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The EFQM Excellence Model as a framework for Total Quality Management in healthcare: results of a longitudinal quantitative study

Abstract

Purpose

To guide organizations towards Total Quality Management (TQM), various models have been developed such as the European Foundation for Quality Management Excellence Model (EFQM Excellence Model). This paper is a longitudinal investigation of whether the EFQM Excellence Model can serve as a framework for TQM in healthcare.

Methodology

Data on a national representative survey about quality management in the hospital population in the Netherlands were used to conduct this study. The survey had five measurement points between 1995 and 2011.

Findings

The results of our study show that applying the EFQM Excellence Model in hospitals is related to improvement in organizational performance over time, a feedback loop in which hospitals use their results to further improve their organizational processes is established, and improvement is stronger when all the model's elements are considered simultaneously.

Practical implications

The results of our study can be applied by quality managers of healthcare institutions to achieve higher quality of care.

Value

Previous research on the relationship between the EFQM Excellence Model and TQM neglects two essential characteristics of the TQM philosophy, namely the holistic perspective on quality management and the presumed feedback loop of organizational performance that feeds a cycle of continuous quality improvement. Our study provides new insights into the long term benefits of applying the EFQM Excellence model as a framework for TQM in healthcare.

Introduction

The last decades, the standards and expectations of customers have risen and as a result there has been a growing concern about quality of goods and services. In response, many quality improvement methods have been developed. One of these methods is called Total Quality Management (TQM). TQM is defined as an integrative management philosophy that aims for continuous improvement in the quality of products and services within an organization.[1-5] Various models have been developed to guide organizations towards TQM such as the Malcolm Bridge Quality Award and the European Foundation for Quality Management Excellence Model (EFQM Excellence Model).[2,6]

Previous research into the relation between the EFQM Excellence Model and TQM neglects two essential characteristics of the TQM philosophy, namely: (1) the holistic perspective on quality management and (2) a continuous cycle of quality improvement that is presumed to be established through a feedback loop of organizational performance.[2,7] Previous research was mostly based on testing isolated relations of the EFQM Excellence Model within cross-sectional study designs.[2,7,8] However, a holistic approach that takes account of all organizational aspects and organizational performance over a longer period of time is required. The aim of this paper is to investigate whether the EFQM Excellence Model can serve as a framework for TQM and takes a longitudinal approach. Our study contributes to a deeper understanding of the value of applying the EFQM Excellence Model. The following research question is empirically tested in this paper by means of longitudinal survey research: *'Can the European Foundation for Quality Management Excellence Model serve as a framework for Total Quality Management?'*.

We chose to conduct this research in a particular sector with a high societal relevance, namely the healthcare sector. More specifically, this research was carried out in hospitals. Even though the EFQM Excellence Model was originally developed for the for-profit sector, to date the model has also been applied in not-for-profit sectors such as healthcare and education.[9-17] In healthcare, quality improvement has become increasingly important over recent years, as it is supposed to have a direct effect on patient outcomes, both clinical outcomes and patient satisfaction. The improvement of quality in this sector has the potential to improve the quality of lives or even save lives.

This paper has the following structure: in the next two sections we give a more detailed overview of existing literature on TQM and the EFQM Excellence Model. Based on that overview, the specific research questions and hypotheses are presented. The fourth section describes the methodology: the longitudinal design, the questionnaire, the data collection in a national representative sample of hospitals and the statistical analyses. Section five presents the results and shows the long-term effects of applying the EFQM Excellence Model in terms of TQM. In the last section, the conclusions stemming from this research and its implications and limitations are discussed, as well as directions for future research.

Overview of the literature

The concept of TQM

Several definitions for TQM have been developed, all slightly different but these definitions share the general idea that TQM is an integrative management philosophy that aims at continuous quality improvement to meet the expectations of customers.[2,3,18,19] According to TQM, this can only be attained when the individual parts of an organization are managed in an interrelated (holistic) way.[18,20,21] In the literature on TQM, three main principles that underlie this concept are distinguished. Firstly, the core concepts of TQM fall into *two dimensions* that are named the 'social-soft' dimension and the 'technical-hard' dimension.[2,18,22] The 'social-soft' dimension encapsulates the human resource management aspects of an organization, whereas the 'technical-hard' dimension considers continuous improvement of goods and services by improving production processes. Secondly, the two dimensions and their underlying aspects need to be *managed simultaneously* because they are interrelated. If the aspects are dealt with separately, this will not lead to the desired improvement.[2-5,23] As pointed out by Hietschold:*'The main focus of TQM is on the organization as a whole'*.[24] Thirdly, the management of both dimensions will lead to *improved organizational performance*. Several studies have confirmed a causal relationship between dimensions of TQM and performance of organizations.[8,18,20,21] However, about seventy percent of organizations fail to put TQM in practice.[25] Therefore it is important to know the mechanisms through which TQM leads to continuous quality improvement. As TQM is a long-term approach, the improvement achieved in performance is expected to persist and accumulate over time leading to a cycle of continuous improvement. However, as yet there is no evidence for a cycle of continuous improvement in the literature since most studies had a cross-sectional design.[7,8,26]

TQM in healthcare

As a result of quality methods being applied in the industrial sector as a part of daily business processes, healthcare became interested in such methods as well. TQM initiatives were implemented in healthcare to ensure and improve the quality of care and reduce costs.[27-30] From the early 1990s these TQM initiatives were applied in healthcare organizations throughout the world. The application of TQM spread rapidly,[27] partly due to the fact that it is an appealing approach for customer-oriented sectors.[31] This follows from the definition of TQM in healthcare: *'the systematic involvement of healthcare teams in identifying the underlying causes of unnecessary variation in processes and outcomes of care, and taking corrective and preventive action with the goal of continuous quality improvement in patient care delivery'*.[32] As such, TQM in healthcare has the potential to reduce variation in outcomes and aims to detect opportunities for improvement both in terms of clinical outcomes and cost-effectiveness.[30,33]

Despite this, questions are raised about the universal applicability of TQM[34] because there is growing awareness that successful implementation of TQM highly depends on contextual variables.[24,35] Previous studies identified industry type as an important context factor.[34] In relation to this, some studies have been conducted to identify the various practices underlying the success of TQM implementation in healthcare settings.[36] In addition, a review by Nicolay et al.[33] identifies the performance effects of TQM implementation for various medical disciplines and patient groups. However, more research is needed that concerns the detailed impact of dimensions of TQM on performance, taking into account the entire organization as well as (longitudinal) performance measures that are relevant to both healthcare organizations and patients.[33,36]
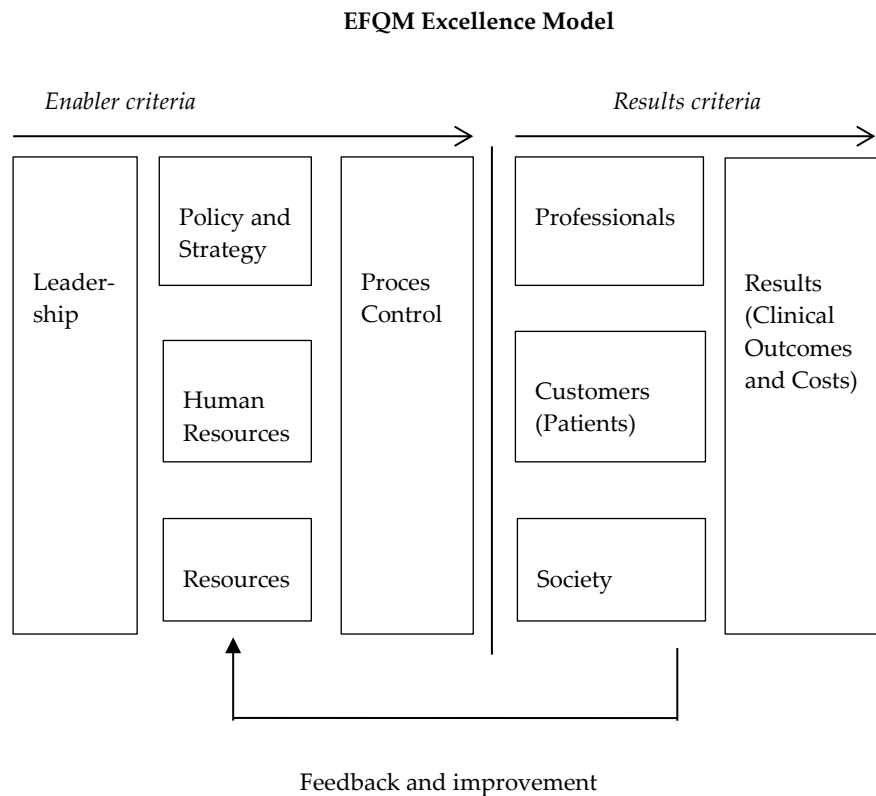
Several models have been designed to guide organizations towards TQM, such as the EFQM Excellence Model and the Malcolm Bridge Quality Award. Multiple studies consider such quality models as operational frameworks for TQM.[2,37-41] In this paper we will focus on the EFQM Excellence Model as a framework for organizations to reach TQM since this model has been widely used throughout Europe. In the following section, the EFQM Excellence Model is described and an overview of studies on the results of applying the model to organizational performance is given.

The EFQM Excellence Model as a framework for TQM

The EFQM Excellence Model

Since the early 1990s, the EFQM Excellence Model has been used to shape organizations' quality policy and detect areas for improvement. The model is a broad, generic and non-directive framework[42] that is applied in three ways. Firstly, it is used as a frame of reference for an organization's quality policy. Secondly, the model can serve as a self-assessment instrument to identify the strengths and weaknesses of the quality management of an organization. And lastly, organizations use it to apply for the European Quality Awards.[2,43] The EFQM Excellence Model consists of five organizational areas and four outcome areas, see Figure 1.

Figure 1   The EFQM Excellence Model

EFQM Excellence Model

Enabler criteria   *Results criteria*

Leader-ship	Policy and Strategy	Proces Control	Professionals	Results (Clinical Outcomes and Costs)
	Human Resources		Customers (Patients)	
	Resources		Society	

Feedback and improvement

The organizational areas are often referred to as 'enabler criteria', whereas the outcome areas represent the 'result criteria' of an organization or in other words the performance of an organization. In this paper we adopt this terminology and will refer to the areas of the model as enabler criteria and result criteria. The enabler criteria are Leadership, Policy & Strategy, Human Resources, Resources, and Process Control. The result criteria are: Professionals (in healthcare: healthcare professionals such as physicians and nurses); Customers (in healthcare: Patients); Society, and Results (in healthcare: Clinical Outcomes and Costs). Table 1 describes the enabler and result criteria.

The model is based on the assumption that improving operational processes will lead to improvement and superiority of performance.[7,14,26,42,44] The EFQM Excellence Model proposes a pattern of relationships within[23,45,46] and between[12,26] the enabler criteria and result criteria. These propositions follow the same logic as the main ideas behind TQM. The model assumes that an organization should focus on all its activities and levels to establish a continuous pathway towards improvement.[43] In addition, the various elements should be balanced: all criteria need to be managed at the same time. According to TQM, in other words, combining the management of all the enabler criteria will have a larger effect on result criteria compared to focusing on individual enabler criteria.[42]

Table 1   Description of the EFQM Excellence Model enabler criteria and result criteria

Enabler criteria	Description
Leadership	Leaders need to demonstrate their commitment to excellence and continuous improvement and support improvement and involvement by providing adequate resources and support.
Policy & Strategy	Policy and Strategy includes the organization's mission, vision, values and strategy, how these reflect a total quality orientation and how these are developed, communicated, implemented, regularly updated, and improved.
Human Resources	Human Resources concerns the management of the people in the organization, how their full potential is released, their resources improved, capabilities sustained and developed; how performance is continuously assessed; how people are involved, empowered, and recognized.
Resources	Resources refer to how the resources of an organization are effectively deployed in support of policy and strategy.
Process Control	Process Control addresses how processes are identified, reviewed, and revised in order to sustain continuous improvement of the organization's service.
Result criteria	**Description**
Professionals	Comprehensively measure and achieve excellent results with respect to their professionals.
Customers (Patients)	Comprehensively measure and achieve excellent results with respect to their customers (patients).
Society	Comprehensively measure and achieve excellent results with respect to society.
Results (Clinical Outcomes and Costs)	Comprehensively measure and achieve excellent results with respect to results (clinical outcomes and costs).

(EFQM, 2013, Shergold and Reed, 1996)

Literature on the results of applying the EFQM Excellence model
In practice the use of the EFQM Excellence Model is accepted and widespread. Empirical research on the causal relationships within the EFQM

Excellence Model is extensive, however, the evidence suggesting that applying the EFQM Excellence Model leads to improvement of performance is limited.[2,7] Existing research is mostly based on descriptive studies that use single cases or lack control groups.[2,7] Furthermore, previous research focused on partial or isolated relationships. In the following paragraph we will briefly describe the important contributions to the literature on the empirical evidence of applying the EFQM Excellence Model in terms of improved performance. For a more detailed and in-depth description of this literature, we refer to the papers by Bou-Llusar *et al.* and Doeleman *et al.* which contain detailed literature reviews on the topic.[2,7]

Oakland & Oakland showed a significant relationship within the result criteria of the EFQM Excellence Model where achievements in one of the result criteria are associated with improved outcomes in other result criteria.[47] Eskildsen & Kanji conducted a study that found that poor management of people and processes is reflected in two of the results criteria.[48] Prahbu *et al.* demonstrated strong associations between the enabler criterion Human Resources and the result criterion Professionals; between the enabler criterion Leadership and the result criterion Customers through the assurance of good training for employees; and between people-related issues and operational outcomes measures.[49] Eskildsen & Dahlgaard showed that the enabler criteria Human Resources and Process Control are positively associated with the result criterion Professionals.[50] Bou-Llusar *et al.* were the first to take into account all of the elements of the model by testing the relationships between the various enabler criteria and the result criteria and thereby made an important contribution to the understanding of the complete set of relationships in the model. They found evidence that the enabler criteria and result criteria are strongly associated. Furthermore, they concluded that a positive enabler-result criteria correlation exists when all the criteria in the model are considered simultaneously and a balanced approach in the development of the enabler criteria allows the correlation between enabler criteria and result criteria to be maximized.[26] Despite the fact that this study took an integrative approach, the study was cross-sectional and did not consider the long-term relationship between the enabler criteria and result criteria.[26] In the light of continuous improvement, analyzing the long-term effects of enabler criteria is a prerequisite if premises are to be stated about the contribution of the EFQM Excellence Model to organizational performance.[2,7,26] Furthermore, as it can be assumed that the implementation of quality management aspects does not have an instant effect but instead requires time before any effect becomes manifest, it seems reasonable to suppose that the results of this implementation will not

be visible if measured at the moment of implementation, but only at a later point in time.[7,51]

Expanding on the existing literature on the relationships of the EFQM Excellence Model and whether the model can serve as a framework for TQM, the current study takes a longitudinal perspective on this relationship. In addition, this study takes a holistic perspective to investigate the effect of managing all the enabler criteria simultaneously instead of testing the effects of individual enabler criteria.

Hypotheses

The hypotheses that will be tested in this study are derived from the main ideas of TQM, which were described in the previous section: (1) The management of enabler criteria of the EFQM Excellence Model lead to improved organizational performance,[18,20,21] (2) The management of enabler criteria of the EFQM Excellence Model lead to improved organizational performance that will persist and accumulate over time resulting in a feedback loop of continuous improvement, [7,26] (3) The relationships between the enabler criteria and the result criteria of the EFQM Excellence Model are stronger when all the enabler criteria are managed in parallel, because they are interrelated.[3-5,23,26] This leads to the following hypotheses that will be tested in this study (see Figure 2):

Figure 2   Hypotheses
[H1]
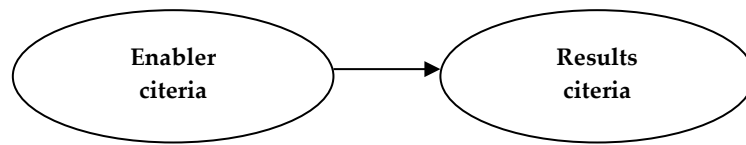
[H2]
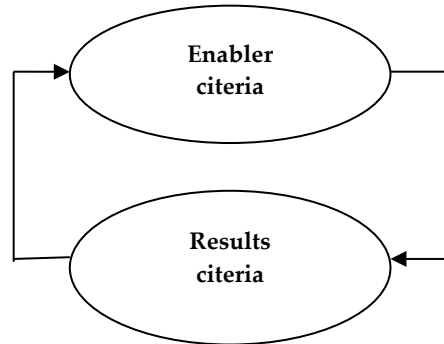
[H3]
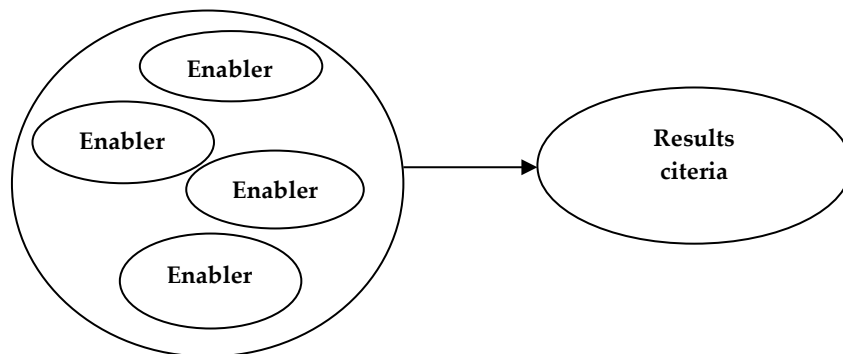
[H1] There is a positive causal relationship between the enabler criteria and the result criteria of the EFQM Excellence Model. High scores for the enabler criteria will lead to high scores for the result criteria.

[H2] The enabler criteria and the result criteria of the EFQM Excellence Model continuously improve over time, resulting in a feedback loop of continuous improvement of both the enabler criteria and the result criteria.

[H3] The relationships between the enabler criteria and the results criteria of the EFQM Excellence Model will be stronger when all of the enabler criteria are developed.

Methodology

EFQM enabler and result criteria were measured using data from a national representative survey among the hospital population in the Netherlands. The survey had multiple measurement points and was carried out in 1995, 2000, 2005, 2007 and 2011 by NIVEL (Netherlands Institute for Health Services Research).[52-57] The questionnaire was originally developed and validated in the Netherlands in 1995 and was used to measure quality management activities and quality system development in hospitals through self-assessment.[52-57] For the fifth measurement in 2011 the questionnaire was slightly adjusted to correspond to current issues and definitions within the hospital sector.[57] For the purpose of the current research, items were regrouped according to the various enabler and result criteria of the EFQM Excellence Model using the definitions of the enabler and result criteria in Table 1. For example, the item *'Management indicate what is expected from staff regarding the quality policy of the hospital'* was grouped under the enabler criterion Leadership and the item *'Staff can participate in quality improvement activities during working hours'* was grouped under the enabler criterion Human Resources. This regrouping was undertaken by the author in consultation with the co-authors, who all had significant experience in research in the field of quality improvement and quality models. The number of items varies within different enabler and results criteria. The final set of items, their answer categories and year of measurement are shown in Appendix A.

Study design, sample and questionnaire

All Dutch hospitals were approached and asked to participate in the study. A total of 548 questionnaires were sent to the total population of Dutch hospitals over the years 1995, 2000, 2005, 2007, and 2011. The number of hospitals in the Netherlands decreased over that timeframe due to mergers. The average response over the years was 73%, the average number of completed questionnaires per measurement point was 80, and in total 398 questionnaires were completed during the length of the study. Response rates per measurement year are shown in Table 2. The questionnaire was completed by either a member of the management team or the quality coordinator of the hospital. The views of nurses, medical specialists, and other professionals as well as those of patients or other stakeholders were not included in this survey.

Table 2   Response per measurement year

	1995	**2000**	**2005**	**2007**	**2011**	**Total**
N	143	117	96	97	95	548
completed questionnaires	112	80	71	62	73	398
response percentages	78%	68%	74%	65%	77%	73%

Data preparation

The questionnaire contained both positively and negatively worded items. The negatively worded items were recoded to ensure that a high score reflects a more positive response. Hospitals were allowed to have missing data on items for the various criteria; however, at least one of the items for each of the criteria needed to be answered in order to include that criterion in the analyses. If this was not the case, the hospital was excluded from the analyses for this criterion. Mergers of hospitals were dealt with in the analyses as follows. Hospitals were assigned a unique identifier at the first year of measurement that was used as a unit of analysis. This unique identifier remained the same during the entire study period unless one of the following two situations occurred: (1) A larger or more (financially) dominant hospital took over a smaller or less dominant hospital, (2) Two hospitals started working together as a new organization. In the first case, the two hospitals had a unique identifier up to the point of the merger. After the merger, the identifier of the smaller hospital disappeared as a unit of analysis and the identifier of the larger hospital remained in the study. This assumes that the policy of the larger, more dominant hospital was 'forced upon' the smaller hospital that was taken over. In the second case, the two hospitals started jointly working together as a new organization, with neither of the two being more dominant. Each hospital had its own unique identifier before the merger, but a new unique identifier was created thereafter for the new joint organization. The two original individual identifiers were excluded from the analyses for the remaining period of the study after the merger.

Ecometrics model

Ecometrics is a statistical multilevel method to evaluate the validity and reliability of imperfect measures of contextual properties.[58,59] The aim of this method is to measure latent characteristics of 'ecological units' (in this study the ecological unit is the hospital). Furthermore, the method aims to combine multiple observations into one scale to analyze reliability and validity of the scale. With an ecometrics approach, all available data can be used in a multiple response model.[58,59] An ecometrics approach was needed in the current study for two reasons. First, to handle the fact that not every hospital participated in every year of measurement and not all items were measured in every year of measurement, and second, because the data are hierarchical, since the different measurements are clustered within hospitals. The data structure is as follows: the items are at the lowest level (level 1) and these are nested in hospitals at the highest level (level 2).

A weighted average scale value is calculated by the model (intercept fixed part) over all items using equal weights for the items. Each item had its own level 1 error variance, which captures the measurement error. At the hospital level for every year of measurement (five measurements in total) a separate between hospital variance is estimated. From this for every hospital a residual (deviation from the average scale value) is estimated for every measurement year. The sum of the average scale score and the residuals give for every hospital a scale score in that year of measurement (if the hospital has data in that year). The remaining analyses were based on these yearly hospital scale scores.

The internal consistency of the various enabler and result criteria was calculated to ensure that our measurement instrument was reliable and that hospitals were responding consistently to the items within any one criterion. The reliability coefficient was calculated in a multilevel multiple response model. The interpretation of this value is comparable to Cronbach's alpha in psychometric studies.[58,59] When the items within a certain criterion are measuring the same construct, the coefficient should be at least 0.6.[60]

Multilevel linear regression analyses within a time lag model

To test the hypotheses in a multilevel linear regression model, a time lag data model was built beforehand. A time lag model takes account of the temporal sequence of a possible causal effect. An observed relationship might be causal when the cause (x) precedes the effect (y).[60] As we assume that the implementation of quality management aspects does not have an instant effect but instead requires time to become manifest, a time lag model

is the appropriate approach.[7,51] The time sequence between our predictor variables (the enabler criteria) and the outcome variables (the result criteria) was modeled in this time lag model. Furthermore, to test the presumed feedback loop in the model, whereby the results of the quality management system feed back into the organization (in other words, improved result criteria lead to improved enabler criteria) leading to improved policy and processes, the same procedure was followed the other way around. We hypothesized that organizations with improved result criteria are likely to adjust their enabler criteria to further improve, therefore we performed the same principles to the effect of result criteria on enabler criteria. This way we were able to analyze the possibility of a continuous cycle of quality improvement. The resulting data structure, which was used to test the causal relationships in this study, is illustrated in Figure 3.

Figure 3   Time lag model for the relationship between enabler criteria and feedback loop
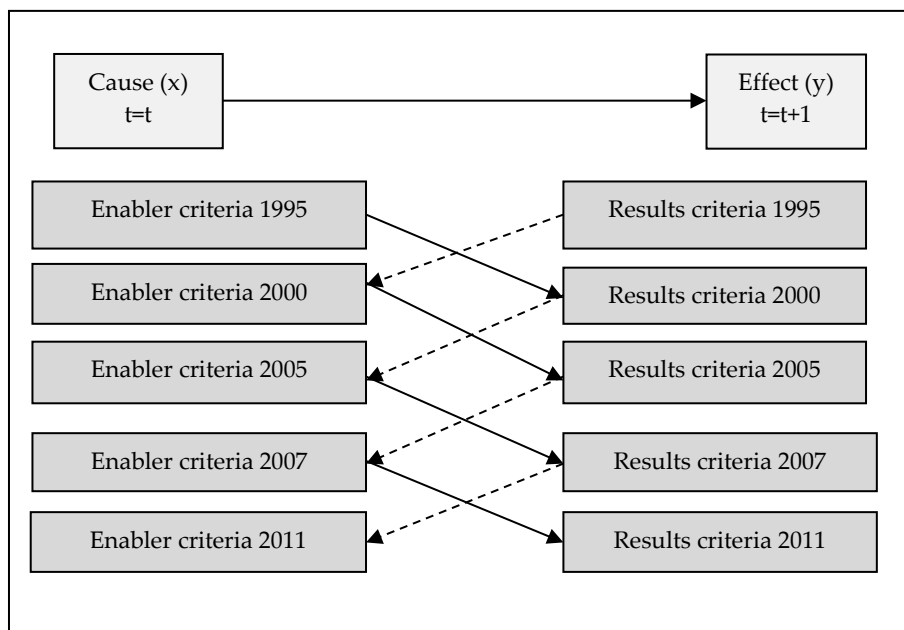
Given that the time lag in the dataset took account of the year of measurement, there was no need to perform separate analyses for the different years of measurement and all data stemming from one year of measurement could be combined in the analyses. This was the starting point for the multilevel linear regression analyses.

The multilevel linear regression analyses were done in several steps. Firstly, separate analyses were performed for every enabler-results relationship in the model, both with and without controlling for year of measurement. Secondly, separate analyses were performed for every results-enabler relationship in the model to test the feedback loop, again with and without controlling for year of measurement. And thirdly, the relationship between the combined enabler scores and the results was analyzed, with and without controlling for year of measurement. For this last analysis, a new variable was constructed to reflect the total development of all the enabler criteria combined. This variable was construed according to a procedure called summated rating scale construction.[61] Each hospital was assigned a score of 0 or 1 for each of the enabler criteria. A hospital that had performed better than average on an enabler criterion was assigned a score of 1 and hospitals performing at or below average on an enabler criterion were assigned a score of zero. The sum of these five scores became a hospital's score for the overall development of the enabler criteria. The range of this new variable was between 0 and 5, as there are five enabler criteria. The score was used in the last multilevel linear regression analysis to test whether hospitals that had developed all enabler criteria simultaneously were performing better in terms of results compared to hospitals that developed fewer enabler criteria. The descriptive analyses were performed using STATA 13.0. Multilevel analyses were performed using MLwiN 2.24. Coefficients in the multilevel regression analyses were considered statistically significant at $p<0.10$, because of the relatively small number of hospitals and because hypothesis testing was one-sided.

Findings

Reliability of the measurement scales

The reliability of the measurement scales is shown in Table 3. Reliability coefficients of the scales in the enabler criteria ranged from 0.82 to 0.96 with an average of 0.88. Reliability coefficients for the scales in the result criteria ranged from 0.30 to 0.81 with an average of 0.65. All the scales had acceptable to good internal consistency except for the scale that measures the result criterion Professionals, which had a reliability coefficient of 0.30. Deleting items in this scale did not contribute to the internal consistency. It seems that it was not possible to capture the intended underlying construct of this results criterion with the items used in this study.

Table 3   Internal consistency coefficients of measurement scales

Enabler criteria	Internal consistency	Result criteria	Internal consistency
Leadership	0.85	Professionals	0.30
Policy and Strategy	0.82	Customers	0.69
Human Resources	0.96	Society	0.78
Resources	0.85	Results	0.81
Process Control	0.94		

Descriptive statistics of the scales

Table 4a gives an overview of the averages scores of all participating hospitals for the various enabler criteria for the different years of measurement. The mean score for all enabler criteria increased over time. Standard deviations decreased over time, indicating that the spread in scores between hospital on the enabler criteria decreased over time.

Table 4b shows averages scores of all participating hospitals for the various result criteria, for the different years of measurement. The mean score for most of the result criteria increased over time. In one of the result criteria (Professionals), there was an increase up until the final measurement in 2011, when the average score decreased slightly. The standard deviations in the results criteria increased over time, which indicates that there is a larger spread in scores between hospitals in the final measurement than in earlier measurements.

Table 5a gives the between hospital variance in scores for the enabler criteria for every measurement year. The variance decreased over time for each enabler criterion. Hospitals' scores for the enabler criteria became more similar over time which is another indication for the fact that the organizational input of hospitals became more similar between hospitals over time.

Table 5b gives the between hospital variance in scores for the result criteria for every measurement year. For the result criterion Professionals, variance was relatively consistent over time. For the criterion Results, variance decreased first, but increased again in the last two measurements. For the criteria Customers and Society, variance increased over time, indicating that there were larger differences in scores for these criteria during the final measurements than for the earlier measurements.

Table 6a shows the correlations between the enabler criteria of the EFQM Excellence Model and Table 6b shows the correlation between the result criteria. Correlations between the enabler criteria ranged between 0.30 and 0.62. Correlations between results criteria ranged from 0.27 and 0.56. All correlations were positive, and significantly different from zero.

Table 4a   Mean enabler criteria scores between 1995 and 2011: means, standard deviations and ranges

Enabler criteria	Leadership			Policy and Strategy			Human Resources			Resources			Process Control		
	Mean	SD	Range (0-1)	Mean	SD	Range (1-3)	Mean	SD	Range (0-1)	Mean	SD	Range (0-1)	Mean	SD	Range (0-1)
1995	0.55	0.23	0.19-0.94	1.82	0.38	1.10-2.62	0.53	0.30	0.06-0.98	0.36	0.29	0.05-0.96	0.73	0.21	0.12-0.97
2000	0.56	0.23	0.20-0.94	2.43	0.19	1.71-2.77	0.66	0.18	0.26-0.96	0.63	0.23	0.14-0.95	0.82	0.12	0.51-0.97
2005	0.82	0.11	0.42-0.88	2.53	0.02	2.47-2.57	0.88	0.10	0.40-0.96	0.65	0.08	0.41-0.77	0.86	0.11	0.39-0.96
2007	0.80	0.13	0.41-0.91	2.55	0.11	2.22-2.71	0.87	0.08	0.71-0.97	[a]	[a]	[a]	0.91	0.08	0.63-0.98
2011	0.83	0.11	0.41-0.91	2.56	0.06	2.38-2.65	0.87	0.16	0.22-0.98	0.64	0	0.64-0.64	0.91	0.06	0.73-0.96

a There are no observations for Resources in 2007.

Table 4b   Mean result criteria scores between 1995 and 2011: means, standard deviations and ranges

Results criteria	Professionals			Customers			Society			Results		
	Mean	SD	Range (1-3)	Mean	SD	Range (1-3)	Mean	SD	Range (1-3)	Mean	SD	Range (1-3)
1995	2.26	0.08	1.94-2.37	2.23	0.05	2.21-2.35	2.13	0.21	1.74-2.65	1.96	0.21	1.57-2.56
2000	2.27	0.01	2.24-2.30	2.21	0.28	1.39-2.76	2.13	0.24	1.42-2.68	1.99	0.22	1.45-2.68
2005	2.29	0.05	2.15-2.41	2.29	0.28	2.08-2.77	2.24	0.32	1.72-2.84	2.10	0.25	1.64-2.68
2007	2.28	0.08	2.09-2.47	2.30	0.30	2.07-2.87	2.26	0.32	1.72-2.84	2.17	0.34	1.64-2.80
2011	2.26	0.12	1.96-2.53	2.34	0.39	1.65-2.84	2.23	0.36	1.21-2.86	2.14	0.28	1.77-2.78

Table 5a   Between hospital variance in scores for enabler criteria for every measurement year

	Leadership		Policy & Strategy		Human Resources		Resources		Process Control	
	var	S.E.	var	S.E.	var	S.E.	var	S.E.	Var	S.E.
1995	3.87	1.13	0.69	0.14	7.02	1.62	6.22	1.63	3.24	0.84
2000	3.71	0.91	0.07	0.02	2.75	0.59	2.42	0.68	1.58	0.40
2005	1.31	0.65	0.00	0.01	1.37	0.39	0.51	0.37	1.51	0.33
2007	1.39	0.68	0.03	0.01	0.96	0.32	[a]	[a]	1.26	0.41
2011	1.35	0.66	0.01	0.01	2.77	0.67	0	0	0.91	0.28

a There are no observations for Resources in 2007.

Table 5b   Between hospital variance in scores for result criteria for every measurement year

	Professionals		Customers		Society		Results	
	var	S.E.	var	S.E.	var	S.E.	var	S.E.
1995	0.02	0.01	0.02	0.03	0.08	0.03	0.11	0.05
2000	0.00	0.01	0.11	0.03	0.10	0.03	0.08	0.02
2005	0.01	0.01	0.12	0.03	0.13	0.03	0.08	0.02
2007	0.02	0.01	0.13	0.03	0.13	0.03	0.14	0.03
2011	0.03	0.01	0.20	0.04	0.16	0.03	0.10	0.02

Table 6a   Correlations between enabler criteria

	Leader-ship	Policy & Strategy	Human Resources	Resources	Process Control
Leadership	1.00				
Policy & Strategy	0.52*	1.00			
Human Resources	0.62*	0.60*	1.00		
Resources	0.30*	0.60*	0.37*	1.00	
Process Control	0.45*	0.44*	0.50*	0.32*	1.00

*significant p<0.001

Table 6b   **Correlations between results criteria**

	Professionals	Customers	Society	Results
Professionals	1.00			
Customers	0.27*	1.00		
Society	0.34*	0.56*	1.00	
Results	0.32*	0.54*	0.56*	1.00

*significant p<0.001

Multilevel linear regression analyses

Table 7a shows the results of the separate multilevel linear regression analyses of the enabler criteria against the result criteria. All the coefficients are positive which indicates that a higher score on enabler criteria results in a higher score on result criteria in the next measurement year. The results are statistically significant (p<0.10) for the relationships between all the enabler criteria and the result criteria Customers, Society and Results, but not for the result criterion Professionals.

Table 7b shows the results of the separate multilevel linear regression analyses of the enabler criteria against the result criteria, controlled for measurement year. A similar pattern emerges when the same analyses are performed with the measurement year as a control variable: the relationships between enabler and result criteria are again positive and some, but not all, remain statistically significant (p<0.10).

Table 8a shows the results of the separate multilevel linear regression analyses of the result criteria against the enabler criteria, the feedback loop.

Almost every coefficient is positive, which indicates that a higher score on result criteria leads to higher scores on enabler criteria. However, only a few relationships proved to be statistically significant at $p < 0.10$. Statistically significant relationships were found between the result criterion Professionals and the enabler criterion Leadership. Furthermore, statistically significant relationships were found between the result criterion Society and the enabler criteria Leadership, Policy and Strategy, Human Resource Management and Process Control. And last, statistically significant relationships were found between the result criterion Results and the enabler criteria Leadership, Policy and Strategy, Human Resource Management and Process Control.

Table 8b shows the results of the separate multilevel linear regression analyses of the results criteria against the enabler criteria (feedback loop), controlled for measurement year. When the same analyses are performed controlling for measurement year, none of the relationships are statistically significant which indicates that measurement year has an effect on the enabler criteria.

Table 9a shows the results of the multilevel linear regression analysis of the total development against the enabler criteria. The results show that developing all enabler criteria has a positive effect on results criteria. The effect of the total development is positive and significant for all result criteria except the result criterion Professionals.

Table 9b shows the results of the multilevel linear regression analysis of the total development against the enabler criteria, controlled for the measurement year. The results of this analysis are similar; the positive relationship between the total development score and result criteria is still present. However, only the relationship between the total development score and the results criterion Results is not statistically significant at $p < 0.10$. This indicates that, for three out of four result criteria and controlled for the moment of measurement, developing all enabler criteria has a positive effect on results.

Table 7a   Separate multilevel linear regression analyses of the enabler criteria against the result criteria

Results criteria	Professionals		Customers		Society		Results	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Enabler criteria								
Leadership	0.019	0.024	0.154	0.101	0.193*	0.102	0.202*	0.084
Policy & Strategy	0.009	0.015	0.188*	0.061	0.230*	0.061	0.202*	0.050
Human Resources	0.019	0.024	0.294*	0.099	0.288*	0.101	0.289*	0.082
Resources	-0.001	0.018	0.278*	0.094	0.241*	0.098	0.280*	0.089
Process Control	0.005	0.040	0.327*	0.168	0.257	0.170	0.313*	0.140

*p<0.10

Table 7b Separate multilevel linear regression analyses of the enabler criteria against the result criteria, controlled for measurement year

Results criteria	Professionals		Customers		Society		Results	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Enabler criteria								
Leadership	0.042	0.029	0.014	0.120	0.126	0.122	0.089	0.099
Measurement year	-0.008	0.006	0.052*	0.025	0.025	0.025	0.042*	0.020
Policy & Strategy	0.030	0.020	0.145	0.085	0.290*	0.085	0.186*	0.070
Measurement year	-0.010	0.007	0.021	0.029	-0.030	0.028	0.008	0.023
Human Resources	0.045	0.030	0.214*	0.124	0.272*	0.125	0.215*	0.102
Measurement year	-0.009	0.006	0.027	0.026	0.005	0.026	0.025	0.021
Resources	-0.010	0.020	0.233*	0.106	0.158	0.109	0.165*	0.099
Measurement year	0.007	0.006	0.030	0.033	0.056	0.034	0.075*	0.030
Process Control	0.021	0.044	0.169	0.184	0.150	0.187	0.155	0.154
Measurement year	-0.005	0.005	0.045*	0.023	0.031	0.023	0.044*	0.019

*p<0.10

Table 8a   Separate multilevel linear regression analyses of the result criteria against the enabler criteria (feedback loop)

Enabler criteria	Leadership		Policy and Strategy		Human Resources Management		Resources		Process Control	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Results criteria										
Professionals	0.358*	0.214	0.214	0.142	0.270	0.185	0.064	0.147	0.066	0.118
Customers	0.041	0.056	0.058	0.037	0.066	0.047	0.018	0.040	0.046	0.030
Society	0.111*	0.049	0.054*	0.033	0.090*	0.041	-0.005	0.036	0.045*	0.027
Results	0.092*	0.053	0.065*	0.035	0.121*	0.044	0.004	0.034	0.052*	0.029

*$p<0.10$

Table 8b Separate multilevel linear regression analyses of the result criteria against the enabler criteria (feedback loop), controlled for measurement year

Enabler criteria	Leadership		Policy and Strategy		Human Resources Management		Resources		Process Control	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Results criteria										
Professionals	0.234	0.188	0.156	0.134	0.185	0.171	0.083	0.147	0.011	0.109
Measurement year	0.082*	0.011	0.038*	0.008	0.056*	0.010	-0.009	0.008	0.035*	0.006
Customers	-0.013	0.049	0.033	0.035	0.030	0.044	0.027	0.040	0.021	0.028
Measurement year	0.082*	0.011	0.038*	0.008	0.053*	0.010	-.012	0.008	0.035*	0.006
Society	0.044	0.044	0.023	0.032	0.046	0.039	0.006	0.037	0.014	0.025
Measurement year	0.080*	0.011	0.038*	0.008	0.052*	0.010	-0.011	0.008	0.035*	0.006
Results	-0.018	0.049	0.014	0.035	0.054	0.043	0.021	0.036	-0.002	0.028
Measurement year	0.084*	0.011	0.039*	0.008	0.050*	0.086	-0.012	0.008	0.036*	0.007

*p<0.10

Table 9a. Multilevel linear regression analysis of the total development[**] against the result criteria

Result criteria	Professionals		Customers		Society		Results	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Total development	0.003	0.002	0.026*	0.008	0.029*	0.009	0.027*	0.008

*p<0.10

**the total development is the sum of the development of all the different enabler criteria.

Table 9b. Multilevel linear regression analysis of the total development [**] against the result criteria, controlled for measurement year

Result criteria	Professionals		Customers		Society		Results	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Total development	0.004*	0.003	0.019*	0.010	0.022*	0.010	0.009	0.009
Measurement year	-0.005	0.003	0.020	0.133	0.017	0.014	0.048*	0.012

*p<0.10

**the total development is the sum of the development of all the different enabler criteria.

Discussion

This study examined whether the EFQM Excellence Model can serve as a framework for TQM in healthcare. Consistent with previous research, we found positive correlations between the various enabler criteria and between the various result criteria.[26] This is according to expectations since the individual enabler criteria are all supposed to measure different aspects of enablers, and the individual result criteria all measure different aspects of organizational outcomes. Coherence is therefore a necessity. Our findings also showed that variance of scores between hospitals on enabler criteria and result criteria decreased over time. This indicates that hospitals became more similar over time, both in terms of their organizational structure and input as in terms of their organizational outcomes. This might be due to increased sector-wide standardization through the use of standards and protocols, which might have caused less variance. Another possible explanation could be the plentitude of laws, national action programs and nation-wide improvement projects enrolled in Dutch hospitals in the last decade.[62,63] Consistently with the idea of TQM, the results obtained show that applying the EFQM Excellence Model is related with better organizational

performance. We found a positive causal relationship between the various enabler criteria and the various result criteria. These findings confirm hypothesis 1 of our study. Secondly, we also found a positive causal relationship between the various result criteria and the various enabler criteria over time. Although this effect was weaker than the relationship between enabler criteria and result criteria, it remains an indication for a cycle of continuous quality improvement. Hypothesis 2 of our study can thus be confirmed. In this study, we hypothesized that higher scores in result criteria lead to improved enabler criteria in the next time period. However, it could also be argued that low scores in results criteria at one point in time lead to improved enabler criteria in the next time period. The idea behind this is that low scores in result criteria urge organizations to improve their enabler criteria more than high scores in result criteria would. However, it is likely to expect that these improved enabler criteria should in the next time period lead to improved result criteria and the end result will be the same: both enabler criteria and result criteria improve over time. Furthermore, the results of our study show that the positive relationship between the enabler criteria and the result criteria of the EFQM Excellence Model is stronger when all of the enabler criteria are developed. This is in line with hypothesis 3 of our study, which states that managing all the aspects of the EFQM Excellence Model in an integrative manner has a stronger impact on organizational outcomes in comparison to focusing on parts of the model. Overall, our study suggests that the EFQM Excellence Model could serve as a framework for TQM. However, stronger evidence for the feedback loop of continuous quality improvement is desirable and needs to be obtained in future research.

Implications
Our study replicates the findings of earlier studies on the internal structure of the EFQM Excellence Model in a different setting: healthcare. The results of our study indicate that hospitals became not only more quality oriented, but also more similar over time. Most quality approaches, including more recent ones such as Six Sigma and Lean that have also been applied to health care settings,[64] aim to reduce variation by standardizing processes. The results of this study could be seen as evidence in favor of standardization. However, it is very important to note that standardization is only desirable when it is thoroughly substantiated, and hospital managers as well as health care professionals should look into their processes in order to see where standardization can be applied and unnecessary and undesirable variation can be reduced in a way that processes are still being sensitive to individual patient needs and requirements.

This study established a positive causal relationship between the enabler criteria and the result criteria of the EFQM Excellence Model. This is consistent with findings of other studies in different sectors on the empirical evidence when applying the EFQM Excellence Model.[2,7,26] However, as mentioned before, these studies were mostly cross-sectional and focused on single organizations and were not carried out in the healthcare sector.[2,7,26] The results of the current study can therefore be seen as a major contribution to both theory and practice and in favor of using the EFQM Excellence Model as a framework for TQM in the healthcare sector. In addition, the longitudinal design reveals that it requires time before the results of quality activities become clearly visible in organizational outcomes. This implicates that managers and professionals should be urged to be patient and not to expect quality changes instantly.

Consistently with the holistic TQM approach to quality management, we found that the relationship between enabler criteria and result criteria is stronger when all of the enabler criteria are managed simultaneously. This is important, but perhaps also complex, for the management of organizations: no organizational aspects should be neglected and the development of all aspects should be interrelated in order to give the greatest effect on organizational performance.

Strengths and limitations of the study
This study is the first to consider the long-term contribution of applying the EFQM Excellence Model as a framework for TQM in healthcare. To our knowledge there were only a few studies with a longitudinal design but these were based on single cases.[65,66] A longitudinal design is required in order to identify any causal relationships between variables. Secondly, this study is the first that examines continuous quality improvement through a feedback loop of organizational performance, an essential part of the philosophy behind TQM. Thirdly, this study takes account of all the relationships in the model and not single isolated relationships. This is important because the management of all organizational input is assumed to have an accelerating effect on organizational performance.

Despite these strengths, we acknowledge several limitations to this study as well. Firstly, organizational performance was measured by taking the respondents' perceptions of the various result criteria and not the actual objective performance. This means that quality improvement activities may have been overestimated in the current study. However, the range of scores and persistent improvements in scores over time suggests that respondents

filled out the questionnaire honestly. In the time lag model, the scores on the result criteria were linked to the scores on the enabler criteria of the previous measurement which meant that in many cases this was a different respondent and thereby eliminating possible socially desirable reporting. Ideally, more objective measurements of outcomes would be taken into account (such as standardized patient mortality rates), but these were not available for the total duration of the study. Secondly, the statistical power to generalize findings is limited. Sampling in this study was restricted by the number of hospitals in the Netherlands. Due to hospital mergers, the total number of hospitals decreased. For the most part, this problem was overcome by the longitudinal design of the study and the multilevel analyses resulting in a greater total study sample and hence more power. However, generalizations to wider healthcare settings, other countries, or even other sectors need to be drawn with a certain amount of caution. Thirdly, the reliability of the measurement scale for the result criteria Professionals was inadequate. This might be due to the fact that the items that were used capture on the one hand values of healthcare professionals (such as satisfaction) and on the other hand the way in which healthcare professionals are being evaluated (for example motivation and flexibility). Furthermore, the result criteria Professionals as measured in this research does not refer to all employees, but specifically to healthcare professionals such as physicians and nurses. The items used in this study did not seem to capture the underlying intended construct and therefore the findings related to this measurement scale should be interpreted with caution.

Directions for future research
Future research should try to replicate the findings of our study to strengthen the evidence that the EFQM Excellence Model can be used by hospitals and other healthcare institutions to guide TQM activities. Related to this, future research should base its studies on longitudinal data with multiple measurements. As Doeleman pointed out, a longitudinal design with a control group is preferable.[7] However, in practice a controlled setting in which it is possible to account for moderating influences is difficult to achieve.[7] Furthermore, the majority of research to date on the relationship between applying the EFQM Excellence Model and TQM was carried out in educational settings and results of these studies showed similar patterns of results.[9,10,67,68] Our research was carried out in a specific subsector of healthcare, namely hospitals and future research could expand to other fields in healthcare such as long-term care. In long-term care there is a specific focus on customer needs, which would make an interesting setting to research a customer driven model such as TQM.

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Appendix A

This appendix contains the items that were used to measure the various enabler criteria and result criteria of the EFQM Excellence Model and years of measurement.

Enabler criteria

LEADERSHIP	Year of measurement				
Item	*1995*	*2000*	*2005*	*2007*	*2011*
Management indicate what is expected from staff with regard to quality policy of the hospital.	x	x	x	x	x
Management assess whether staff adhere to agreements made with regard to the quality policy of the hospital.	x	x	x	x	x
Management monitor the execution of unit working plans.	x	x	x	x	x

POLICY AND STRATEGY					
Item	*1995*	*2000*	*2005*	*2007*	*2011*
Quality policy document: a description of the aims of quality assurance, the desired level of care delivery and the ways of the organization for achieving these goals.	x	x	x	x	x
Quality action plan for the entire organization: written document with measures for implementation and planning of action to realize quality goals.	x	x	x	x	x
Annual quality report, or quality section in the annual general report: a justification and the results of all activities that have been carried out within the framework of quality policy.	x	x	x	x	x

Written description of the mission: the basic principles and vision of the organization.	x	x	x	x	x
Quality manual: a description of all quality management procedures and of the people responsible for maintaining them.	x	x	x	x	x
Product descriptions: detailed description of the care for various patient populations.	x	x	x	x	x
Quality action plan for some departments.	x	x	x	x	x
Quality action plan for every department.	x	x	x	x	x
Written Safety Management Plan.					x

HUMAN RESOURCES

Item	1995	2000	2005	2007	2011
Professionals are encouraged to develop in their profession.	x	x	x	x	x
Staff receive systematic feedback on the results of the treatment of patients.	x	x	x	x	x
Professionals are encouraged to report incidents and adverse events.			x	x	x
New staff are trained in quality improvement methods.	x	x	x	x	x
New staff are trained in adherence to guidelines/protocols.			x	x	x
Training /education of staff.	x	x	x	x	x
Training / education of management.	x	x	x	x	x
Staff can participate in quality improvement activities during working hours.	x	x	x	x	x
Staff receive systematic feedback on adherence to guidelines/protocols.			x	x	x

Item	1995	2000	2005	2007	2011
Staff receive systematic feedback on incident reports.			x	x	x
Selection of new staff with a positive attitude to quality improvement.	x	x	x	x	x

RESOURCES

Item	1995	2000	2005	2007	2011
A specific internal budget is reserved for quality improvement.	x	x	x		x
One or more steering groups or quality committees have been established.	x	x	x		x
One or more quality and safety officers / coordinators have been appointed.	x	x	x		x
Support by (external) consultants.	x	x	x		x

PROCESS CONTROL

Item	1995	2000	2005	2007	2011
Prophylactic use of antibiotics.		x	x	x	x
Preoperative screening.			x	x	x
Blood transfusion policy.			x	x	x
Prevention of central line infection.			x	x	x
Prevention of pressure ulcers.			x	x	x
Prevention of falls.					x
Prevention of medication errors.					x
Standards for specific treatments/interventions.	x	x	x	x	x
Standards for patient education.	x	x	x	x	x
Standards for the use of medical aids (e.g. crutches, bandages, etc.).	x	x	x	x	x

Standards for critical moments in service provision.	x	x	x	x	x
Standards for specific target groups and diagnoses.	x	x	x	x	x
Standards for patient routing from intake to discharge.	x	x	x	x	x
Standards for cooperation with other organizations.	x	x	x	x	x

Results criteria (perceived)

PROFESSIONALS

Item	1995	2000	2005	2007	2011
Increased staff satisfaction.	x	x	x	x	x
More motivation among staff.	x	x	x	x	x
Staff have opportunities to develop further.			x	x	x
A culture of continuous learning has emerged.			x	x	x
More flexibility among staff.	x	x	x	x	x

CUSTOMERS (PATIENTS)

Item	1995	2000	2005	2007	2011
Increased patient satisfaction.		x	x	x	x
Improved patient orientation.	x	x	x	x	x

SOCIETY

Item	1995	2000	2005	2007	2011
Improved public relations of the unit / hospital.	x	x	x	x	x

Item	1995	2000	2005	2007	2011
Increased satisfaction of referring professionals.	x	x	x	x	x
Improved competitive position.			x	x	x

RESULTS (CLINICAL OUTCOMES AND COSTS)

Item	1995	2000	2005	2007	2011
Cost savings in own hospital.	x	x	x	x	x
Cost savings not in own hospital.		x	x	x	x
Increasing productivity.		x	x	x	x
Better risk management.					x
Improved care processes.		x	x	x	x
Improvements in patient safety.			x	x	x
Improved clinical outcomes.		x	x	x	x
Hospital more manageable.	x	x	x	x	x