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Total quality index: a benchmarking tool for total quality management

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Abstract *The total quality index (TQI) proposed in this study is an information technology-supported benchmarking tool that helps managers assess a total quality management program by enabling the cost-effective measurement of key organizational processes. TQI utilizes the analytic hierarchy process and the Delphi technique to measure ideal and actual quality management along eight critical factors synthesized by Saraph* et al. *and supported by subsequent research. A study utilizing TQI was conducted to evaluate the progress of quality management in clinical and non-clinical settings. Eight clinical and six non-clinical departments were selected from four different hospitals to participate in this study. The results show that, contrary to the common beliefs, there is little difference in the actual and ideal scores on the eight critical factors between the clinical and non-clinical settings.*

Introduction

Initially developed in manufacturing, total quality management (TQM) has become a widespread movement in health care (Burda, 1988). As the economy became increasingly service oriented, issues of quality and productivity began to spread to the service sector. However, the productivity of service workers has not kept pace with the increasing investment in technology in this sector (Roach, 1991). Also, global competition and deregulation potentially threaten the future of service organizations (Orr *et al.*, 2001). As a result, organizations in this sector have turned to TQM for tools to help them to be competitive. Several issues including the need to contain rising costs, the growth of for-profit health care, and advances in medical information systems have contributed to the rapid adoption of TQM in health care (Berwick, 1989; Brashier *et al.*, 1996).

Health maintenance organizations (HMOs) were among the first health care organizations to join the total quality management movement (Berwick, 1987).

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The HMOs' adoption of TQM was driven primarily by cost containment because they operate on a fixed fee basis. These programs focused on measuring quality, but not improving it. They experimented with non-traditional forms of measurement and unrestricted access to information and records. Although these early forms of quality management did not look like TQM, they incorporated some of the essential principles, such as being data driven and focusing on processes rather than on individuals. However, these early attempts at quality management programs did provide a foundation for the acceptance of other models including TQM and benchmarking.

There have been many successful applications of manufacturing techniques in health care (Albert *et al.*, 1990; Berwick, 1991; Buterbaugh, 1992), and the health care industry has adopted the quality models for manufacturing (Burda, 1988). Furthermore, the Joint Commission on Accreditation of Healthcare Organizations has encouraged the implementation of quality improvement programs for all health care organizations. However, the basic question is "Can the tools of modern quality improvement, with which other industries have achieved breakthroughs in performance, help in health care as well?" (Berwick *et al.*, 1990).

Recently, there has been a growing body of work critically examining the usefulness of TQM in health care. The industry had difficulties when applying TQM programs from other sectors. Some problems are encountered in viewing the patient as a client. An objective of TQM is meeting customer needs. Typically, patients do not know what is best for them medically. Should health care providers give patients what they want or what they need? There is also a clash between the organizational models of TQM and health care. Many hospital workers are members of professional groups. Reporting lines are complex and not always direct. For example, physicians often are not employees of a hospital, and they answer to a medical board that is separate from the administrative staff. Furthermore, physicians may be reluctant to participate in a TQM program because of their training. Fried (1992) explains how physicians are not trained to be team players as TQM encourages. They are trained to make decisions independently and rely on their own judgment. Also, there is skepticism about TQM because of its perceived relationship to quality assurance. Quality assurance is seen as regulation imposed from outside with its bad apple approach to quality assessment causing distrust (Fried, 1992). Brashier *et al.* (1996) observed "Many resent the fact that 'outsiders' are trying to tell them how to do their jobs. They are not factory workers . . . and cannot be managed as such."

There is also the perception that TQM is becoming a fad in health care management. The area has become fragmented with consultants emphasizing those areas that represent their own strengths. There are a number of "poorly trained consultants in the market selling programs with little chance of working" (Burda, 1991). In addition, the cost-effectiveness of these programs is an issue because significant amounts are invested in training and consultants while specific problems are not being addressed.

The model and its objectives

There is a large body of literature on multi-criteria modeling and problem solving using gap analysis. Pounds (1969) gave a general description of a problem situation as a difference between some existing situation and some desired situation. Most descriptions or definitions begin with a difference or gap between the present situation and the desired situation (Bartee, 1973; MacCrimmon and Taylor, 1976; Reitman, 1964) called the ideal situation in this study. In terms of organizations, Cyert and March (1963) describe a problem as a difference between actual performance and ideal performance. Here, the problem gap is one involving differences between actual and ideal performance measures. For Kiesler and Sproull (1982), a manager's recognition of a problem involves a comparison of environmental stimuli with internal aspiration criteria.

Quality management involves the recognition of such a gap. This gap is the discrepancy between the signals that managers receive from the environment on various aspects of the quality management process and their own idea of what the process should be. Benson *et al.* (1991) have used the phrases actual quality management and ideal quality management to describe these two states of quality management. Ideal quality management is described as a business unit manager's beliefs concerning what quality management should be in the business unit, while actual quality management is described as the manager's perceptions of the current practice of quality management in the unit (Benson *et al.*, 1991).

There are two generally accepted behavioral approaches to quality management. First, Deming's (1982) Theory D offers 14 managerial prescriptions and proscriptions describing general ways that managers should act and what they should do to improve individual and team performance, job organization, and managing external groups. Second, the less popular organizational behavior modification (O.B.Mod.) approach (Luthans and Kreitner, 1985) is a behavioral approach to performance improvement grounded in the work of Skinner (1938, 1966). While both approaches share the same end, the difference between them is their level of specificity (Redmon and Dickinson, 1987). Theory D is more of an organization-wide approach to cultural changes, while O.B.Mod. focuses on altering simple behaviors of individuals within organizations. Recently, there have been efforts to merge the two approaches by extending the O.B.Mod. approach with social learning theory (Luthans and Thompson, 1987). This adds the recognition of cognitive processes to the operant processes of O.B.Mod. When this is done, there are no major differences between the two approaches. However, a criticism has been that neither approach is sufficiently specific for managers to operationalize (Luthans and Thompson, 1987). Forker and Mendez (2001) note that the collapse of many quality management programs hinged on breakdowns in execution.

Benchmarking is an effective vehicle for focusing continuous improvement on the basic processes that run an organization (Bhutta and Huq, 1999; Prado, 2001; Simpson and Kondouli, 2000). It consists of investigating processes and practices that are employed, and establishing metrics for assessing an organization's performance (Camp, 1989). Furthermore, the benchmarking approach can be adapted to accommodate assessment input from health care professionals, including doctors, and minimize resistance and pushback. The utilization of information technology reduces the time and effort required to participate in the assessment process, enhancing the likelihood of participation of other-directed health care professionals. What are needed are theoretical and methodological structures for the analysis (Bhutta and Huq, 1999; Forker and Mendez, 2001; Kumar *et al.*, 1999).

Saraph *et al.* (1989) synthesized critical areas of organizational quality management and sets of specific requirements for each of the eight critical factors. They have also proposed a questionnaire, presented in the Appendix, that can be used to evaluate actual and ideal quality management with the sets of requirements as operational measures of the critical factors. The questionnaire was developed for evaluating quality management in either manufacturing or service organizations. Empirical tests showed the measures to be both reliable and valid. Subsequent research has supported the content validity of the instrument (Kumar *et al.*, 1999). An inherent advantage of the Saraph *et al.*, Benson and Schroeder questionnaire is that it minimizes the time and cost for developing the concepts and operational measures essential for the benchmarking approach to TQM.

This research develops and applies an IT-supported benchmarking model that helps managers assess a quality management program by enabling the cost-effective measurement of critical organizational processes. The model utilizes AHP and Delphi to measure both actual and ideal quality management along the eight critical success factors synthesized by Saraph *et al.* (1989).

To formulate the algebraic model, assume:

- F_i The importance weight of a quality management critical factor (for $i = 1, \ldots, 8$).
- f_{ij} The importance weight of an item associated with a quality management critical factor (for $i = 1, \ldots, 8$; and $j = 1, \ldots, k_i$).
- R^*_{ij} The ideal rating of an item associated with critical factor (for $i = 1, \ldots, 8$; and $j = 1, \ldots, k_i$).
- R^t_{ij} The actual rating of an item associated with a critical factor for a given time period (for $i = 1, \ldots, 8$; $j = 1, \ldots, k_i$; and $t = 1, \ldots, n$).

TQI* The ideal total quality index.

TQI^t The actual total quality index for a given time period.

d^t The gap between the ideal and actual total quality index for a given time period.

K_i The number of items within each quality management critical factor.

n The number of time periods where the total quality index is measured.

The objective of the model is to:

$$\text{Minimize } d^t = TQI^* - TQI^t \tag{1}$$

where:

$$TQI^* = \sum_{i=1}^{8} F_i \left(\sum_{j=1}^{K_i} f_{ij} R^*_{ij} \right) \tag{2}$$

$$TQI^t = \sum_{i=1}^{8} F_i \left(\sum_{j=1}^{K_i} f_{ij} R^t_{ij} \right) \tag{3}$$

and

$$\sum_{i=1}^{8} F_i = 1, \quad \sum_{j=1}^{K_i} f_{ij} = 1, \quad 1 \le R^*_{ij} \le 5, \quad 1 \le R^t_{ij} \le 5$$

Both F_i and f_{ij} are developed with the analytic hierarchy process (AHP). AHP was introduced by Saaty (1972) to assist DMs in the evaluation of complex judgmental problems. The department managers in this study used AHP to assign numerical values to the eight quality management critical factors (F_i) and the sub-factors (f_{ij}) suggested by Saraph *et al.* (1989). The process was confined to a series of pairwise comparisons. Saaty (1972) argues that a manager naturally finds it easier to compare two things than to compare all the items in a list. AHP also evaluates the consistency of the managers and allows for the revision of their responses. Because of the intuitive nature of the process and its power in resolving the complexity in a judgmental problem, AHP has been applied to many diverse decisions. In particular, AHP has been a very popular technique for determining weights in multi-criteria problems (Shim, 1989; Zahedi, 1986). A comprehensive list of the major applications of AHP, along with a description of the method and its axioms, can be found in the works of Saaty (1972, 1977a, b, 1980, 1990, 1994, 1999), Weiss and Rao (1987) and Zahedi (1986).

There has been some criticism of AHP in the operations research community. In response, Harker and Vargas (1990) show that AHP has an axiomatic foundation, the cardinal measurement of preferences is fully represented by the eigenvector method, and the principles of hierarchical composition and rank reversal are valid. On the other hand, Dyer (1990a) has questioned the theoretical basis underlying AHP and argues that it can lead to preference reversals based on the alternative set being analyzed. Saaty (1990) explains how rank reversal is a positive feature when new reference points are introduced. In this study, the geometric aggregation rule was used to avoid rank reversal, which had varying degrees of importance to different researchers (Dyer, 1990a, b; Harker and Vargas, 1990; Saaty, 1990).

Assuming manager i believes that $c_1, c_2, \ldots, c_I$ are the I factors that contribute to the overall quality management program, the manager's next task is to assess the relative importance of these factors with AHP by comparing each possible pair of factors c_j, c_k and indicating which factor is more important and by how much.

These judgments are represented by an $I \times I$ matrix:

$$A = (a_{jk}) \quad (j, k = 1, 2, \ldots, I)$$

If c_j is judged to be of equal importance as c_k, then $a_{jk} = 1$.
If c_j is judged to be more important than c_k, then $a_{jk} > 1$.
If c_j is judged to be less important than c_k, then $a_{jk} < 1$.

$$a_{jk} = 1/a_{kj} \quad a_{jk} \neq 0$$

Thus, matrix A is a reciprocal matrix so that the entry a_{jk} is the inverse of the entry a_{kj}. a_{jk} reflects the relative importance of c_j compared with factor c_k. For example, $a_{12} = 1.50$ indicates that c_1 is 1.50 times as important as c_2.

The vector w representing the relative weights of each of the I factors was found by computing the normalized eigenvector corresponding to the maximum eigenvalue of matrix A. An eigenvalue of A is defined as λ which satisfies the following matrix equation:

$$Aw = \lambda w$$

where λ is a constant, called the eigenvalue, associated with the given eigenvector w. Saaty has shown that the best estimate of w is the one associated with the maximum eigenvalue (λ_{max}) of the matrix A. Because the sum of the weights should be equal to 1.00, the normalized eigenvector is used. Saaty's algorithm for obtaining this w is incorporated in the software Expert Choice (2000) utilized in this study.

One of the advantages of AHP is that it assesses the consistency of the manager's pairwise comparisons. When the judgments are perfectly consistent, the maximum eigenvalue (λ_{max}) should equal the number of factors that are compared (I). Typically, the responses are not perfectly consistent, and λ_{max} is greater than I. The larger the λ_{max}, the greater is the degree of inconsistency. Saaty defines a consistency index (CI) as $(\lambda_{max} - I)/(I - 1)$ and provides a random index (RI) table for matrices of order 3-10. This RI is based on a simulation of a large number of randomly generated weights (Table I).

Saaty recommends the calculation of a consistency ratio (CR) that is the ratio of CI to RI for the same order matrix. A CR of 0.10 or less is considered acceptable. Each manager used Expert Choice (2000), an AHP-based software, individually to perform all necessary calculations. When the CR was unacceptable, the manager was informed that the pairwise comparisons were logically inconsistent and was asked to revise his/her Expert Choice judgments.

Numerical example

Table II provides a numerical example illustrating the calculation of the components of the measures used in this study. The illustration assumes that there are three critical quality management factors (F_1, F_2, and F_3); four items (f_{11}, f_{12}, f_{13}, and f_{14}) associated with F_1; three items (f_{21}, f_{22}, and f_{23}) associated with F_2; and four items (f_{31}, f_{32}, f_{33}, and f_{34}) associated with F_3. Assume that the decision maker (DM) has assigned the importance weights of 0.50, 0.30, and 0.20 to F_1, F_2, and F_3, respectively, using AHP and Expert Choice. Furthermore, the DM has assigned the following importance weights to the items: 0.40, 0.30, 0.20, and 0.10 to f_{11} through f_{14}; 0.60, 0.30, and 0.10 to f_{21} through f_{23}; and 0.50, 0.20, 0.20, and 0.10 to f_{31} through f_{34} using AHP as well. Next, assume for this illustration that the DM used the scale proposed by Saraph *et al.* (1989) to rate both the ideal quality and the actual quality management of the eight critical factors. Table II shows the calculations of the TQI* for the current period $(t = 1)$.

The TQI* of 5.00 and the TQI^1 of 2.64 in Table II are summary figures for all the critical factors and do not specify whether the gap is unacceptably large or acceptably small. The total quality index for each critical factor (TQI_i) gives managers more information about the quality management process in each of the critical areas. For example, health care organizations may experience coordination problems between the quality department, typically an administrative function, and other departments such as the pathology lab or the intensive care units. These departments generally have their own hierarchy within the medical staff and do not report directly to administration. This problem could be identified in the model by a relatively significant gap between the actual TQI_2^t and ideal TQI_2^* for critical factor 2 (the role of the quality department) for a given time period. If the gap is unacceptably large, managers

n	3	4	5	6	7	8	9	10
RI	0.58	0.90	1.12	1.32	1.41	1.45	1.49	1.51

Table I. Random index table

Critical factor weights (F_i)	Item weights (f_{ij})	Ideal rating $\left(R_{ij}^*\right)$	Actual rating $\left(R_{ij}^1\right)$	$\left(F_i \cdot f_{ij} \cdot R_{ij}^*\right)$	$\left(F_i \cdot f_{ij} \cdot R_{ij}^1\right)$
F_1= 0.50	f_{11}= 0.40	5	3	1.00	0.60
	f_{12}= 0.30	5	2	0.75	0.30
	f_{13}= 0.20	5	2	0.50	0.20
	f_{14}= 0.10	5	3	0.25	0.15
				$TQI_1^* = 2.50$	$TQI_1^1 = 1.25$
F_2= 0.30	f_{21}= 0.60	5	4	0.90	0.72
	f_{22}= 0.30	5	2	0.45	0.18
	f_{23}= 0.10	5	3	0.15	0.09
				$TQI_2^* = 1.50$	$TQI_2^1 = 0.99$
F_3= 0.20	f_{31}= 0.50	5	2	0.50	0.20
	f_{32}= 0.20	5	3	0.20	0.12
	f_{33}= 0.20	5	1	0.20	0.04
	f_{34}= 0.10	5	2	0.10	0.04
				$TQI_3^* = 1.00$	$TQI_3^1 = 0.40$
				$TQI^* = 5.00$	$TQI^1 = 2.64$

Table II.
Actual and ideal TQI for an example period

could be prompted either to form some intervention strategies to narrow it or adjust their belief about the ideal rating.

If properly assessed, the intervention would center around one or more of the items associated with the critical factor. In the previous example, a manager could identify the source of the problem as a lack of coordination between the quality department and other departments. Strategies could then be developed that address this specific item. A manager could also conclude that no problems exist with any item, or any that do exist are not as significant as indicated by the measured gap of the factor. This could lead to a change in how the manager believes TQI_i^* should be rated. What causes managers either to develop strategies for intervention or to adjust their ideal rating should be examined over time. Movement over time could reflect interventions made by managers or changes in their ideal TQI. Further investigation into the managers' responses to the feedback they receive from TQI tables, as well as the environment, could then be undertaken to determine what actually has happened.

The study

A study was conducted to investigate the usefulness of the TQI in different health care settings. Four hospitals that are geographically dispersed throughout the state of New Jersey participated in the study for a period of one year. Each hospital was already active in quality management. Top management had stated a commitment to quality management, and departmental managers were familiar with the basic principles and terminology of quality management. Hospitals that were either not involved in quality management or in the beginning stages of involvement would require additional education and were not chosen for this study.

In hospital A, the radiology, laboratory, and pharmacy departments participated. The radiology, laboratory, pharmacy, and environmental services departments participated from hospital B. Hospital C included the nuclear medicine, social services, and food and nutrition departments in the study. Finally, in hospital D, the radiology, applied clinical technology, respiratory care, and pharmacy departments participated. In health care, departments are typically categorized as either *clinical* or *non-clinical*. Clinical departments are subjected to broad regulations from local and state licensing authorities as well as national accrediting organizations. In addition, clinical departments are typically those with highly skilled medical professionals that provide direct physiological medical care. Non-clinical departments provide care, but in a less invasive manner. The care provided by non-clinical departments is not a part of the core physiological medical care. This research relies on this generally accepted distinction between clinical and non-clinical areas. Table III shows the classification of the participating departments.

The participation of all department members was voluntary. While they were informed about the project and invited to participate by e-mail and inter-office memos, no personal persuasion was permitted. At the first quarter assessment, 83 percent of non-clinical and 79 percent of clinical personnel participated across all four hospital systems. There were no apparent differences among the hospital participation rates. At the end of the second quarter, participation increased to 89 percent of non-clinical and 92 percent of clinical personnel. The participation percentages remained at these levels for the third and fourth quarters. Those not participating were primarily newly hired personnel and older department members who were approaching retirement.

Initially, all department members, staff as well as managers, attended several hands-on training sessions to ensure that everyone thoroughly understood the AHP pairwise comparison and Expert Choice. Then, the members of each department used Expert Choice to assess the importance weight (F_i) for each critical factor and the importance weight (f_{ij}) for each item (j) associated with a critical factor (i). During the training sessions, the participants agreed that they should have an opportunity to review their judgments after receiving anonymous feedback containing the judgments of the others in their own departments. The revision of individual judgments in view of anonymous group feedback is a fundamental principle of the Delphi technique. Delphi was developed at the Rand Corporation to obtain the most reliable consensus of opinion from a group of knowledgeable individuals about an issue not subject to objective solution (Dalkey and Helmer, 1963). The technique consists of iterative sequences of collecting judgments from a group, anonymous feedback and individuals reconsidering their judgments. In health care, Delphi has been used to identify issues affecting health care

Table III.
Matrix of clinical and non-clinical cases

Hospitals	Clinical					Non-clinical			
	Radiology	Applied clinical technology	Laboratory	Nuclear medicine	Respiratory care	Social services	Pharmacy	Environmental services	Food and nutrition
A	×	–	×	–	–	–	×	–	–
B	×	–	×	–	–	–	×	×	–
C	–	–	–	×	–	×	–	–	×
D	×	×	–	–	×	–	×	–	–

administration (Hudak *et al.*, 1993), to assess interventions and policies in the mental health industry (Bijl, 1992) and to construct a model for project funding decisions at the National Cancer Institute (Hall *et al.*, 1992).

Next, the managers and staff in each department completed the quality management questionnaire in the Appendix to capture their perceptions of the ideal rating $\left(R_{ij}^{*}\right)$ and the actual rating $\left(R_{ij}^{t}\right)$ for each item. Again, the department members had the opportunity to review their assessments after receiving anonymous feedback about the judgments of others in their department. The assessment of the actual state was repeated for four consecutive quarters.

The data were collected from the eight clinical and six non-clinical departments and were used to calculate the difference (d^{t}) between the actual (TQI^{t}) and ideal scores (TQI^{*}) using the model and equations (1)-(3). At the end of the study, the average of all d^{t}s for each department was treated as an observation. Assuming that these observations are two independent random samples from two populations with mean and variance $\left(\mu_{c}, \sigma_{c}^{2}\right)$ for the clinical population and $\left(\mu_{N}, \sigma_{N}^{2}\right)$ for the non-clinical, the hypothesis that there is a difference between the perception of actual and ideal quality management for the clinical and non-clinical populations can be stated as:

$$H_0 : \mu_c = \mu_N$$

$$H_A : \mu_c \neq \mu_N$$

Table IV shows the ideal and actual means on the eight critical factors for clinical and non-clinical departments. Two different *t*-tests were performed on the data to test for a difference between the means of the clinical and non-clinical groups. The first assumes equality of error variances while the second allows for the inequality of variances. The results of both tests are shown in Table V.

Levine's test for the equality of variances showed that there is a difference between the variances of the clinical and non-clinical groups for factors *F*1 (p-level $= 0.014$) and *F*2 (p-level $= 0.032$). For these factors, *t*-test 2 was used because the equality of variances could not be assumed. For the other six factors, *t*-test 1 was used. Except for factor *F*7, the *p*-level is above the critical levels for $\alpha = 0.05$ and 0.10. For *F*7, quality data and reporting, the *p*-level is 0.011. For this factor, the difference between the ideal and actual is higher for the clinical departments (0.254) than the non-clinical (0.143). Thus, in all the cases except quality data and reporting, there is no significant difference between the mean scores of the clinical and non-clinical groups[1].

Conclusion

In hospitals, the perception of clinical superiority has a long history. There is a long history of clinical superiority within hospitals. This is understandable

Table IV.
Ideal vs actual critical factor means (clinical vs non-clinical cases)

	Critical factors							
	Role of departmental management and quality policy 1	Role of quality management personnel 2	Training 3	Service design 4	Supplier quality management 5	Process management/operating procedures 6	Quality data and reporting 7	Employee relations 8
Clinical								
Ideal	0.696	0.691	0.704	0.447	0.475	0.622	0.539	0.815
All quarter average (actual)	0.460	0.437	0.428	0.255	0.274	0.405	0.295	0.491
Ideal/actual mean difference	0.236	0.254	0.276	0.192	0.201	0.217	0.244	0.324
Non-clinical								
Ideal	1.017	0.655	0.872	0.430	0.436	0.563	0.354	0.698
All quarter average (actual)	0.699	0.402	0.497	0.253	0.268	0.312	0.210	0.402
Ideal/actual mean difference	0.318	0.253	0.375	0.177	0.168	0.251	0.144	0.296
Clinical/non-clinical mean difference	(0.082)	0.001	(0.099)	0.015	0.033	(0.034)	0.100	0.028

Table V. Pairwise t-test for equality of means (clinical vs non-clinical)

Critical factor		t-test[a]	Levine's test for equality of variances		t-test for equality of means			
			F	p-level	t	df	p-level	Mean[b] difference
F1	Role of Dep. Mgt. and Quality Policy	1	8.196	0.014	(2.039)	12.00	0.064	(0.082)
		2			(1.786)	5.65	0.127	
F2	Role of Quality Mgt. Personnel	1	5.892	0.032	0.527	12.00	0.608	0.001
		2			0.476	6.61	0.650	
F3	Training	1	0.318	0.583	(1.268)	12.00	0.229	(0.099)
		2			(1.167)	7.29	0.280	
F4	Service design	1	1.009	0.335	0.518	12.00	0.614	0.015
		2			0.481	7.59	0.644	
F5	Supplier quality management	1	1.976	0.185	0.662	12.00	0.520	0.033
		2			0.603	6.84	0.566	
F6	Process mgt. operating procedures	1	2.372	0.149	(0.876)	12.00	0.398	(0.034)
		2			(0.797)	6.88	0.452	
F7	Quality data and reporting	1	1.566	0.235	3.009	12.00	0.011	0.100
		2			3.141	11.99	0.009[c]	
F8	Employee relations	1	1.655	0.223	0.746	12.00	0.470	0.028
		2			0.691	7.52	0.511	

Notes: [a]In t-test 1, equal variances are assumed while in t-test 2, equal variances are not assumed; [b]clinical minus non-clinical; [c]significant at (α=0.05 and 0.10 level of confidence – two tail test) because clinical functions are the essence of a hospital's purpose. All other functions are considered ancillary. This is true even though what drives the industry is changing from a medical mission to provide care regardless of cost to an economic perspective to provide care in the most profitable way. Similarly, the literature makes an overwhelming case for clinical departments performing better in quality management (Anderson and Daigh, 1991; Berwick, 1989; Berwick *et al.*, 1990; Dwyer and Amundson, 1992; Godfrey *et al.*, 1992; Ummel, 1990).

However, in this study, the comparison of the ideal and actual quality assessments reveals no significant difference between the clinical and non-clinical departments on seven of the eight critical factors in the Saraph *et al.* (1989) instrument. These results suggest the extent to which perceptions can differ from reality. The findings of this study may be attributable to a normalization of the expectations of actual quality management that are then reflected in the weights assigned to ideal quality management. These expectations may not differ across clinical and non-clinical departments along the rating scale used. In other words, it is possible that managers in each area adjust their belief of what ideal should be in accordance with what actual is perceived to be. The result is a gap whose size is similar for both clinical and non-clinical areas. Another possibility is that there may be at least a portion of the gap that remains constant. That is, there would be some gap under any circumstances even under the most favorable operating conditions. This could result from either of two staff positions. First, a constant gap could imply that the staff are never wholly content with their quality management environment. There may be some aspect of the environment, such as employee relations, where there may always be tension. This tension can translate into a gap between where the staff would like to be and where they perceive they are at a given point of time. Second, this gap may reflect a situation that is not stable over time. There may be shifts in both the belief of what ideal quality management is and staffs' perceptions of how actual quality management is practiced. These possible explanations represent hypotheses for future research.

The statistical analysis shows a difference between the clinical and non-clinical departments on critical factor $F7$, quality data and reporting. On this factor, clinical departments have a larger gap than the non-clinical. Clinical employees have a tradition of data collection and analysis. This includes physicians and nurses who do research as well as other skilled clinical employees who must maintain records to satisfy licensing agents or regulatory bodies. This ongoing process of data collection and analysis makes clinical departments more acutely aware of weaknesses in actual practice. This result may also reflect the absence of a management philosophy that uses the information collected in a way that has a positive impact on the quality of health care provided. In other words, the data cannot be interpreted without a clearly defined and understood management policy. For all of the participating hospitals there is an explicit commitment to quality management and its encompassing philosophy. Therefore, it can be inferred that at least for *F7*, clinical employees either fail to grasp the basic philosophy of quality management or they choose to neglect it for more traditional approaches.

This research indicates that there may be a connection between perceptions and actual quality management. Future research can be done to investigate the influence that perceptions have on actual quality management. In the behavioral sciences, it has been asserted that perceptions can be a powerful determining factor of reality. It would be useful to examine the nature of this influence as well as the degree to which perceptions determine actual quality management. Also, it would be useful to examine the mindset of employees regarding their status within hospitals on a clinical versus non-clinical grouping along with issues of authority and responsibility. The degree to which perceptions have a role in determining this status can be the subject of future research.

In addition to the specific results, this study demonstrated that quality programs can be structured in a way that overcomes the frequently observed resistance to externally imposed TQM programs and motivate professionals to participate in the process. The experiences in this study indicate that a voluntary process built on assessment input from health care professionals can achieve the desired outcome of acceptance reflected in broad participation.

Note

1. For factor *F*1, *t*-test 1 is significant at $\alpha = 0.10$. However, the Levine test indicates that the assumption of equality of variances cannot be accepted and *t*-test 2 should be used. This *t*-test suggests a non-significant difference at $\alpha = 0.10$.

References

Albert, J. *et al.*, (1990), “Ready for quality? How one hospital introduced the Deming method”, *Hospital Topics*, Vol. 68 No. 2, pp. 7-10.

Anderson, C.A. and Daigh, R.D. (1991), “Quality mind-set overcomes barriers to success”, *Healthcare Financial Management*, Vol. 45 No. 2, pp. 20-32.

Bartee, E.M. (1973), “A holistic view of problem solving”, *Management Science*, Vol. 20, pp. 439-48.

Benson, P.G., Saraph, J.V. and Schroeder, R.G. (1991), “The effects of organizational context on quality management: an empirical investigation”, *Management Science*, Vol. 37 No. 9, pp. 1107-24.

Berwick, D.M. (1987), “Monitoring quality in HMO’s”, *Business and Health*, Vol. 5 No. 1, p. 10.

Berwick, D.M. (1989), “Continuous improvement as an ideal in health care”, *New England Journal of Medicine*, Vol. 320 No. 1, pp. 53-6.

Berwick, D.M. (1991), “Blazing the trail of quality: the HFHS quality management process”, *Frontiers of Health Services Management*, Vol. 7 No. 4, pp. 47-50.

Berwick, D.M., Godfrey, A.B. and Roessner, J. (1990), *Curing Health Care: New Strategies for Quality Improvement*, Jossey-Bass, San Francisco, CA.

Bhutta, K.S. and Huq, F. (1999), "Benchmarking – best practices: an integrated approach", *Benchmarking*, Vol. 6 No. 3, pp. 254-68.

Bijl, R. (1992), "Delphi in a future scenario study on mental health and mental health care", *Futures*, Vol. 24 No. 3, pp. 232-50.

Brashier, L.W., Sower, E., Motwani, J. and Savoie, M. (1996), "Implementation of TQM/CQI in the health-care industry: a comprehensive model", *Benchmarking for Quality Management and Technology*, Vol. 3 No. 2, p. 31.

Burda, D. (1988), "Providers look to industry for quality models", *Modern Healthcare*, Vol. 18 No. 29, p. 24.

Burda, D. (1991), "Total quality management becomes big business", *Modern Healthcare*, Vol. 21 No. 4, p. 25.

Buterbaugh, L. (1992), "TQM: the quality care revolution", *Medical World News*.

Camp, R.C. (1989), *Benchmarking: The Search for Industry Best Practices that Lead to Superior Performance*, ASQC Press, Milwaukee, WI.

Cyert, R.M. and March, J.G. (1963), *A Behavioral Theory of the Firm*, Prentice-Hall, Englewood Cliffs, NJ.

Dalkey, N.C. and Helmer, O. (1963), "An experimental application of the Delphi method to the use of experts", *Management Science*, Vol. 9, pp. 458-67.

Deming, E.W. (1982), *Quality, Productivity, and Competitive Position*, MIT Press, Cambridge, MA.

Dwyer, W.M. and Amundson, J.A. (1992), "TQM for suppliers", in Melum, M.M. and Sinioris, M.K. (Eds), *Total Quality Management: The Health Care Pioneers*, American Hospital Publishing, pp. 367-73.

Dyer, J.S. (1990a), "Remarks on the analytic hierarchy process", *Management Science*, Vol. 36 No. 3, pp. 249-58.

Dyer, J.S. (1990b), "A clarification of remarks on the analytic hierarchy process", *Management Science*, Vol. 36 No. 3, pp. 274-5.

Expert Choice (2000), Decision Support Software, McLean, VA.

Forker, L. and Mendez, D. (2001), "An analytical method for benchmarking best peer suppliers", *International Journal of Operations and Production*, Vol. 21, p. 195.

Fried, R.A. (1992), "A crisis in health care", *Quality Progress*, Vol. 25 No. 4, p. 68.

Godfrey, A.B., Berwick, D.M. and Roessner, J. (1992), "Can quality management really work in health care?", *Quality Progress*, Vol. 22 No. 4, pp. 23-7.

Hall, N.G., Hershey, J.C., Kessler, L.G. and Stotts, R.C. (1992), "A model for making project funding decisions at the National Cancer Institute", *Operations Research*, Vol. 40 No. 6, pp. 1040-52.

Harker, P.T. and Vargas, L.G. (1990), "Reply to remarks on the analytic hierarchy process by J.S. Dyer", *Management Science*, Vol. 36 No. 3, pp. 269-73.

Hudak, R.P., Brooke, P.P. Jr, Finustuen, K. and Riley, P. (1993), "Health care administration in the year 2000: practitioners' views of future health issues and job requirements", *Hospital and Health Service Administration*, Vol. 38 No. 2, pp. 181-95.

Kiesler, S. and Sproull, L. (1982), "Managerial response to changing environments: perspectives on problem sensing from social cognition", *Administrative Science Quarterly*, Vol. 27, pp. 548-70.

Kumar, A., Motwani, J., Douglas, C. and Das, N. (1999), "A quality competitiveness index for benchmarking", *Benchmarking*, Vol. 6, pp. 112-21.

Luthans, F. and Kreitner, R. (1985), *Organizational Behavior Modification and Beyond*, Foresman and Company, Glenview, IL.

Luthans, F. and Thompson, K.R. (1987), "Theory D and O.B.Mod.: synergistic or opposite approaches to performance improvement?", *Journal of Organizational Behavior Management*, Vol. 9 No. 1, pp. 105-24.

MacCrimmon, K.R. and Taylor, R.N. (1976), "Decision making and problem solving", in Dunnette, M.D. (Ed.), *Handbook of Industrial and Organizational Psychology*, Rand McNally, Chicago, IL, pp. 1397-453.

Orr, S., Sohal, A.S., Gray, K. and Harbrow, J. (2001), "The impact of information technology on a section of the Australian health care industry", *Benchmarking*, Vol. 8 No. 2, p. 108.

Pounds, W.F. (1969), "The process of problem finding", *Industrial Management Review*, Vol. 11, pp. 1-19.

Prado, J.C. (2001), "Benchmarking for the development of quality assurance systems", *Benchmarking*, Vol. 8 No. 1, pp. 62-9.

Redmon, W.K. and Dickinson, M.D. (1987), "A comparative analysis of statistical process control, Theory D, and behavior analytic approaches to quality control", *Journal of Organizational Behavior Management and Statistical Process Control*, Vol. 9 No. 1, p. 52.

Reitman, W.R. (1964), "Heuristic decision procedures, open constraints, and the structure of ill-defined problems", in Shelly, M. II and Bryan, G.L. (Eds), *Human Judgements and Optimality*, Wiley, New York, NY.

Roach, S.S. (1991), "Services under siege – the restructuring imperative", *Harvard Business Review*, Vol. 69 No. 5, pp. 82-91.

Saaty, T.L. (1972), *An Eigenvalue Allocation Model for Prioritization and Planning*, Energy Management and Policy Center, University of Pennsylvania, Philadelphia, PA.

Saaty, T.L. (1977a), "A scaling method for priorities in hierarchical structures", *Journal of Mathematical Psychology*, Vol. 15, pp. 234-81.

Saaty, T.L. (1977b), "Modeling unstructured decision problems: a theory of analytical hierarchies", *Proceedings of the First International Conference on Mathematical Modeling*, pp. 69-77.

Saaty, T.L. (1980), *The Analytic Hierarchy Process*, McGraw-Hill, New York, NY.

Saaty, T.L. (1990), *Multicriteria Decision Making: The Analytic Hierarchy Process*, RWS Publications, Pittsburgh, PA.

Saaty, T.L. (1994), *Fundamentals of Decision Making and Priority Theory with the Analytic Process*, RWS Publications, Pittsburgh, PA.

Saaty, T.L. (1999), *Decision Making for Leaders: The Analytic Hierarchy Process for Decisions in a Complex World*, RWS Publications, Pittsburgh, PA.

Saraph, J.V., Benson, P.G. and Schroeder, R.G. (1989), "An instrument for measuring the critical factors of quality management", *Decision Sciences*, Vol. 20 No. 4, pp. 810-29.

Shim, J.P. (1989), "Bibliographical research on the analytic hierarchy process (AHP)", *Socio-Economic Planning Sciences*, Vol. 23, pp. 161-7.

Simpson, M. and Kondouli, D. (2000), "A practical approach to benchmarking in three service industries", *Total Quality Management*, Vol. 11 No. 4-6, pp. 623-30.

Skinner, B.F. (1938), *The Behavior of Organisms: An Experimental Analysis*, Appleton Century Crofts, New York, NY.

Skinner, B.F. (1966), "What is the experimental analysis of behavior?", *Journal of Experimental Analysis of Behavior*, Vol. 9, pp. 213-8.

Ummel, S.L. (1990), "Total quality management: healthcare's complex and timely choice", *Computers in Healthcare*, Vol. 11 No. 8, p. 36.

Weiss, E.N. and Rao, V.R. (1987), "AHP design issues for large-scale systems", *Decision Sciences*, Vol. 18, pp. 43-61.

Zahedi, F. (1986), "The analytical hierarchy process – a survey of the method and its applications", *Interfaces*, Vol. 16, pp. 96-108.

Appendix. Quality management questionnaire for staff members (department managers) to assess the current state (ideal state) of quality management

The purpose of this questionnaire is to assess your perceptions of the extent of effective quality management in your department. The questionnaire captures the most important aspects of effective quality management as espoused by the leading practitioners and researchers. This is a confidential survey. Your name is not required to complete it.

Please read each statement carefully and circle the number that best describes the current practice of quality management within your department. (For the department managers, this statement reworded to focus on the ideal state: . . .that best describes the ideal level of quality management in your department.) Answer each statement as accurately as possible and remember that you are assessing your own perceptions of how quality management is practiced in your hospital (Table AI). (For the department managers: should be practiced in your department.)

	Rating of current practice in your department (rating of the ideal level of QM in your department)				
	Very low	Low	Medium	High	Very high
Role of divisional top management and quality policy					
Extent to which the top division executive (responsible for division profit and loss) assumes responsibility for quality performance	1	2	3	4	5
Acceptance of responsibility for quality by major department heads within the division	1	2	3	4	5
Degree to which divisional top management (top divisional executive and major department heads) is evaluated for quality performance	1	2	3	4	5
Extent to which the division top management supports long-term quality improvement process	1	2	3	4	5
Degree of participation by major department heads in the quality improvement process	1	2	3	4	5
Extent to which the divisional top management has objectives for quality performance	1	2	3	4	5
Specificity of quality goals within the division	1	2	3	4	5
Comprehensiveness of the goal-setting process for quality within the division	1	2	3	4	5

Table AI.

(*continued*)

	Rating of current practice in your department (rating of the ideal level of QM in your department)				
	Very low	Low	Medium	High	Very high
Extent to which quality goals and policy are understood within the division	1	2	3	4	5
Importance attached to quality by the divisional top management in relation to cost and schedule objectives	1	2	3	4	5
Amount of review of quality issues in divisional top management meetings	1	2	3	4	5
Degree to which the divisional top management considers quality improvement as a way to increase profits	1	2	3	4	5
Degree of comprehensiveness of the quality plan within the division	1	2	3	4	5
Role of the quality department					
Visibility of the quality department	1	2	3	4	5
Quality department's access to divisional top management	1	2	3	4	5
Autonomy of the quality department	1	2	3	4	5
Amount of coordination between the quality and other departments	1	2	3	4	5
Effectiveness of the quality department in improving quality	1	2	3	4	5
Training					
Specific work-skills training (technical and vocational) given to hourly employees throughout the division	1	2	3	4	5
Quality-related training given to hourly employees throughout the division	1	2	3	4	5
Quality-related training given to managers and supervisors throughout the division	1	2	3	4	5
Training in the "total quality concept" (i.e. philosophy of company-wide responsibility for quality) throughout the division	1	2	3	4	5
Training in the basic statistical techniques (such as histograms and control charts) in the division as a whole	1	2	3	4	5
Training in advanced statistical techniques (such as design of experiments and regression analysis) in the division as a whole	1	2	3	4	5
Commitment of the divisional top management to employee training	1	2	3	4	5
Availability of resources for employee training in the division	1	2	3	4	5

(*continued*)

Table AI.

	Rating of current practice in your department (rating of the ideal level of QM in your department)				
	Very low	Low	Medium	High	Very high
Product/service design					
Thoroughness of new product/service design reviews before the product/service is produced and marketed	1	2	3	4	5
Coordination among affected departments in the product/service development process	1	2	3	4	5
Quality of new products/services emphasized in relation to cost or schedule objectives	1	2	3	4	5
Clarity of product/service specifications and procedures	1	2	3	4	5
Extent to which implementation/producibility is considered in the product/service design process	1	2	3	4	5
Quality emphasis by sales, customer service, marketing, and PR personnel	1	2	3	4	5
Supplier quality management (supplier of goods and/or services)					
Extent to which suppliers are selected based on quality rather than price or schedule	1	2	3	4	5
Thoroughness of the supplier rating system	1	2	3	4	5
Reliance on reasonably few dependable suppliers	1	2	3	4	5
Amount of education of supplier by division	1	2	3	4	5
Technical assistance provided to the suppliers	1	2	3	4	5
Involvement of the supplier in the product development process	1	2	3	4	5
Extent to which longer term relationships are offered to suppliers	1	2	3	4	5
Clarity of specifications provided to suppliers	1	2	3	4	5
Process management/operating procedures					
Use of acceptance sampling to accept/reject lots or batches of work	1	2	3	4	5
Amount of preventative equipment maintenance	1	2	3	4	5
Extent to which inspection, review, or checking of work is automated	1	2	3	4	5
Amount of incoming inspection, review, or checking	1	2	3	4	5
Amount of in-process inspection, review, or checking	1	2	3	4	5
Amount of final inspection, review, or checking	1	2	3	4	5
Stability of production schedule/work distribution	1	2	3	4	5
Degree of automation of the process	1	2	3	4	5
Extent to which process design is "fool-proof" and minimizes the chances of employee errors	1	2	3	4	5
Clarity of work or process instructions given to employees	1	2	3	4	5

Table AI.

(*continued*)

	Rating of current practice in your department (rating of the ideal level of QM in your department)				
	Very low	Low	Medium	High	Very high
Quality data and reporting					
Availability of cost of quality data in the division	1	2	3	4	5
Availability of quality data (error rates, defect rates, scrap, defects, etc.)	1	2	3	4	5
Timeliness of the quality data	1	2	3	4	5
Extent to which quality data (cost of quality, defects, errors, scrap, etc.)	1	2	3	4	5
Extent to which quality data are available to hourly employees	1	2	3	4	5
Extent to which quality data are available to managers and supervisors	1	2	3	4	5
Extent to which quality data are used to evaluate supervisor and managerial performance	1	2	3	4	5
Extent to which quality data, control charts, etc., are displayed at employee work stations	1	2	3	4	5
Employee relations					
Extent to which quality circle or employee involvement type programs are implemented in the division	1	2	3	4	5
Effectiveness of quality circle or employee involvement type programs in the division	1	2	3	4	5
Extent to which employees are held responsible for error-free output	1	2	3	4	5
Amount of feedback provided to employees on their quality performance	1	2	3	4	5
Degree of participation in quality decisions by hourly/non-supervisory employees	1	2	3	4	5
Extent to which quality awareness building among employees is ongoing	1	2	3	4	5
Extent to which employees are recognized for superior quality performance	1	2	3	4	5
Effectiveness of supervisors in solving problems/issues	1	2	3	4	5

Table AI.