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Creating patient value in glaucoma care: applying quality costing and care delivery value chain approaches

A five-year case study in the Rotterdam Eye Hospital

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Abstract

Purpose – The purpose of this paper is to explore in a specific hospital care process the applicability in practice of the theories of quality costing and value chains.

Design/methodology/approach – In a retrospective case study an in-depth evaluation of the use of a quality cost model (QCM) and the applicability of Porter's care delivery value chain (CDVC) was performed in a specific care process: glaucoma care over the period 2001 to 2006 in the Rotterdam Eye Hospital in The Netherlands.

Findings – The case study shows a reduction of costs per product by increasing the number of outpatient visits and surgery combined with a higher patient satisfaction. Reduction of costs of non-compliance by using the QCM is small, due to the absence of (external) financial incentives for both the hospital and individual physicians. For CDVC to be supportive to an integrated quality and cost management the notion "patient value" needs far more specification as mutually agreed on by the stakeholders involved and related reimbursement needs to depend on realised outcomes.

Research limitations/implications – The case study just focused on one specific care process in one hospital. To determine effects in other areas of health care, it is important to study the use and applicability of the QCM and the CDVC in other care processes and settings.

Originality/value – QCM and a CDVC can be useful tools for hospital management to manage the outcomes on both quality and costs, but impact is dependent on the incentives in the context of the existing organisational and reimbursement system and asks for an agreed on operationalisation among the various stakeholders of the notion of patient value.

Keywords Quality costs, Value chain, Health services, Eyes, The Netherlands

Paper type Case study

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Introduction

Hospital management requires managing both medical and financial performance (Crosby, 1979, 1983; Rivers and Tsai, 2001; Walburg, 2003; Brinkman, 2006). Usually in Dutch hospitals, physicians are focussed on medical results, while the hospital administration is primarily interested in the financial outcomes (RVZ, 1999). According

to the law, the hospital board is responsible for the overall quality delivered by the hospital (Ministerie van Volsgezondheid, Welzijn en Sport, 1996).

Methods and data used to manage and improve quality are different to the methods and data used for cost control (Custers *et al.*, 2001, 2004; Revere and Black, 2003; Van den Heuvel *et al.*, 2006). These different approaches and the resulting inconsistencies in performance management cause serious problems in health care (IOM, 2000, 2001). Based on the statement that investments on quality are necessary before realising returns, Custers *et al.* (2001) developed a quality cost model (QCM) to match quality and cost information for both policy and decision making in hospitals. To facilitate the choice between potential quality projects, the cost of the projects (prevention, assessment) were compared with the potential gains (reduced costs of non compliance). Evaluation of the use of QCM in five health care institutions demonstrated its general applicability but broad use was limited by facts related to hospital culture and the prevailing reimbursement structure in 2001 based on hospital budget (van Ineveld *et al.*, 2002; Custers *et al.*, 2004). In 2005 a new reimbursement structure for hospital care was introduced. Based on the system of diagnosis-related groups (DRGs), the Dutch government developed its own specific system called Diagnose Behandel Combinaties(DBCs (diagnosis treatment combination)). These DBCs differ from DRGs as they include all the costs of both outpatient and inpatients costs and the fees for the specialist services. The DBCs reflect all the hospital (absorption) costs involved with all the necessary activities executed for the patient from first contact to discharge. This also means that costs of housing, depreciation, finance, etcetera, are part of a DBC. Although the financing via DBCs is subject to overall budget agreements, since 2005 the Dutch Government allows that on average 10 per cent of the production of a hospital is subject to free negotiations between health care insurers and hospitals on price and quantity per DBC. The Government expects quality to become an integral part of these negotiations. These in 2005 chosen DBCs are mostly related to non-complex hospital care. The remaining production is still part of a fixed budget scheme. From 2008 onwards an increasing number of DBCs will be chosen to become part of free negotiations and thus of more competitive forces (Schut and Van de Ven, 2005; Schreyögg *et al.*, 2006).

Porter and Teisberg (2006) postulated to reduce the tension between quality and costs by introducing the notion of "patient value" (see also Porter, 1985; Nolan and Berwick, 2006). In their much quoted book they proposed a care delivery value chain (CDVC) in which the focus should be on the added value for the patient and each (part) product or service in the whole process. They identified eight principles for a health care system to be able to compete on value:

(1) focus on value for patients, not just on lowering costs;

(2) competition based on results;

(3) competition focussed on medical conditions over the full cycle of care;

(4) high quality care should be less costly;

(5) value must be driven by provider experience, scale and learning at the level of the medical care process;

(6) competition should be regional and national, not just local;

(7) data on results should support value-based competition and must be widely available; and

(8) innovations that increase value must be strongly rewarded.

To study the use of the QCM and the CDVC in practice, we have applied the two approaches on a concrete care delivery process: glaucoma care in the Rotterdam Eye Hospital, over a period of five years. We used the methodology described by Yin (2003) to evaluate our experiences. This methodology is advisable when the boundaries between the evaluated phenomenon and the context are not clearly evident and one has to cope with a situation in which there are many more variables of interest then data points. We have focused in our single, longitudinal case study on the following research questions:

RQ1. How did the organisation of the glaucoma care process develop between 2001 and 2006?

RQ2. What are the results of using a QCM and what is the relation to the CDVC?

RQ3. In which way does the new reimbursement system influence the quality costing behaviour of the hospital management?

Given the changing conditions in the reimbursement structure in 2005, we analyzed the use of the QCM and the applicability of the CDVC over the period 2001 to 2006. The unit of analysis is one specific care process in one specific hospital, the Rotterdam Eye Hospital. We have focused on glaucoma care delivery, because patient groups may be easily identified, treatment paths are obvious and the main routing of the patients is known. The case hospital (30 ophthalmologists, 350 employees) had its first experiences with the use of QCM for another care process, cataract surgery in the late 1990s (Bandel *et al.*, 1997, 1999).

Glaucoma is a group of eye diseases and one of the most common causes of blindness worldwide (Quigley and Broman, 2006). It affects the optic nerve that connects the eye to the brain and requires life-long treatment. It can be treated, but not cured, and approximately 1-2 per cent of the (Western) general population has it (NEI, 1998; Kymes *et al.*, 2006). Some more detailed characteristics of glaucoma are given below.

What is glaucoma?

Glaucoma is a group of eye diseases and one of the commonest causes of irreversible blindness worldwide. Approximately 1 or 2 per cent of the general population has it (Western world), but only half of all patients are aware of it (Quigley, 1996, Quigley and Broman, 2006). Without treatment it typically worsens slowly. Treatment may slow or stop the worsening.

Management of glaucoma requires many tests, e.g. visual fields, optic nerve examinations, eye pressure management and eye exam and is time consuming. Efficient management will save time, money and notably unnecessary blindness/suffering.

In the US, glaucoma is responsible for 7 million patient visits to the ophthalmologist and an annual financial burden on society (health expenditure and loss of income) was estimated to be US$1.5 billion in 1998 (NEI, 1998). Direct medical costs of American glaucoma patients have been recently estimated to be US$ 2.9 billion (PBA, 2007). The increased (double) aging of society will increase the need for glaucoma care over the next decades.

Methods

To obtain data to answer the research questions the following methods were applied:

- A multidisciplinary group of physicians, nurses and research employees twice created a flow chart of the glaucoma care process (in 2001 and in 2006). From these findings, and from formal changes in organisation of glaucoma care, a description of the developments in the organisation of the glaucoma care process over a period of five years is provided.
- Based on these flow charts, quality indicators were constructed for the different parts of the process. These indicators were based on literature, on clinical experience in the group, on measurability, on consequences for the patient and on critical position in total care delivery. For each quality indicator, a standard score was specified and costs were calculated. Potential costs of non-compliance were calculated. By means of patient records, patient satisfaction surveys and cost calculations, a zero level measure (2001) and two effect measures (2002 and 2006) were determined. The number of respondents by measurement instrument were as shown in Table I.

  We have used the statistical package "SPSS Inc. 15.0 for Windows" to analyze the data of the patient satisfaction surveys and patient records. Descriptive statistics were used to obtain frequencies and means for the different indicators.
- A literature and document search was done to gain up-to-date knowledge on relations between reimbursement and quality cost management. We used the databases PubMed/Medline, Cochrane Library, Emerald, Web of Knowledge and Web of Science and searched on: quality, costs, value chain, failure costs, cost of non-compliance, indicators, business case, reimbursement. For further understanding of the Dutch situation management letters, policy statements and (annual) reports from the case hospital and national stakeholders were used. The acquired insights were compared with the situation in our case study.

  To increase the construct validity, an expert group and key informants have reviewed the different drafts of the case study reports. They have confirmed the identified items that will be described in the results section. Data triangulation was used when comparing data gathered by the financial department with data generated by the involved medical department. For the same reason, those who have been the subjects of the case study (physicians, nurses, management) have reviewed and commented on the research outcomes.

Results

RQ1*: glaucoma care delivery process: design and developments*

The overall glaucoma care delivery process in the case hospital has been drawn in Figure 1.

Measurement instrument	2001 ($t = 0$)	2002 ($t = 1$)	2006 ($t = 2$)
Patient satisfaction survey	85	41	155
Patient records	73	30	78

Table I. Number of respondents by measurement instrument and time

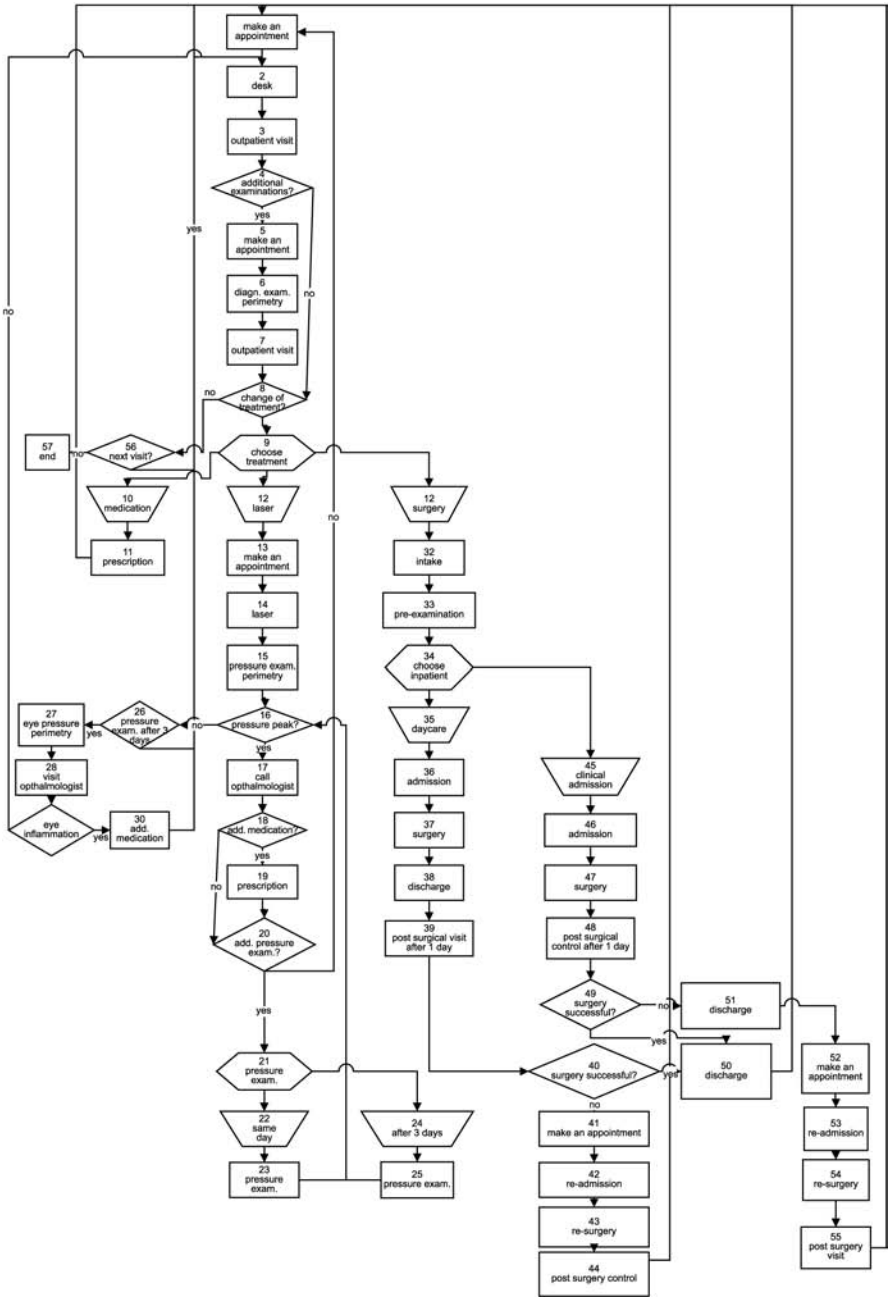

Figure 1.
Flow chart of glaucoma care process in the case hospital

The overall process of 2001 contains 57 different steps. The flow chart is similar to the one of 2006, although it contains important differences in the flow of stable glaucoma patients.

Developments in glaucoma care delivery

The analysis of the developments in glaucoma care in the case hospital showed important changes in the demand for care, innovation and organisational structure. In Figure 2, the developments in these areas are shown in their mutual relationship. We have drawn this framework to analyze the order and intensity of actions of the different developments and stake holders. Below, the different areas shown in Figure 2, will be discussed in more detail. Next, we comment on the different paths of the framework.

Developments in the demand for care. The number of outpatient visits increased with almost 40 per cent, from 6.879 patients in 2001 to 11.015 patients in 2006 (see Figure 3). The number of ophthalmologists for glaucoma is still the same (four).

The number of surgical procedures (trabeculectomy, Baerveldt implants) remained much the same, while the number of peripheral iridectomies (YAG-laser) and laser trabeculoplasties (LTPs) increased. In the outpatient department (OPD), the increasing number of visits at a fixed capacity overburdened the system. In 2002, restrictions on appointments for new patients were therefore introduced to regulate the flow. By shared care measures (see section "Shared care" below), the number of outpatient visits (first and follow-up visits) since 2004 increased.

Innovation and technology. Since 2002, a new imaging technology for the examination of the optic nerve has been used: the GDx VCC (Carl Zeiss Meditec, Inc., Dublin, California, USA), which measures the thickness of the optic nerve tissue. This may assist clinicians to make the diagnosis of glaucoma and also to monitor the disease (Reus, 2005). If carefully instructed, paramedics, such as technicians and optometrists, may also use the GDx VCC.

Shared care. The GDx VCC might also be used by optometrists in commercial optic dispensaries. In 1993, a collaborative project was started between optometrists in primary care and the, tertiary care, case hospital. Optometrists took pictures with the GDx VCC and sent the images via a protected online connection to the hospital. This yielded the detection of many previously undetected cases of glaucoma. These were seen and treated by the case hospital's glaucoma specialists. Referring stable glaucoma patients to the participating optic dispensaries for glaucoma monitoring however, failed. The dual substitution of tasks compared to usual care, i.e. follow-up by paramedics instead of by ophthalmologists, as well as follow-up outside the hospital instead of within, appeared to contribute largely to this failure (de Mul *et al.*, 2004, 2007; Verhoef *et al.*, 2004). Therefore, as well as because of the increasing burden at the OPD, a shared-care project within the hospital was started in 2004. This entailed establishing a so-called glaucoma shared care unit (Stevens *et al.*, 2002; Blanco *et al.*, 2007). Stable glaucoma patients visit this unit for follow-up visits twice at regular intervals, followed by a visit to the glaucoma ophthalmologist after the same interval. This led to a substantial increase in the number of visits both at the glaucoma shared care unit and the glaucoma OPD. As a result of this shared care, glaucoma specialists could focus on more difficult care delivery.

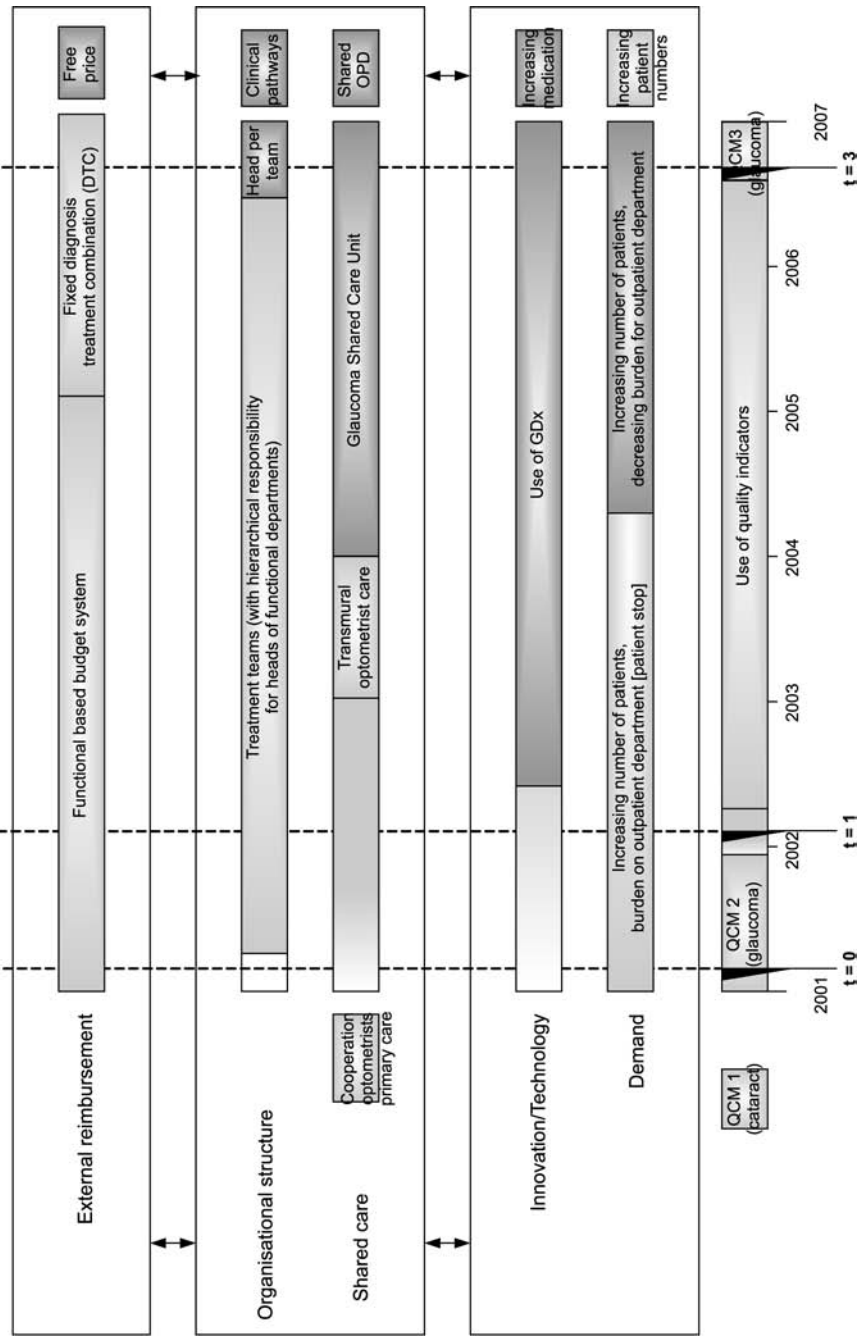

Figure 2.
Developments in glaucoma care delivery in the case hospital, 2001-2006

Organisational structure. From the perspective of organisational structure, a decrease in hierarchy levels occurred. In 2001, the organisation of the case hospital was determined by medical function. Many departments (perimetry, OPD) each with their own hierarchical heads, played a role in glaucoma care delivery. In the studied period, the focus changed to redesigning (clinical) treatment teams. In 2006, one hierarchical head per treatment team still existed. The organisational redesign was focussed on a more simple hierarchical structure per treatment team.

RQ2*: use of a QCM and a CDVC*

The integration of quality management and cost management is not a new issue for trade and industry. The most traditional models are the prevention appraisal failure costs (PAF) model designed by Feigenbaum (1956) and Masser (1957) and the process cost model (PCM) designed by Crosby (1979, 1983).

PAF. Investments in prevent and assessment could result in a decrease of costs of non-compliance. The model shows that a maximum quality level is not an economic option. Based on this model, perfect quality from economic perspective is never reachable. Maximum quality asks an endless investment in prevention with a result that is not profitable anymore. There is no evidence for this hypothesis (Diepman, 1996; Dale and Plunkett, 1995). The model also neglects the changing importance of quality. The more customers request quality, the more the strategic focus needs to be on prevention activities. Taking these statements into account, PAF is useful in prioritising improvements, but based on the ideas of total quality management (TQM) it is important to focus on the costs of each process instead of random defined quality costs. Based on these failures a process cost model was developed.

PCM. The PCM identifies all activities within the process, based on flow charts. The question of added value should be answered for each activity. Activities without added value can be eliminated. The costs of quality (COQ) are the sum of the cost of conformance (COC) and the costs of non-conformance (CONC), so COQ = COC + CONC (Hwang and Aspinwall, 1996).

Both the PAF and the PCM model share a restriction: they do not compare the necessary expenses and the obtained results. Health providers however, do prefer more insight in the necessary actions (costs) and the related effects (gains) of quality care in order to allocate the resources in an efficient way.

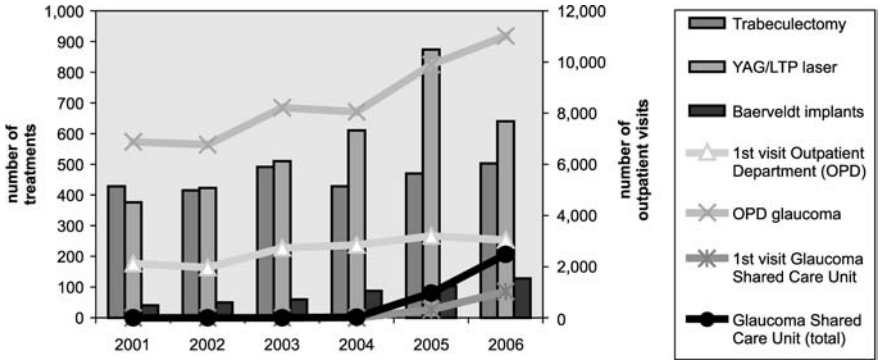

Figure 3.
Developments in (first time) visits at outpatient department (OPD), Glaucoma Shared Care Unit and surgery in case hospital, 2001-2006

Six Sigma. Another way of relating optimising processes to reducing costs is Six Sigma. This method is developed and widely used in industry and nowadays also experiences in health care (Van den Heuvel *et al.* 2004, 2006). Starting with identifying "critical to quality" characteristics, Six Sigma tries to tackle quality outcomes in five phases: define, measure, analyse, improve and control. It is also strongly oriented on organisational structure: a lot of project leaders (called Black Belts or Green Belts) are trained in project management, problem-solving methodology and statistical methods. For a hospital organisation, however, it is a question if it is stimulating for medical professionals to get involved into the details of strict managerial methods.

Business case for quality. Next to the earlier initiatives, there is a call for developing business cases for quality initiatives (Reiter *et al.*, 2007). Starting with describing the intervention and determining the case perspective, the effects on quality, cash flows are calculated. Up to now, research reports about the use of business cases mostly describe case studies (Leatherman *et al.*, 2003; Luck *et al.*, 2007; Manna *et al.*, 2006).

QCM

To define, measure and evaluate quality and cost outcomes in the case study, we used a QCM developed by Custers *et al.* (2001) (see Figure 4). The model integrates quality management and financial management, based on the advantages of PAF and PCM and with use of the principles of business case experiences. The consequences of poor quality and quality improvement on the bottom line of an organisation are made visible by QCM. By translating poor quality into costs of non-compliance and therefore the potential gain of corresponding savings highlights the importance of an improvement initiative from a managerial perspective and allows prioritising improvement initiatives on an economic argument. The costs of quality improvements can be set against the gains (benefits) of (potential) savings. The related cost benefit ratio's can be used to rank different quality improvements in order of importance. By comparing the realised and the potential costs and gains, monitoring becomes possible. Within this perspective, quality improvement initiatives are treated as investments in the sustainability of a health care organisation.

The care process that is linked to a certain category of patients (e.g. DBC) forms the centre of the QCM. The model starts with defining the care process, identifying the "critical success factors" based on what is medically important and the goals and strategy of the organisation and the formulation of the indicators (steps A to B).

Subsequently, the costs of non-compliance are calculated (step C). These costs of non-compliance represent the total costs to an organisation resulting from the failure to achieve quality. Per indicator, the costs of non-compliance can be calculated in terms of "repair activities" or "loss of income".

Next, the costs of non-compliance are compared to the standard (D). The steps E and F will lead to a prioritisation of the improvement initiatives. This includes an analysis of the underlying reasons for poor performance, the development of solutions and the implementation costs of these solutions. In step G the cost benefit ratio of each project will be calculated and based on this, the available resources and the scope of impact on the organisation a decision will be made on which improvement initiatives will be implemented. Table II shows the quality indicators that are used in the quality and cost study in the case hospital. The indicators and norms are primarily based on the

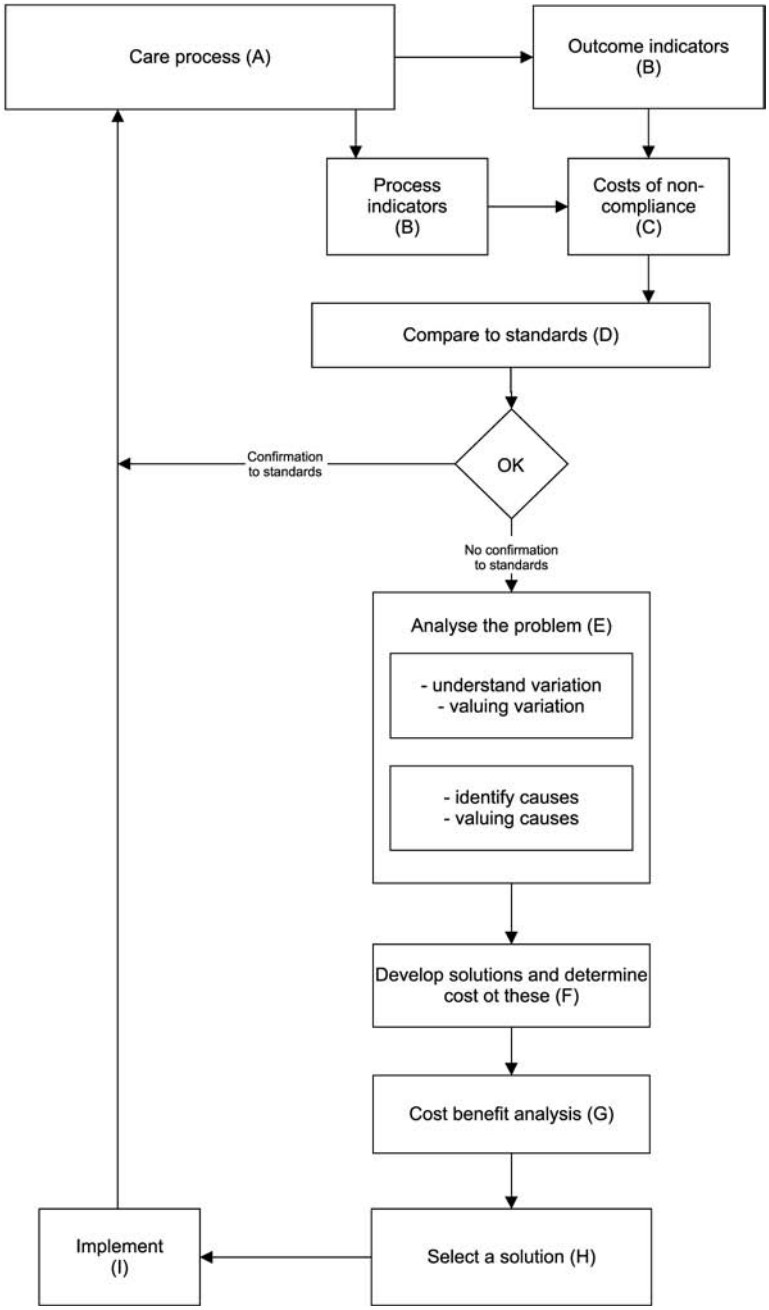

Figure 4.
Quality cost model (QCM)

Table II.
Quality indicators, costs of non-compliance and realised and potential cost savings: results in 2001, 2002 and 2006

	Indicator	Norm (%)	2001 score $t = 0$ (%)	CN/n (€)	CN (€)	2002 score $t = 1$ (%)	RCS ($t = 1$) (€)	2006 score $t = 2$ (%)	RCS ($t = 2$) (€)	RCS ($t = 1 + 2$) (€)	PCS ($t = 1 + 2$) (€)
	Medical effectiveness										
1	Target pressure (TP) is noted in patient medical record	*70*	*51*	9,91	11.863	*58*	1.695	*56*	1.307	3.002	8.861
	Efficiency										
2	Patients get a flyer at the outpatient department about examination of eye pressure (if this examination is necessary)	*95*	*74*	6,08	827	*74*	0	*84*	309	309	518
3	Waiting time for a glaucoma outpatient visit is half an hour maximally	*75*	*50*	1,45	457	*50*	0	*79*	262	262	195
4	Patients from outside the region go back to their own ophthalmologist if deemed possible	*80*	*62*	27,23	7.351	*62*	0	*62*	0	0	7.351
5	Medical patient record is available at the outpatient visit	*90*	*77*	17,36	14.216	*77*	0	*90*	7.725	7.726	6.490
	Patient oriented										
6	Patients get information about viewing, buying or hiring a CD-ROM about glaucoma	*80*	*15*	0,53	2.174	*15*	0	*100*	2.174	2.174	0
7	Patients get oral and written information at the clinic department about surgery and aftercare	*90*	*69*	2,83	195	*69*	0	*81*	74	74	121
8	Patients get actual information about length of any delays at the outpatient department	*90*	*71*	0,12	141	*71*	0	*71*	0	0	141
9	Patients are at first postoperative seen by their own surgeon.	*85*	*75*	18,1	597	*75*	0	*83*	198	198	399
10	Patients get surgery by the surgeon they saw earlier at outpatient department	*65*	*54*	18,44	664	*54*	0	*89*	504	504	160
11	Patients can make a combined visit at the perimetry and outpatient departments	*70*	*58*	7,11	2.254	*58*	0	*73*	810	810	1.444
					40.739		*1.695*		*13.364*	*15.059*	*25.680*

Notes: CN/n = costs of non-compliance per time; CN = costs of non-compliance; RCS ($t = 1$) = realised cost savings at $t = 1$; RCS ($t = 2$) = realised cost savings at $t = 2$; RCS ($t = 1 + 2$) = total realised cost savings; PCS = potential cost savings at $t = 2$

evidence and opinions of an multidisciplinary expert group composed of specialists and employees of the case study hospital.

Situation at t = *0 (2001)*. For each indicator, a normative score was determined. For example, the multidisciplinary group agreed that target pressure (TP) should be registered in the patient medical record for at least 70 per cent of all glaucoma patients. Observing a TP is considered to be important in glaucoma management. Writing it down precludes that it will be predetermined at each additional follow-up visit, thereby saving time and, therefore, costs.

After finishing the set of quality indicators and normative scores in 2001, a $t = 0$ measurement was performed. A total of 73 random selected medical records were analyzed for the notation of the TP. For 37 cases (51 per cent) TP was not noted in the medical record. Based on these results, the costs were calculated and an analysis of costs of non-compliance was made (see Table II). The costs of non-compliance for delivering higher care quality results at the 11 indicators are calculated at more than €40,000.

Results at t = *−1 (2002)*. In 2002, the first results showed that the outcome of the different indicators had not significantly changed. To count the costs of non-compliance, the price level of 2001 was used. The notation of the TP (indicator 1) had improved a little and gave a small reduction in costs of non-compliance (€1,695). In the multidisciplinary team, the importance of this indicator was stressed. Referring patients back to their own ophthalmologist outside the local region (4) was not achieved. Most patients were highly satisfied about the case hospital and the glaucoma ophthalmologists had few means to really refer them back. Moreover, the free choice of a care provider was generally considered to be important for each patient.

Results at t = *2 (2006)*. Five years after $t = 0$, a second measurement was done to analyze the results and to compare them to the normative scores. The TP was more often registered (indicator 1) compared to $t = 0$, but had worsened in comparison to $t = 1$. No significant changes are determined in referring patients back to their own opthalmologists (4) and the delivery of actual information about delay time at the outpatient department (8).

With respect to the indicators "maximum waiting time of 0.5 hour" (3), "surgeon should be the outpatient physician" (10), "combination appointment outpatient and perimetry department" (11) the norms were reached. Overall, the improvement on these indicators gave a reduction of costs of non-compliance of €13,364 after four years.

The availability of the patient medical record (5) was improved and met the standard in 2006, but the multidisciplinary group stressed the importance of reaching a 100 per cent score on this indicator. The dissemination of information by flyers about the examination of eye pressure (2) and about surgery and its aftercare (7) were also improved over time, but do not meet the predetermined standards, just like the indicator "first outpatient visit after post surgical control by the own surgeon" (9).

Expressed in the QCM the hospital realised a reduction in costs of non-compliance of €15,059 between 2001 and 2006. With respect to the projections of 2000, approximately 37 per cent was realised. Just a small part (approximately 4 per cent) was obtained in the first year after the introduction and the definition of the quality indicators.

CDVC

When QCM was developed, issues such as quality costs and the reduction of cost of non-compliance played an important role in the business-economic views on health

care (Morse, 1991; Donaldson and Gerard, 1993; Walburg, 2003). In more recent views and experiences in industry, one may see an approach towards (added) "value". Porter and Teisberg (2006) drew attention to the contribution of different activities in care processes in obtaining and increasing patient value. They developed the CDVC. Contrary to a demand-based healthcare system, Porter and Teisberg's value-oriented approach focussed on integrated treatment and service, available over time for the different medical conditions. In their views, each description of the care process has some fixed steps of different activities over time. Porter and Teisberg distinguish: monitoring/preventing, diagnosing, preparing, intervening and monitoring/managing. Although hospitals place both the recovering and the monitoring stage mostly outside of the care process, they are each important in obtaining patient value. In glaucoma care, most of the patients are in these stages a long time.

According to the CDVC model, three assessment criteria play an important role in creating patient value:

(1) *Assessing*. Patient access to care in the different parts of the process.

(2) *Measuring*. The ways of gaining information about medical aspects of the patient, during the care process, medical information is gathered repeatedly.

(3) *Informing*. Attention, instructions and coaching of the patient.

We transferred the 11 selected glaucoma quality indicators used in the QCM into the model of CDVC. As seen in Figure 5, the indicators cover almost the whole process and areas of assessing, measuring and informing.

The row of "measuring" was covered with few QCM quality indicators and these were partially effective in reducing costs. The process steps of "diagnosing" and "monitoring/managing" were covered by more QCM quality indicators and also showed a reduction of costs of non-compliance. By contrast, the columns "preparing" and "intervening" parts in the process were covered less for "assessing", "measuring", and "informing". The CDVC intends to show that total patient value consists of value activities and "margin". Value in health care is defined as the health outcome per dollar of cost expended. Margin is defined as "the difference between total value and the collective costs of realising value activities" (Porter and Teisberg, 2006). This collective perspective differs to the quality costing perspective of one single hospital. Benefits could be made in the part of the chain outside the hospital, while costs are made in de hospital.

RQ3: reimbursement and hospital management on quality and costs

Reimbursement not (yet) based on product-based quality results. A fixed reimbursement budget for hospitals and physicians (budget fee) still exists for most of the Dutch health care delivery (Aas, 1995; NZA, 2007). Since 2005 selected DBC's, approximately 10 per cent of the total care delivery in The Netherlands (for example cataract care), is financed by agreed prices and volumes between hospitals and insurance companies. Unlike cataract care, glaucoma is still part of the fixed budget and as a DBC not subject to negotiations with a health insurance company. Internal calculations of the hospital show that the actual reimbursement for glaucoma care within the fixed budget is about €300. This is far below the actual costs as calculated by the hospital of approximately €1,800. This number is close to estimations of what the price would be for glaucoma if they were negotiated between hospitals and health insurance companies (Ministry of

	Quality Cost Theory			Process orientated thinking		
Knowledge development	Cooperation optometrists in primary care	Developments in imaging technology		New pharmacology	Cooperation glaucoma patient organization	Application of optometrists and technicians/task substitution
Informing	Lifestyle counseling **CD-ROM (6)***	Explanation of diagnosis and implications **Brochure press. Exam. (2)** **CD-ROM (6)** **Information about delay (8)**	**CD-ROM (6)**	**CD-ROM (6)**	**CD-ROM (6)** **Information eye drops and after care (7)**	**CD-ROM (6)** **Information about delay (8)**
Measuring	GDx VCC Eye pressure management	Visual fields HFA GDx VCC Eye pressure Optic nerve exam. **Note TP** (1)	Intake & screening Depends on treatment		Eye pressure management GDx VCC	**Notice TP** (1)
Accessing	Visits commercial optic shops	Outpatient visit **Delay time (3)** **Patient record available (5)** **Combination attendence (11)**	Outpatient visit **Delay time (3)** **Patient record (5)**	Hospital visit **Surgery by own opthamologist (10)**	Glaucoma Shared Care Unit Outpatient visit **Length of delay (3)** **Post operative visit (9)**	Glaucoma Shared Care Unit **Delay time (3)** **Back-referral to opthamologist (4)** **Patient medical record available (5)**
	Outpatient department				Glaucoma Patient Organization	
	Monitoring/ preventing - screening risk group (annual) - risk factors	**Diagnosing** - medical and family history - risk factors - eye pressure	**Preparing** - surgery specific preparation (e.g. medication)	**Intervening** - pharmaceutical - surgery: trabeculectomy, Baerveldt implant - laser treatment	**Recovering/ rehabilitating** - cooperation patient organization/peer group	**Monitoring/managing** - screening (twice a year)

Provider margin

Patient value

(Health results per unit of costs)

* indicators in **bold** refer to indicators used in QCM

Figure 5.
Care delivery value chain for glaucoma

VWS, 2007; NZA, 2007). In the USA glaucoma surgery costs $2,270 (PBA, 2007). The current deficit on glaucoma care in the eye hospitals is internally covered through the profits made with cataract surgery. This way of substitution is common in a budget system, but is not in line with the policy aim to have market conform prices of specific care processes and their products. Zuurbier and Steinbusch (2006) have shown that relationships and transition tools between old and new systems for Dutch hospitals are necessary if hospitals want to maintain their current financial position.

Task substitution in the glaucoma shared care unit was (among other things) possible, because the health insurance companies fully reimbursed the visits by allied health professionals as if they had been executed by ophthalmologist themselves. Although the reimbursement did not cover the costs, the task substitution did not increase the loss per treatment (see also Williams and Cookson, 2006). As long as reimbursement of health care is not related to the activities involved in treating a patient, and the outcome of a treatment and prices are not freely negotiable, the reimbursement system is not proportionate. Delivering quality care and realising more demand gives just more loss in a system with already loss per treatment. In the current budget system for glaucoma care, quality improvement based on outcomes is more oppressed than stimulated.

No financial incentives for glaucoma ophthalmologists. The fee budget for physicians in which the financial returns depends on the adapted model of allocation between the partners. Allocation based on working hours, instead of piece-wages and quality of care does not give an added incentive. With local agreements on the reimbursements and quality of glaucoma care, ophthalmologists may benefit from increasing both the quantity and the quality of care.

No multidisciplinary glaucoma team with responsible process owner. During the last years, the treatment processes were more centralised in the internal business and organisational structure of the case hospital. Establishing a single head per treatment team in 2006 led to a more obvious hierarchy. One person now became responsible for the performance of the entire team. However, there was no multidisciplinary glaucoma team (with its own policy, planned meetings, etc). Managing and dividing of the budget among teams and departments is still based on standard parameters and costs of non-compliance are not shown and used for making budget decisions on a structural bases. Based on the theory "quality is free" (Crosby, 1983), the strategic top of the hospital tries to achieve improvements without more personnel or investments.

Discussion

Glaucoma care process redesign and development

The case hospital had a strategic motivation for using the QCM. Because of a national Dutch policy 15 years ago, single medical speciality hospitals had to close or merge ("big is beautiful"). The case hospital chose to stand out as a "centre of excellence" to avoid such a merger. Its quality had to be a distinguishing parameter, and the quality cost theory was seen as a driving force.

Use of quality cost models for specific treatment processes needs unequivocal steering of those processes (Custers *et al.*, 2004). In 2000, a QCM for glaucoma was introduced although without glaucoma care being organised as a separate product line with one person being responsible for the overall management of the quality and costs outcomes. Looking back, more successful use of QCM probably could have occurred with one assigned executive per treatment team (see also Walburg, 2003).

QCM and CDVC

QCM requires a certain degree of knowledge on the various cost elements that are linked to activities and potential revenue losses and information on the quality of care. In addition, the combination of quality and cost outcomes does not primarily interest physicians, nurses and other personnel as long as there are no direct financial consequences for functions and departments. Therefore, QCM should be used both top down and bottom up.

Developments in quality and costs are related to the CDVC theory of Porter and Teisberg (2006). We have tried to use this model as a framework for thinking in "value" by putting quality and cost results from QCM into CDVC. To really use and calculate "patient value" (in terms of health results per unit of cost), however, the meaning of "value" should be further operationalised. Comparing the QCM and the CDVC, value could be interpreted as a decrease of costs of non-compliance. Effects of added value and reduction of costs of non-compliance on care delivery processes are, however, different. Profit and loss account is similarly influenced by the growth of earnings and cost reduction. In the present Dutch health care system added value for patients differs from reduction of internal costs of non-compliance for the hospital. In contrast, the external costs of non-compliance (arising after hospital care delivery to a patient, due to non-conformities or defects at any stage of the care delivery) are more related to the total patient value and the cost for the whole society. CDVC forces to think in processes and gives attention to the different parts of the process, but more clues and wider operationalisation is necessary for the final purpose: fix and quantification of "patient value". In this respect the theory by Porter and Teisberg as presented in their book stays rather generic and vague as to how to calculate patient value.

To realise successful competition on results for care providers, determination of this value is important. Increase of earnings and decrease of costs has the same effects on gain. In the current Dutch health care system, patient value differs from a reduction in costs of non-compliance of the provider. Any reduction of direct costs has no added value to the patient. To a hospital organisation however, financial outcomes are important parameters.

Value based competition: principles and practice

The question for care providers in general and the case hospital in particular is: how useful is a CDVC in cooperating with actual care delivery and preparing for new provider roles in the upcoming decade? Comparing the principles for value-based competition used by Porter and Teisberg (2006) (see introduction) to day-to-day glaucoma care in the Netherlands, it seems to be the principles are (and could) used partly.

According to the first principle of CDVC, one should focus on value for patients, not just on lowering costs. Using the QCM will help organisations increasing the value for patients and at the same time create value for the organisation in terms of reducing costs and retaining and attracting more patients or high qualified staff. The notion of "value" however is not sufficiently operationalised. To measure value in "health results per unit of costs", detailed information about the outcome of care and costs are necessary. Hospitals should thus be asked to generate this type of output information. Successively to that, competition based on results could be realised if concrete outcome results are shown.

Second, the principle that high quality care could be less costly was the reason for using quality cost theory in the case study. The results of the QCM showed an improvement for patient and professional and a reduction of costs of non-compliance.

In the next principles, Porter and Teisberg (2006) stress that competition should centre on medical conditions over the full chain of care and competition should be regional and national, not just local. This chain approach plays a central role in the strategy of the case hospital in building an "eye care network" with optometrists, general practitioners and general hospitals. Building this kind of chains and creating matching chain outcome indicators, seems to be important in really meeting patients' needs all over the care chain. To measure added value over the total chain, it is necessary for providers to create cooperation between different (types of) organisations in care delivery.

Also the principle stating that value must be driven by provider experience, scale and learning at the medical condition level seems to play an important role in the case hospital. A hospital that focuses on selected treatments has much expertise on specific items, could treat large numbers of patients and have education for specialised physicians and other personnel. Integrated effects of experience, span of control and education can contribute to the creation of value. Porter and Teisberg (2006) draw in relation to this principle a virtual cycle, which relates large numbers of patients, rapid innovations and improvement of results.

In conclusion, in this case study we show that QCM and CDVC can be useful tools for hospital management to manage both on quality and cost outcomes in glaucoma care. Within the CDVC approach, QCM can be used to facilitate the choice between quality projects and provide focus on the potential reduction in costs of non-compliance. Over a period of five years, the studied care process has been better organisationally embedded, only as a reaction to competitive forces, and QCM has been applied successfully although with marginal financial gains. To reach agreement among the various stakeholders on what constitutes patient value could be a first step. The external validity of this single case study is increased by the fact that the context variables are not only relevant for the glaucoma care delivery, but also applicable for other care pathways. Although the theory of CDVC sounds nice, to realise it in practice is highly dependent on not only reengineering internal organisational processes and developing the necessary measurement tools on quality and costs but also on the existing external reimbursement system. Long-term value is surely not a quick win.

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