thank you for your help with this project.

Lokesh S. Basappa
Department of Industrial Engineering
Western Michigan University
Kalamazoo, MI 49008-5061

Dear Quality Assurance Director,

This survey material was sent to you during October 1993. Unfortunately I haven't received a reply. Would you please consider filling out this questionnaire, and returning it to me as soon as possible?. An explanation of the study and phone numbers where you may direct questions are listed below.

Your cooperation is requested in gathering data for educational purposes, a Master's thesis on "Total Quality Management (TQM) Effectiveness in Healthcare Organizations". The purpose of this study is to understand how TQM strategies can be applied in hospitals and get insight into the bottlenecks faced by these organizations in quality improvement initiatives.

Some hospitals have a separate TQM office or department that includes the managerial, administrative, and clinical aspects of hospital operations; if your hospital has such an office or team would you please pass a copy of this questionnaire to them (their input would be very important in obtaining an accurate picture of ongoing efforts in the area of total quality management).

The data will be held in strict confidence. Any information collected will be used strictly for purpose of this study and will not be provided to anyone not involved with the research. Only aggregate and summarized information will be reported. When the questionnaire is completed please put it into the pre-addressed envelope. These return envelopes have been coded only for the follow-up process.

If you have any questions or comments concerning the questionnaire or it's use, please feel free to call me (616-387-7558) or Dr. Liwana Bringelson (616-387-3742), my thesis advisor.

Thank you for your help with this project.

Lokesh S. Basappa
Department of Industrial Engineering
Western Michigan University
Kalamazoo, MI 49008-5061

Appendix B
Survey Questionnaire

Total Quality Management Effectiveness In Hospitals Questionnaire

Your Position/ Title:

The following questions deal with basic descriptive information about your hospital, please answer them as accurately as possible.

	Yes	No	If Yes, When
Have you formally implemented TQM	-----	-----	-----
1. Average length of stay (days)	-----		
2. Employee turn over (percentage)	-----		
3. Average cost per case (\$/case)	-----		

For the following questions please indicate your experience with quality strategies **before implementing TQM** (with a check mark), using the seven point scale: Very low (VL), Average (A), Very high (VH).

	VL	A	VH
1. Employee trained in TQM concept	--- --- --- --- --- --- ---		
2. Ability to define outcome indicators	--- --- --- --- --- --- ---		
3. Assessment of patient requirements	--- --- --- --- --- --- ---		
4. Efficient staff/supplies utilization	--- --- --- --- --- --- ---		
5. Utilization of employee suggestion system	--- --- --- --- --- --- ---		
6. Implementation of employee suggestions	--- --- --- --- --- --- ---		
7. Effective staff meetings	--- --- --- --- --- --- ---		
8. Responding to employee opinion surveys	--- --- --- --- --- --- ---		
9. Meeting patients' needs	--- --- --- --- --- --- ---		
10. Communication among departments	--- --- --- --- --- --- ---		
11. Awareness of JCAHO 10-steps	--- --- --- --- --- --- ---		
12. Sharing information with other hospitals	--- --- --- --- --- --- ---		
13. Vendor involvement in the quality process	--- --- --- --- --- --- ---		
14. Level of employee turnover	--- --- --- --- --- --- ---		
15. Cost per discharge	--- --- --- --- --- --- ---		
16. Number of cases forwarded to Risk Management	--- --- --- --- --- --- ---		

Total Quality Management Effectiveness In Hospitals Questionnaire

For the following questions please indicate your experience with quality strategies **after implementing TQM** (with a check mark), using the seven point scale: Very low (VL), Average (A), Very high (VH).

	VL	A	VH
1a. Employee trained in TQM concept	--- --- --- --- --- ---		
2a. Ability to define outcome indicators	--- --- --- --- --- ---		
3a. Assessment of patient requirements	--- --- --- --- --- ---		
4a. Efficient staff/supplies utilization	--- --- --- --- --- ---		
5a. Utilization of employee suggestion system	--- --- --- --- --- ---		
6a. Implementation of employee suggestions	--- --- --- --- --- ---		
7a. Effective staff meetings	--- --- --- --- --- ---		
8a. Responding to employee opinion surveys	--- --- --- --- --- ---		
9a. Meeting patients' needs	--- --- --- --- --- ---		
10a. Communication among departments	--- --- --- --- --- ---		
11a. Awareness of JCAHO 10-steps	--- --- --- --- --- ---		
12a. Sharing information with other hospitals	--- --- --- --- --- ---		
13a. Vendor involvement in the quality process	--- --- --- --- --- ---		
14a. Level of employee turnover	--- --- --- --- --- ---		
15a. Cost per discharge	--- --- --- --- --- ---		
16a. Number of cases forwarded to Risk Management	--- --- --- --- --- ---		

Appendix C
SPSS Program Code Book

Column 01:	Hospital Number		
Column 02:	Question : Q1		
Column 03:	Question : Q2		
Column 04:	Question : Q3		
Column 05:	Question : Q4		
Column 06:	Question : Q5		
Column 07:	Question : Q6		
Column 08:	Question : Q7		
Column 09:	Question : Q8		
Column 10:	Question : Q9		
Column 11:	Question : Q10		
Column 12:	Question : Q11		
Column 13:	Question : Q12		
Column 14:	Question : Q13		
Column 15:	Question : Q14		
Column 16:	Question : Q15		
Column 17:	Question : Q16		
Column 18:	Question : Q1a		
Column 19:	Question : Q2a		
Column 20:	Question : Q3a		
Column 21:	Question : Q4a		
Column 22:	Question : Q5a		
Column 23:	Question : Q6a		
Column 24:	Question : Q7a		
Column 25:	Question : Q8a		
Column 26:	Question : Q9a		
Column 27:	Question : Q10a		
Column 28:	Question : Q11a		
Column 29:	Question : Q12a		
Column 30:	Question : Q13a		
Column 31:	Question : Q14a		
Column 32:	Question : Q15a		
Column 33:	Question : Q16a		
Column 34:	Descriptive Information D1:	Have you Formally Implemented TQM? "Yes 1 and No 2"	
Column 35:	Descriptive Information D2:	Average Length of Stay (Days)	
Column 36:	Descriptive Information D3:	Employee Turnover (%)	
Column 37:	Descriptive Information D4:	Cost per Case (\$/Case)	

Appendix D
Questionnaire Data

01	1	4	4	1	1	1	3	1	2	2	5	2	2	4	3	4
02	1	4	4	3	3	3	4	2	4	5	4	2	2	4	4	3
03	1	1	1	1	1	1	3	1	3	1	1	1	1	3	0	2
04	7	7	7	1	4	6	4	6	7	4	7	4	2	4	4	2
05	7	4	5	6	4	4	3	3	6	3	4	5	1	1	4	2
06	0	1	3	2	4	4	3	4	4	3	5	4	2	2	4	4
07	5	5	3	2	3	3	5	5	6	4	7	5	2	0	7	4
08	0	4	7	5	3	4	5	4	6	5	6	2	1	6	6	0
09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	7	7	7	7	7	7	4	4	4	4	7	4	7	4	0	1
11	1	4	6	6	3	4	4	4	6	6	2	5	3	4	5	4
12	1	1	6	5	5	4	4	6	4	4	4	4	4	4	4	4
13	2	4	6	5	3	3	3	3	5	4	6	5	4	5	4	2
14	1	3	4	4	1	1	4	3	4	4	5	4	1	4	0	4
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	5	4	5	4	5	5	4	5	5	2	1	2	2	6	4	4
17	1	6	4	3	5	4	4	4	4	4	6	4	1	6	5	4
18	2	6	5	3	1	1	2	1	4	3	5	4	2	7	7	5
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	4	4	4	4	1	1	3	2	4	2	6	5	1	4	0	4
21	1	2	2	3	3	3	2	6	4	4	1	4	2	6	4	2
22	1	4	6	4	4	4	4	3	6	4	4	2	1	6	6	2
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	2	4	3	3	1	1	3	1	6	3	6	5	2	5	5	1
26	3	7	7	4	3	2	4	4	7	4	7	6	2	4	4	4
27	1	4	4	2	4	4	4	2	3	3	7	1	1	1	2	2
28	1	4	5	6	2	2	1	2	5	2	7	4	1	4	0	4
29	6	5	5	4	3	4	5	5	5	3	6	3	3	4	3	4
30	1	1	6	6	1	1	1	4	4	2	7	1	1	7	0	0
31	1	4	4	4	4	4	4	4	6	6	4	4	7	7	4	4
32	4	5	5	4	3	3	5	3	5	3	7	4	3	4	4	4
33	0	7	4	3	4	3	7	3	4	2	3	2	1	4	4	4
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	2	5	5	4	3	3	6	3	5	4	6	3	2	4	4	5
36	3	3	5	5	4	3	4	3	5	3	0	4	4	4	4	4
37	2	4	4	2	1	1	2	1	5	3	6	1	1	7	4	2
38	1	2	0	4	4	4	4	4	5	2	4	3	4	4	0	3
39	2	4	3	4	1	1	3	1	5	4	4	4	3	7	0	2
40	1	4	5	4	4	4	4	4	6	4	4	2	2	5	5	3
41	6	7	3	6	6	6	6	6	3	4	1	3	6	6	6	1
42	4	5	4	4	4	5	4	4	4	3	3	4	3	4	6	3
43	1	3	5	4	4	3	3	2	5	4	4	3	1	4	4	4
44	2	7	7	3	7	6	4	5	6	5	7	4	1	5	4	1
45	5	6	4	4	2	2	4	2	4	5	7	4	4	4	4	4
46	2	1	6	3	3	2	3	1	5	3	3	4	2	4	1	3
47	2	4	5	4	6	6	5	2	6	4	7	1	3	7	0	3
48	2	5	3	4	3	4	4	3	5	4	6	5	2	3	3	4
49	1	4	5	3	3	3	3	4	5	4	5	5	3	4	6	4
50	1	2	1	4	3	4	3	1	5	3	4	4	1	6	0	1

01	6	5	5	4	3	3	3	3	4	4	5	5	6	4	5	3
02	3	5	7	6	7	6	6	6	7	6	7	7	6	7	6	2
03	2	5	5	4	5	4	4	2	4	4	4	5	4	3	0	4
04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05	7	5	5	6	5	5	4	5	6	5	4	5	2	7	4	2
06	4	2	4	4	2	2	5	3	4	5	4	5	3	3	4	4
07	7	6	5	7	6	6	5	6	6	6	7	6	3	0	6	4
08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	7	7	7	7	7	7	4	4	4	4	7	4	7	4	0	1
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	3	4	6	5	5	5	5	5	6	5	5	4	4	4	4	4
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	6	5	5	4	4	4	5	5	5	5	5	5	2	4	0	4
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	5	4	5	4	6	6	4	6	6	3	1	2	2	6	4	4
17	7	5	7	5	7	5	5	6	7	5	6	7	4	7	0	4
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	5	4	5	4	5	5	4	3	5	5	7	5	1	0	0	5
21	6	6	6	4	4	5	5	4	5	5	2	4	2	6	4	2
22	4	4	6	6	6	6	6	6	6	5	5	4	3	6	0	3
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	7	6	5	5	4	4	4	5	6	5	7	6	5	6	5	1
26	5	7	7	4	5	5	5	5	7	5	7	7	3	4	4	3
27	7	7	7	5	7	7	6	6	6	6	7	7	7	6	4	2
28	5	4	6	7	2	2	4	2	6	4	7	3	1	0	0	0
29	6	6	5	4	5	5	5	4	5	3	6	2	3	4	3	4
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	6	7	5	5	6	5	6	6	5	5	7	7	6	3	3	4
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	5	5	5	5	3	3	4	5	4	5	6	5	4	4	4	6
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	7	6	6	6	6	6	6	6	6	7	6	6	4	6	4	5
41	6	6	4	7	7	7	7	7	4	7	3	6	7	7	7	1
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	7	4	5	4	5	6	5	6	4	4	3	5	2	4	4	5
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	6	6	5	4	4	5	6	5	5	6	7	5	5	3	3	5
46	5	4	7	3	3	2	3	1	5	4	4	4	3	4	2	4
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	5	6	5	5	4	4	6	3	6	5	6	6	3	6	5	4
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	5	3	4	4	5	4	3	1	5	4	4	4	2	6	0	1

01	1	4.6	20	4204
02	1	10	7.6	7200
03	1	0	5	0
04	2	0	0	0
05	1	3.7	0	0
06	1	10	5	0
07	1	5.4	0	0
08	2	0	0	0
09	2	5.2	7.3	984.2
10	1	0	0	0
11	2	0	0	0
12	1	3.8	0	2775
13	2	0	0	0
14	1	7.6	8.5	10046
15	2	0	0	0
16	1	0	0	0
17	1	0	0	0
18	2	0	0	0
19	2	0	0	0
20	1	0	0	0
21	1	0	0	0
22	1	0	0	0
23	2	0	0	0
24	2	0	0	0
25	1	5.4	0	0
26	1	3.3	15	5150
27	1	10	0	0
28	1	5.2	15	0
29	1	5	0	4750
30	2	4.6	0	5054
31	2	0	0	984.2
32	1	4.3	0	0
33	2	0	0	0
34	2	0	0	0
35	1	8	10	5640
36	2	0	0	0
37	2	0	0	0
38	2	0	0	0
39	2	0	0	0
40	1	3.8	6	4400
41	1	7	0	0
42	2	0	0	0
43	1	4.6	0	0
44	2	0	0	0
45	1	0	0	0
46	1	5.5	0	0
47	2	0	0	0
48	1	5.6	0	5124
49	2	0	0	4000
50	1	0	10	0

Appendix E
Weighted Score Analysis Program

```

DATA LIST FILE = "TQM.DAT" / Hospital 1-4 (A) Q1 6 Q2 8 Q3 10 Q4 12 Q5 14
Q6 16 Q7 18 Q8 20 Q9 22 Q10 24 Q11 26 Q12 28 Q13 30 Q14 32 Q15 34 Q16 36
Q1a 38 Q2a 40 Q3a 42 Q4a 44 Q5a 46 Q6a 48 Q7a 50 Q8a 52 Q9a 54 Q10a 56
Q11a 58 Q12a 60 Q13a 62 Q14a 64 Q15a 66 Q16a 68 D1 70 D2 72-75 D3 77-80
D4 82-86
COMPUTE W1= Q1 * 5
COMPUTE W2= Q2 * 10
COMPUTE W3= Q3 * 10
COMPUTE W4= Q4 * 5
COMPUTE W5= Q5 * 10
COMPUTE W6= Q6 * 10
COMPUTE W7= Q7 * 5
COMPUTE W8= Q8 * 7.5
COMPUTE W9= Q9 * 7.5
COMPUTE W10= Q10 * 10
COMPUTE W11= Q11 * 2.5
COMPUTE W12= Q12 * 2.5
COMPUTE W13= Q13 * 10
COMPUTE W14= Q14 * 10
COMPUTE W15= Q15 * 5
COMPUTE W16= Q16 * 5
COMPUTE W1a= Q1a * 5
COMPUTE W2a= Q2a * 10
COMPUTE W3a= Q3a * 10
COMPUTE W4a= Q4a * 5
COMPUTE W5a= Q5a * 10
COMPUTE W6a= Q6a * 10
COMPUTE W7a= Q7a * 5
COMPUTE W8a= Q8a * 7.5
COMPUTE W9a= Q9a * 7.5
COMPUTE W10a= Q10a * 10
COMPUTE W11a= Q11a * 2.5
COMPUTE W12a= Q12a * 2.5
COMPUTE W13a= Q13a * 10
COMPUTE W14a= Q14a * 10
COMPUTE W15a= Q15a * 5
COMPUTE W16a= Q16a * 5
SELECT IF (D1 = 1)
COMPUTE HOS1 = SUM (W1 TO W16)
LIST HOSPITAL HOS1
COMPUTE HOS1a = SUM (W1a TO W16a)
LIST HOSPITAL HOS1a
MISSING VALUES Q1 TO D4 (0)

```

Appendix F
Factor Analysis Program

```
DATA LIST FILE = "TQM.DAT" / Hospital 1-4 (A) Q1 6 Q2 8 Q3 10
      Q4 12 Q5 14 Q6 16 Q7 18 Q8 20 Q9 22 Q10 24 Q11 26 Q12 28
      Q13 30 Q14 32 Q15 34 Q16 36
FACTOR VARIABLES = Q1 TO Q16 / ROTATION
/MISSING = PAIRWISE
```

Appendix G
Correlation Analysis Program
for Selected Variables

```

DATA LIST FILE = "TQM.DAT" / Hospital 1-4 (A) Q1 6 Q2 8 Q3 10 Q4 12 Q5 14
Q6 16 Q7 18 Q8 20 Q9 22 Q10 24 Q11 26 Q12 28 Q13 30 Q14 32 Q15 34 Q16 36
Q1a 38 Q2a 40 Q3a 42 Q4a 44 Q5a 46 Q6a 48 Q7a 50 Q8a 52 Q9a 54 Q10a 56
Q11a 58 Q12a 60 Q13a 62 Q14a 64 Q15a 66 Q16a 68 D1 70 D2 72-75 D3 77-80
D4 82-86
SELECT IF (D1=1)
CORRELATIONS VARIABLES = Q1 WITH Q2 Q3 Q5 Q6 Q7 Q9 Q10 Q11 Q13 Q15 Q16
/STATISTICS = ALL
/PRINT = TWO TAIL SIG
CORRELATIONS VARIABLES = Q2 WITH Q3 Q5 Q6 Q7 Q9 Q10 Q11 Q13 Q15 Q16
/STATISTICS = ALL
/PRINT = TWO TAIL SIG
CORRELATIONS VARIABLES = Q3 WITH Q5 Q6 Q7 Q9 Q10 Q11 Q13 Q15 Q16
/STATISTICS = ALL
/PRINT = TWO TAIL SIG
CORRELATIONS VARIABLES = Q5 WITH Q6 Q7 Q9 Q10 Q11 Q13 Q15 Q16
/STATISTICS = ALL
/PRINT = TWO TAIL SIG
CORRELATIONS VARIABLES = Q6 WITH Q7 Q9 Q10 Q11 Q13 Q15 Q16
/STATISTICS = ALL
/PRINT = TWO TAIL SIG
CORRELATIONS VARIABLES = Q7 WITH Q9 Q10 Q11 Q13 Q15 Q16
/STATISTICS = ALL
/PRINT = TWO TAIL SIG
CORRELATIONS VARIABLES = Q9 WITH Q10 Q11 Q13 Q15 Q16
/STATISTICS = ALL
/PRINT = TWO TAIL SIG
CORRELATIONS VARIABLES = Q10 WITH Q11 Q13 Q15 Q16
/STATISTICS = ALL
/PRINT = TWO TAIL SIG
CORRELATIONS VARIABLES = Q11 WITH Q13 Q15 Q16
/STATISTICS = ALL
/PRINT = TWO TAIL SIG
CORRELATIONS VARIABLES = Q13 WITH Q15 Q16
/STATISTICS = ALL
/PRINT = TWO TAIL SIG
CORRELATIONS VARIABLES = Q15 WITH Q16
/STATISTICS = ALL
/PRINT = TWO TAIL SIG

```

Appendix H
Descriptive Analysis Program

DATA LIST FILE = "TQM.DAT" / Hospital 1-4 (A) Q1 6 Q2 8 Q3 10
Q4 12 Q5 14 Q6 16 Q7 18 Q8 20 Q9 22 Q10 24 Q11 26 Q12 28
Q13 30 Q14 32 Q15 34 Q16 36 Q1a 38 Q2a 40 Q3a 42 Q4a 44
Q5a 46 Q6a 48 Q7a 50 Q8a 52 Q9a 54 Q10a 56 Q11a 58 Q12a
60 Q13a 62 Q14a 64 Q15a 66 Q16a 68 D1 70 D2 72-75 D3 77-80
D4 82-86

MISSING VALUE Q1 TO D4 (0)

DESCRIPTIVE VARIABLES = Q1 TO Q16

SELECT IF (D1=1)

DESCRIPTIVE VARIABLES = Q1a TO Q16a

Appendix I
T-TEST Analysis Program

DATA LIST FILE = "TQM.DAT" / Hospital 1-4 (A) Q1 6 Q2 8 Q3 10
Q4 12 Q5 14 Q6 16 Q7 18 Q8 20 Q9 22 Q10 24 Q11 26 Q12 28
Q13 30 Q14 32 Q15 34 Q16 36 Q1a 38 Q2a 40 Q3a 42 Q4a 44
Q5a 46 Q6a 48 Q7a 50 Q8a 52 Q9a 54 Q10a 56 Q11a 58 Q12a
60 Q13a 62 Q14a 64 Q15a 66 Q16a 68 D1 70 D2 72-75 D3 77-80
D4 82-86

MISSING VALUE Q1 TO D4 (0)

TTEST PAIRS = Q1 TO Q16a (PAIRED)

Appendix J

Correlation Analysis of TQM Strategies and Outcome Indicators

DATA LIST FILE = "TQM.DAT" / Hospital 1-4 (A) Q1 6 Q2 8 Q3 10
Q4 12 Q5 14 Q6 16 Q7 18 Q8 20 Q9 22 Q10 24 Q11 26
Q12 28 Q13 30 Q14 32 Q15 34 Q16 36 Q1a 38 Q2a 40 Q3a 42
Q4a 44 Q5a 46 Q6a 48 Q7a 50 Q8a 52 Q9a 54 Q10a 56 Q11a 58
Q12a 60 Q13a 62 Q14a 64 Q15a 66 Q16a 68 D1 70 D2 72-75 D3
77-80 D4 82-86

SELECT IF (D1 = 1)

CORRELATIONS VARIABLES = Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 WITH D2 D3

/STATISTICS = ALL

/PRINT = TWO TAIL SIG

CORRELATIONS VARIABLES = Q9 Q10 Q11 Q12 Q13 WITH D2 D3

/STATISTICS = ALL

/PRINT = TWO TAIL SIG

CORRELATIONS VARIABLES = Q14 Q15 Q16 WITH D2 D3

/STATISTICS = ALL

/PRINT = TWO TAIL SIG

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