

Operational excellence in hospitals

Introduction

More than two decades ago, health-care institutions in Western countries started riding the wave of market liberalization and engaged in professionalizing health-care management. During that time, health-care processes were poorly designed and indubitably not characterized by “freedom of deficiencies” (Institute of Medicine, 1999). As a result, health-care costs were high and patients’ satisfaction was low. This was also the case in the Netherlands. Even before 2000, the Dutch Government seriously urged on reducing health-care costs by a mix of cost-containment policies and efforts to create more competition among health-care providers (Schut and Van de Ven, 2005). These efforts were market-oriented reforms preconditioned to establish a regulated competition in health care, which allows equal access to health care while containing costs. The Netherlands is one of the countries that closely meets the necessary preconditions of a regulated competition. These preconditions revolve around equality of risk selection, efficiency, safety and affordability of care (Van de Ven *et al.*, 2013; Maarse *et al.*, 2016). The Netherlands has the advantage that the same paying system is implemented in all hospitals and other health-care organizations. The fee-for-service system predictably led to a continuous rise of health-care costs due to the financially driven priority on output of care, not necessarily accompanied by higher quality levels.

Operational excellence in modern hospitals finds its foundation in quality and process improvement. Operational excellence is to optimize processes, products and services in relation to its requirements of the clients (Sanchez and Blanco, 2014). It has become an important strategy for organizational competitive advantage. Hence, operational excellence is striving for the best in quality and performance in all operations of the business, and is enabled by and organizations’ ability to an organization-wide process of focused and sustained incremental innovation. For each employee operational excellence is concretely defined in his or her function profile. Senior management is continuously signaling new challenges for the program and when needed it updates the program, for example, after a significant organizational or economic change (Found *et al.*, 2018). Well-known methodologies that enable such continuous improvement in organizations comprise, or are rooted in, among others Total Quality Management, Lean, Six Sigma and Lean Six Sigma. Hospitals are complex adaptive systems, and patient care delivery is desired to be from the highest quality with a zero-tolerance policy to medical errors and complications (Rouse, 2008). Achieving operational excellence is challenging because of the complexity of health care because its organization is fragmented and interconnected. Furthermore, many interdependent stakeholders are involved. There is a huge variability in patients’ medical conditions and needs, which makes standardizing processes difficult. Hospitals are subject to high standards and regulatory requirements in terms of patient safety, quality and privacy. Together with an elderly population having combinations of diseases and comorbidities, it is therefore one of the most challenging societal issues to achieve quality and process improvement while reducing costs in health care. This need for quality and



process improvement has been highlighted even more by the COVID-19 pandemic (Kuiper *et al.*, 2022). Even though health-care professionals often know how to improve patient care and organizational performance, successfully implementing the desired improvements in daily clinical practice remains challenging.

Much of the current debate about health-care quality is grounded on the explicit or implicit assumption that there is an innate trade-off between reducing cost and improving quality (Wackers *et al.*, 2022). The idea, that there is a trade-off, is rooted partly in confusion about what is meant by quality. The term “quality” has several interpretations. Mixing them up may cause problems, some of which may confuse policy discussions, create conflicts between health-care professionals and hospital management and impede solving problems within the health-care system. If it is the prevailing paradigm that reducing cost inevitably will compromise the quality of care, this very mindset becomes an obstacle in dealing with some of the most vexing problems of modern health care. To explore the meaning of quality, the three definitions of quality originated from the manufacturing industry and promoted by quality management pioneer Juran (1989) are still very useful. The definitions clarify the relationship between health-care quality and costs. They substantiate the paradoxical perspective that it is possible to enhance health-care quality while reduce costs. Juran’s primary definition of quality is “fitness for use,” which provides a conceptual guide for caregivers to highlight what is “fit” for a patient in his or her circumstances. By focusing on patient’s needs and expectations, this concept also helps clinicians clarify what is needed to prevent “overuse,” “underuse” or “misuse.” Juran’s “fitness for use” definition has two subsidiary definitions of quality as “features of a product or service” and “freedom from deficiencies” (Juran, 1989). Both have important implications for our conceptualization of health-care quality and help clarifying the complex relationship between quality and cost. Quality as “features of a product or service” implies that more features provide a better quality. However, more features typically cost more. Juran’s second subsidiary definition of quality as “freedom from deficiencies” relates to process improvement. With fewer deficiencies by better processes, a reduction in costs can be achieved. In clinical practice, costs reductions can be achieved by process improvements such as improving productivity; shortening cycle times and waiting times; reducing use of materials and energy; lessening administration and overhead; reducing number of readmissions; and improving patient outcomes. The focus on the “freedom from deficiencies” is primarily on process performance instead of on the “product or service” as in the “features” definition. The reduction of deficiencies in health care and administrative processes results in lower costs. In health care, patients and products are similar; the customer (i.e. the patient) is intimately involved in the delivery process. Therefore, process improvement in health care is a two-edged sword: quality goes up, whereas cost go down (Does *et al.*, 2010). The scoping review paper of Wackers *et al.* (2022) reports that 19 hospitals had positive effects on quality and costs by using different methodologies, such as value-based health care, Lean, Six Sigma and combinations. Unfortunately, from the paper of Wackers *et al.* it is not clearly identified which strategy is the most effective.

In this paper, we focus on quality and process improvement methodologies originated from the manufacturing industry used in health care (i.e. Six Sigma, Lean and Lean Six Sigma), followed by a retrospective evaluation based on quality improvement implementations in hospitals, in which the authors were involved (De Koning *et al.*, 2006). We have been involved in all selected cases in the methods section. One of the authors is a chief executive officer in six different hospitals, and another author is an external consultant and expert in quality improvement programs in all hospitals. Hence, we were able to experience the implementations from both sides: inside-out and outside-in. For this study, the most relevant cases were extracted and summarized in a chronological overview. It will

show the evolution of our thinking based on a critical reflection of what was going on in the hospitals.

Describing of the case studies

First, we give an overview of the results of 33 implementations of quality improvement programs in hospitals between 2001 and 2024. The implementations were carried out in 33 hospitals in the Netherlands: 4 (out of 7) academic, 16 (out of 27) teaching and 13 (out of 37) general hospitals. Different improvement programs were implemented in these hospitals: Six Sigma (cf. [Schroeder et al., 2008](#)), Lean Six Sigma (cf. [De Koning et al., 2006](#)), Lean (cf. [Black et al., 2016](#)) or the combination of Lean Thinking (cf. [Womack and Jones, 2003](#)) with Six Sigma. For this study, the most relevant cases were extracted and summarized in a chronological overview (see [Table 1](#)).

The timeline shows that we started in 2001 with the Six Sigma approach, the industry standard for process improvement in those days ([Snee and Hoerl, 2005](#)). After about five years, we introduced the combination of Lean and Six Sigma in hospitals because of its tremendous successes in service industries ([George, 2003](#)). [Table 1](#) shows that since 2014 we have experimented with several options for the combinations Lean and (Lean) Six Sigma.

Results

This section discusses the hospitals selected, summarizes the experiences of the implementation of the quality improvement programs in other hospitals and describes the interventions proposed to obtain operational excellence in hospitals.

In 2001, the Red Cross Hospital was the first Dutch hospital that implemented Six Sigma ([Van den Heuvel et al., 2005](#), [Snee and Hoerl, 2005](#)). The results of implementing Six Sigma were enthusiastically published and promoted. This first implementation of Six Sigma in a hospital in the Netherlands started by introducing the program to senior management, which was followed by training groups of 10–20 employees and letting them perform their own improvement projects. Every half year, a new group started. The employees enjoyed working with Six Sigma because this allowed them to choose and define their own projects and reap the benefits. Projects were selected from all over the organization, ranging from length of stay and nursing efficiency, to energy saving, computer maintenance and registration. Many projects aimed at solving really persistent problems, such as improving efficiency of the operation theater, increasing the capacity of CT scans or collective purchasing of implants. For the first time, the Red Cross Hospital's annual report of 2004 showed an extraordinary net result of more than €2m, instead of a few hundred thousand euros.

In 2004, during the times when one of the authors was involved in a Six Sigma implementation at a financial service organization, he was familiarized with Lean. Lean optimizes flow, eliminates waste, improves efficiency and promotes continuous improvement ([Liker and Convis, 2012](#)). Six Sigma, on the contrary, offers fewer standard solutions but provides a general analytic framework for both problem-solving and organizational infrastructure. Because patients go through medical care pathways in hospitals, the Lean approach promised added value for hospitals. It was therefore a logical step to combine the Lean speed with Six Sigma quality ([De Koning et al., 2006](#)). At the same time, one of the authors became the CEO of a teaching hospital in the Eastern part in the Netherlands. Also impressed by the Lean philosophy, he started this time with the Lean Six Sigma approach. In the period between 2004 and 2014, other hospitals were attracted to implement Lean Six Sigma as well, including a large number of academic, teaching and general hospitals in The Netherlands ([De Mast et al., 2022](#)). Additional publications appeared about the implementation of Lean Six Sigma at the University Medical Center

Table 1.
Overview of selected
hospitals,
methodology and
results

Results References	Period	Hospital	Quality improvement methodology	Costs savings
Van den Heuvel <i>et al.</i> (2005)	2001–2004	Red Cross Hospital, Beverwijk (general hospital)	Six Sigma	€2.4m based on annual report 2004
Van den Heuvel <i>et al.</i> (2006)	2005–2007	Canisius Wilhelmina Hospital, Nijmegen (teaching hospital)	Lean Six Sigma	€2.8m based on 37 successful Lean Six Sigma projects
Does <i>et al.</i> (2011)	2007–2022	University Medical Center Groningen (academic hospital)	Lean Six Sigma and after seven years combined with Lean	€30m for the period 2007–2014
Van Leeuwen and Does (2011)	2008–2015	Reiner de Graaf Gasthuis, Delft (teaching hospital)	Lean Six Sigma and in 2014 replaced by Lean	€4m annual savings in 2013
Heijink <i>et al.</i>, 2022	2016–2020	Red Cross Hospital, Beverwijk	Lean combined with Six Sigma	Efficiency improvement by 20%

Groningen (UMCG). The total financial impact of Lean Six Sigma over the first seven years at the UMCG has been approximately €30m (Does *et al.*, 2022). In 2014, UMCG received the Excellence in Practice Gold Award from the European Foundation for Management Development (Does and De Jong, 2014).

After many years of experience in implementing Lean Six Sigma in hospitals, we were able to categorize which projects are most suitable and should be run to increase quality and reduce cost (Niemeijer *et al.*, 2011). Although the approach of Lean Six Sigma was very successful in hospitals to reduce costs and improve quality, the number of persons involved was limited. In practice, only selected high-potential employees from all over the organization were trained to become a Lean Six Sigma project leader with a 10–14 days training for Black Belts (full-time project leaders) and a 6–8 days training for Green Belts (part-time project leaders). These courses teach the Define-Measure-Analyze-Improve-Control (DMAIC) roadmap, with the corresponding tools (De Mast *et al.*, 2022). The project leaders are required to practice the new knowledge in an improvement project. The number of employees trained in the Lean Six Sigma methodology did not exceed more than a few percent over the total number of employees (Does *et al.*, 2022).

Studying change management in organizations, there are two main theories to follow: Theory E is change based on economic value and Theory O is change based on organizational capability (Beer and Nohria, 2000). Our first implementations were based on Theory E and introduced (Lean) Six Sigma top-down. The bottom-up approach to create awareness, involvement of employees and a change of attitude on the work floor relates to Theory O. Since 2014, we have experimented with other improvement approaches in hospitals to involve much more health-care professionals and other employees.

Our first new initiative started in the Reinier de Graaf hospital in the Netherlands. Like other hospitals, they had successful positive outcomes with Lean Six Sigma, which resulted in annual structural savings of €4m in 2013. The CEO of this hospital and a team of health-care professionals were inspired by a Lean conference in Florida in 2013 and visited several sites. Especially, during the site visits, the team of this hospital was impressed by the impact Lean has on organizational performance, employee empowerment and job satisfaction. This inspired them to start implementing Lean, which consequently ended the Lean Six Sigma approach. Compared to Lean Six Sigma, implementing Lean is far more comprehensive and an intensive lifelong enterprise. Virginia Mason in Seattle is an impressive example (Kenney, 2011), as well as the Theda Care Clinics in Wisconsin (Mannon, 2014). Both hospitals served as examples in the Reinier de Graaf hospital to involve many more employees in continuous improvement.

In 2014, the UMCG decided to also train Yellow Belts and Orange Belts to increase the number employees working with improvement methodologies. These belts were recruited from all areas of the hospital, including administrative and facilities employees and nutrition assistants. The Yellow Belts supported the Black and Green Belt projects, and the Orange Belts focused on how they could improve their own work and processes and became Lean experts. This typically resulted in a financial savings of about €8,000 per project. The new belts received a two-day training that covered the foundation and basics of the Lean Six Sigma DMAIC method. The Orange Belts received an additional one-day training on lean techniques. Since 2014, about 1,500 Yellow Belts and more than 350 Orange Belts have been trained in the UMCG (Does *et al.*, 2022).

Other Dutch hospitals have followed similar approaches of training and involving more employees in continuous improvement in smaller steps. When one of the authors left management of the Red Cross Hospital in 2005, priorities in the board changed, Six Sigma faded away within half a year and serious financial concerns gradually emerged. From 2016

to 2020, he became chief executive officer of the hospital again. With the experience gained, the hospital started with Lean management. Green and Black Belt projects were initiated, so Six Sigma was also revitalized (Heijink *et al.*, 2022). Even after retirement of the author in 2020, health-care professionals remain to work use Lean with enthusiasm because it gives control over their own workplace, is in their own interest and provides the best results.

Limitations

The focus of this retrospective evaluation is on hospitals in the Netherlands, although we believe that the conclusions extend to other Western countries because many countries have adopted quality and process improvement programs to improve health-care operations and reduce costs (Wackers *et al.*, 2022). Furthermore, challenges and pressure such as the COVID-19 pandemic affected many health-care organizations worldwide. Nevertheless, each country has its own health-care system and the scope of projects that took place can differ. The generalizability of this research therefore might be limited. However, to improve health-care processes and to reduce costs by means of a quality and process improvement program, like Lean, Six Sigma or Lean Six Sigma has found broad acceptance, so the implications may well carry over to other countries.

Discussion

The challenge for future health-care delivery is to sustain accessibility and affordability and deliver a high level of quality. An erroneous approach is to focus singularly on cost reductions instead of quality and process improvement. Future hospitals require to become resilient and to strive for performance excellence. Even though there is a significant importance, there is limited knowledge on what the best practical strategy is to achieve performance excellence throughout hospitals with complex adaptive systems.

Wackers *et al.* (2022) mentioned that payer-initiated cost-containment policies are ineffective in a complex adaptive hospital system. This is an interesting observation that can be better understood by looking at the dynamics of a such a system. A complex adaptive system consists of independent agents and their multiple mutual relationships. In case of a hospital, the agents are health-care professionals, managers, departments, administrators, whom are all connected to each other. They act primarily in their own interests and vision to best serve patient's needs. Agents in a complex adaptive system are intelligent and they experiment, learn and adapt. Due to this adaptation, the behavior of the whole system changes over time (Rouse, 2008).

Lean practitioners will recognize these items (Rother, 2009). Bringing people of different professional backgrounds together, having all relevant information at hand and let them work together to find solutions is done in Kaizen events (Black *et al.*, 2016). With daily start-ups in the entire organization, you create a strong network for solving problems and continuous improvement. This is always done by experimenting and coaching.

Conclusions and implementation

There is an explicit and implicit assumption in health care that there is a trade-off between reducing costs and improving quality. An exploration of quality definitions and quality improvement methodologies in health care helps to refute this assumption and guide the way to performance excellence in hospitals. Both Lean Management and (Lean) Six Sigma, by focusing on process improvement, can enhance quality of care and lower the costs. Considering hospitals being complex adaptive systems, in which a hierarchical approach like Lean Six Sigma does not work perfectly, the conclusion of this study is that the best strategy for a hospital to obtain performance excellence with the involvement of many employees is the Lean Management approach in combination with running projects based on the Six Sigma DMAIC methodology. It results in a bottom-up execution with top-down control by the DMAIC approach: Projects proposed and

executed by Green and Black Belts from the whole organization, but ratified and reviewed by management and program managers steering at the big fishes in the organization. DMAIC projects analyze and improve the process, ensuring that its basic structure and configuration are good with the assistance of employees from the work floor, who are usually members of the project team (Yellow Belts). The final stage of a project (Control) lays down structures for continuous improvement by Lean experts who are recruited from the whole organization (Orange Belts). The results are grounded on quality improvement projects that were initiated, implemented, executed or supervised by the authors, whom have also implemented, educated, trained and coached Lean and Six Sigma in health care because it was first introduced in the Netherlands.

Knowledge from scientific articles and experience is represented throughout this manuscript that encompasses the “silver bullet” to achieve operational excellence in modern and future hospitals. Further research is needed if this recommendation can be carried over to other countries and organizations. In 2024, a new implementation starts in a general hospital following the approach from this study. We expect that many hospitals will follow.

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Further reading

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