Lean Leadership Health Care:
enhancing peri-operative processes in a hospital

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The studies presented in this thesis were conducted within LIDZ, a Dutch network for lean practitioners, Utrecht, the Netherlands, and EMGO Institute for Health and Care Research, VU University medical center Amsterdam, the Netherlands.

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Lean Leadership Health Care:
enhancing peri-operative processes in a hospital

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Chapter 1

General Introduction
General Introduction

This thesis focuses on four areas, all related to the concept of ‘lean’ in health care settings. These areas are: Lean Philosophy, Lean Practice, Lean Leadership and Lean Transformation.

This thesis also contributes to the knowledgebase of Lean practice and Lean leadership in healthcare and provides a resource for those contemplating Lean transformation in this sector. The thesis comprises the following sections.

Section 1: Introduction

This provides an overview of Lean practice and presents a ‘roadmap’ to successful Lean implementation. This model is applied to healthcare, identifying areas of tension and implementation challenges in a hospital setting. Gaps in the literature are identified and the research questions and thesis methodology are presented. Six original studies to be presented in subsequent chapters are summarised and Lean philosophy, Lean leadership and Lean tools are reviewed in a theoretical framework.

Sections 2-7: Six original studies

Three case studies provide examples of the successful implementation of Lean practice in healthcare. A further three studies focus on Lean leadership and challenges of Lean transformation in healthcare, and address gaps in the literature identified in the Introduction.

Section 8: Discussion

The discussion reflects on the experiences and findings of the six studies. Factors influencing the implementation of Lean practice are discussed, and how leaders can use such knowledge to facilitate the process. Lean leadership style is compared with traditional leadership styles. The culture and complexity of healthcare and their influence on Lean transformation is considered and a synthesis of critical success factors for the implementation of Lean practice in healthcare is presented.
‘Lean’ and its adoption in healthcare

**Lean philosophy and Lean practice**

The term *Lean production* was first used in the 1980s to describe the approach to production used by the Japanese car company, Toyota. (Krafcik, 1988; Womack et al., 1991) *Lean philosophy* characterised a radically new approach to manufacturing in which the creation of maximum value for the customer lay at the heart of an organisation’s values. Through the elimination of wasteful processes in a culture of continuous improvement, *Lean practice* delivered better outcomes for the customer and enabled Toyota to deliver superior productivity compared with Western car manufacturers.

**Lean leadership and Lean transformation**

Following the Toyota example, many manufacturing and service organisations have also introduced and enjoyed substantial benefits from Lean practice. From a historical perspective Lean first appeared in UK health service in 2001, and in the USA in 2002. The literature suggests considerable variability in the implementation of Lean with differences in approach and scope. Specifically, the majority of healthcare providers tend towards small enclosed projects that create ‘pockets of best practice’ rather than adopting an organization or system-wide approach (Radnor, 2010). However, the change from a *Traditional management* style and manufacturing processes to a *Lean management* style, Lean practice and new ways of thinking requires effective *Lean leadership*. While the qualities and skills that truly characterise effective *Lean leaders* continue to be debated, Lean leaders across many sectors have successfully driven *Lean transformation*, requiring the creation of a new environment in which Lean practice is embraced by everyone in the organisation.

**Lean philosophy, practice and leadership in healthcare**

Over the past 10 years Lean practice has been introduced into healthcare, though with varying success. Lean philosophy in this context considers the patient as the
‘customer’ and examples of successful Lean initiatives include improvements in the quality of care and patient safety. However, while healthcare organisations such as hospitals have much in common with manufacturing and other service institutions, the transfer of evidence-based management practices to healthcare is viewed sceptically by some. For example, the customer and commissioner in the private sector are one and the same, which is essential in determining ‘customer value’ that drives process improvement activities. In healthcare a range of actors can be identified. The most common customers for hospital staff are the patients as the immediate recipients of care, but also Health Insurance companies and practice-based commissioners as the purchasers of care, central political organizations as regulators, and other internal hospital departments can be identified as ‘customer’. Healthcare organisations such as hospitals are also highly complex professional environments with a unique and embedded culture among employees. Implementing Lean practice in healthcare has been associated with many challenges. These include: resistance to change, a need for evidence that Lean initiatives will work, lack of time to undertake both improvement projects and routine daily activities, and interdepartmental friction if patients move between parts of a hospital that have not fully adopted a Lean philosophy.

To enable patients and healthcare organisations to enjoy the benefits of Lean practice experienced by organisations in other sectors, effective Lean leadership in the complex environment of healthcare is critical. Therefore, an understanding of the style and leadership characteristics required by Lean leaders in healthcare is essential, though the body of literature on this subject is still in its youth.

**Lean philosophy: the elimination of waste**

Lean production, originating at Toyota in the 1980s, placed the creation of maximum value for the customer at the heart of manufacturing philosophy while reducing human effort, resources, inventory, time and manufacturing defects.

There is no universal definition of Lean thinking but five principles prevail: value (benefit gained - as perceived by the customer), value stream (all processes
involved in delivering value to the customer), flow (the smooth, efficient
functioning of the value stream), pull (the system responds to customer demand
so as not to build up inventory) and perfection (elimination of waste) (Womack et
al., 1991).

Lean thinking may be described as:

“an integrated system of principles, practices, tools, and techniques
focused on reducing waste, synchronizing work flows, and managing
variability in production flows” (de Koning et al., 2006)

Elimination of ‘waste’ is critical to the success of Lean philosophy and three types
of problem (commonly grouped as ‘waste’ in Lean practice) are identified which
inhibit the flow and smoothness of work (Kruskal et al., 2012): muda (the
Japanese for waste or uselessness - used to describe non-value-adding activities),
muri (overuse of staff, systems or equipment) and mura (unplanned variations in
a process). In focusing on waste elimination and improvement in work flow, every
activity can add value for the customer whilst operational costs are reduced.

Lean practice has been used across many sectors over the past 30 years but until
recently, business management techniques have been perceived as a separate
discipline from healthcare management. Yet, the principles of Lean thinking are
considered as appropriate to healthcare as to manufacturing and other service
industries (Kim et al., 2006; Ben-Tovim et al., 2008). Over the past 10 years, Lean
practice has been successfully applied to healthcare, with Lean healthcare
literature appearing from 2001 in the UK and 2002 in the US (Robinson et al.,
2012).

However, Lean thinking encompasses not only operational components (a ‘quality
system’ (Joosten et al., 2009)) but also the development of a ‘quality culture’ – an
interaction between people and technology. This concept is often described as an
integrated sociotechnical system (Joosten et al., 2009; Poksinska et al., 2013). In
adopting Lean practice, operational practices must change but people – both
managers and employees – must also go through a process of change. The next
section therefore describes this transformation process and introduces a model which helps to identify tensions along the way.

**Overview of Lean transformation**

*The evolution of Lean management during a Lean transformation process*

During a transformation process, three phases of transition are recognised (Bridges, 2009), which can be mapped alongside three differing styles of management associated with a Lean transformation process (Plette, 2014). Initially, people are uncomfortable with change, are uncertain about their ability to learn new skills and require considerable support and reassurance from managers. Managers must let go of their usual working style of *traditional management*, often associated with hierarchical structure and ‘top-down’ processes. As transition progresses, confusion, impatience and continuing uncertainty requires leaders to create hope and allow employees adequate time for adjustment. As managers change their own practices, an ambiguous *mixed management* style can result because true Lean management has not yet been achieved. Ultimately, individuals appreciate their new role and their ability to fulfil it. Openness to learning and strengthened commitment of individuals can be reinforced by managers whose style has now fully evolved to one of *Lean management* – the communication of the company vision, support and emphasis of the significant role which individuals play.

*The Lean transformation process and identification of tensions when applied to healthcare*

It is useful to consider a conceptual framework, the Transition-to-Lean Roadmap (Bozdogan et al., 2000), which presents a high-level view of the steps required to commence, maintain and support continuous improvement in a Lean transformation process. Three cycles of activity underpin the roadmap (Figure 1).
The entry/re-entry cycle commences with strategic planning and a decision to implement a Lean transformation process, followed by a commitment to adopt a Lean paradigm; an initial Lean vision evolves. To implement a Lean paradigm, existing culture, relationships with all stakeholders (particularly the end consumer), practices, processes, assumptions, resources and business processes must be re-evaluated. Strategic planning and therefore future modification of Lean practices are influenced by lessons learnt from the Lean transformation.
process, and also by environmental factors such as the continuously changing political, economic, regulatory and technological climate. In general, a hospital board and chief executive will initiate the strategic planning process towards a Lean paradigm within the entry cycle.

As the experience of implementing Lean practice in healthcare has a much shorter history than its application to manufacturing and other service industries, the strategic decision to adopt a lean paradigm in a highly complex environment such as a hospital is particularly enterprising, and will itself be a lengthy, complex and controversial process, associated with many political and economic tensions. Arguably, these tensions will arise in the entry cycle of the roadmap (Figure 2).

Adopting healthcare practices is heavily dependent on evidence-based medicine, which has been around for many years, but evidence-based management in healthcare is still evolving (DelliFraine et al., 2010). Initiatives in evidence-based management are generally founded on conceptual arguments because there is a lack of empirical research that demonstrate its effectiveness. The literature on Lean healthcare is young and there are still relatively few studies on the application of Lean principles in medicine (Yousri et al., 2011). Further, there is considerable debate as to whether Lean thinking can improve healthcare (DelliFraine et al., 2010; Joosten et al., 2009).

The long term cycle (or ‘Create the Environment’) prepares the organisation for detailed planning and implementation through creating an appropriate environment. The organisation moves to a focus on activities and resources which create value and the elimination of those that do not (as waste); a detailed Lean vision is developed. However, this cannot be achieved unless organisational structure and behaviours (indeed the culture of the organisation, which may be long-standing and deeply embedded) are appropriately developed. In the long term cycle of the complex professional environment of a hospital, the patient should be considered the primary customer and the value stream refers to all the activities (appointments, consultations, investigations and treatments) that contribute towards helping a patient to overcome a medical problem. Elimination of waste includes the prevention of delays, unnecessary encounters, mistakes and
needless procedures, which can result in improved patient safety, satisfaction, quality of care and operational efficiency. The importance of transformational/Lean leadership in enabling such changes to occur will be considered later. Once achieved, which can take many months or even longer, the organisation is prepared for detailed planning and implementation. The long term cycle is ‘re-entered’ when the results of Lean transformation are realised and/or environmental conditions change, which influence strategic planning.
The short term cycle (or ‘Detailed Implementation’) moves quickly. An implementation plan is developed and activities are prioritised, supported by adequate resources, education and training. Specific programmes, projects and activities are executed. The results of changes are monitored and corrective action is taken as part of a continuous improvement process. Lessons learned from the short term cycle drive modifications to organisational structure and behaviour and ultimately strategic planning.

Many healthcare professionals see a huge distinction between manufacturing and healthcare. ‘People are not automobiles’ and ‘each patient is unique’ represent common arguments expressed initially by resistant staff (Kim et al., 2006). Others consider Lean as an alternative way of describing planned cost-cutting with staff layoffs (Kim et al., 2006). Further, healthcare professionals live in a rigorous evidence-based environment and demand scientific proof before implementing any change in practice (Andersen et al., 2014). Thus, discord exists between the culture of healthcare and Lean thinking. The healthcare literature on Lean practice recognises the importance of creating an appropriate environment and cultural acceptance of change before detailed implementation of improvement initiatives. Without such preparation, implementation often fails. On the Transition-to-Lean Roadmap, these tensions exist, and must be overcome, at the interface between the long term (creating the environment) and short term (detailed implementation) cycles (Figure 2).

Healthcare organisations are highly complex environments in terms of both flow (Plette, 2014) (the patient journey) and organisational structure. The patient journey may involve many departments (Plette, 2014) in the same organisation: waiting room, emergency room, ward, operating theatre and laboratories, many of which are managed as completely independently functioning units (‘silos’) (Kim et al., 2006). Yet Lean teaching recommends that optimising performance of an individual unit within a larger organisation is inadequate and cooperation of multiple units (Kim et al., 2006) across divisional boundaries (Mann, 2009) is required to achieve sustained performance improvement. Without the
involvement and commitment of all hospital departments to Lean transformation, interdepartmental conflict is likely.

Whilst the ultimate objective is to adopt Lean practice across the whole of the organisation, such a massive undertaking may well be initiated with the piloting of Lean practice in some departments, extending the change in phases. Whilst perhaps considered prudent, this may exacerbate the abovementioned problem of interdepartmental collaboration during transformation. Redefining the way hospital departments collaborate can be seen as an essential component of the long term cycle, in which ‘Development of lean structure and behaviour’ is supported by shifting organisational structure from a ‘vertical to a horizontal focus’, elimination of ‘unnecessary layers of management’ and decentralisation of decision-making (Bozdogan et al., 2000). Over the period in which the hospital moves towards full Lean transformation and full departmental collaboration, inevitable tensions will arise during such reorganisation (Figure 2), as described in the studies in future chapters. Lean transformation was initially introduced in only four departments of the teaching hospital in the Netherlands, as described in sections 2-7, and the barrier of ‘Functional and professional silos’ hindering the patient journey and flow of information is identified in chapter 6.

Finally, and similar to organisations such as Toyota, large organisations such as hospitals are continuously influenced by political, economic, regulatory and technological factors. This often results in a changing strategy, which can have a negative impact on potentially successful improvement programmes (Aij et al., 2013), and which represents a further source of tensions (Figure 2).

Having established a route to Lean transformation and recognized some potential areas of tension when Lean practice is applied to complex healthcare environments, it is now appropriate to identify gaps in the literature, which help to inform the focus of our research.
Gaps in the Lean healthcare literature

The Lean healthcare literature started to appear in 2001 (Robinson et al., 2012), some two decades later than the general Lean literature. Consequently, a number of gaps still exist in the healthcare literature. To inform the content and direction of this thesis, some of these are described below.

**How can we measure the effectiveness of Lean transformation?**

Organisations that successfully go through a process of Lean transformation often wish to demonstrate their success and apply for prestigious awards. Holistic performance measurement tools such as the European Excellence Model (EFQM, 2014) are available. However, these tools are most often used in support of application for an award by experts after the transformation process has succeeded (Dahlgaard et al., 2011). Consequently, there is a need for a simple technique which allows employees to participate in the assessment of Lean (Dahlgaard et al., 2011), and which can therefore be used as a parameter to identify possible facilitators to the process.

**What may facilitate the implementation of Lean healthcare?**

The literature on Lean facilitators in healthcare is growing. Factors such as the influence of management, resources and culture are important, but in-depth analysis of different facilitators is still needed (Andersen et al., 2014). Further, statistical evidence supporting facilitators of Lean healthcare is limited (Holden, 2011).

**A need for studies that examine the complex dynamics of Lean transformation**

Whilst operational performance (quality systems) receives attention in the literature, the complex interaction between people and technology to achieve a ‘quality culture’ (an ‘integrated sociotechnical system’ (Joosten et al., 2009; Poksinska et al., 2013)) requires further attention. Case studies provide useful insights but have considerable limitations regarding broad applicability and special
methods for investigation are needed to unravel the complex interactions and interventions which Lean thinking involves (Joosten et al., 2009).

**Can we characterise Lean leadership and relate this to leadership models?**

There are very few studies of Lean leadership in healthcare that relate findings to a leadership model (Pokinska et al., 2013) and provide a template for leaders to follow. Mann describes a Lean management system that provides valuable guidance to support implementation and sustainability of Lean (Mann, 2010). However, such an approach does not depict the true spirit of Lean leadership – the qualities and characteristics Lean leaders require to be successful.

Different levels of leaders (Senge, 1996) (executive, network and line) and types of culture (Schein, 1996) (operator, engineering and executive) are described and are required to interact and collaborate to successfully bring about change. Leaders certainly require appropriate qualities and skills, but these may not be clarified (Daft, 2010) and there is an argument that good leadership relies on competence rather than inherent leadership ability (Jaques and Clement, 1991). Thus, there little agreement about what leadership styles and competencies are important to implement Lean transformation and there is a need for research that provides a deeper understanding of Lean leadership and Lean management practices both in general and certainly in healthcare, positioning such insights in relation to contemporary leadership theory (Pokinska et al., 2013).

**Research questions and methodology**

In the previous paragraphs, using the ‘Transition-to-Lean Roadmap’ strategic approach and applying this to daily healthcare practices, some likely sources of tension during the process of Lean transformation have been identified. Due to the youth of the Lean healthcare literature, there remain gaps in the current body of knowledge. This raises several questions that seek an answer.

Firstly, it is desirable to develop a more thorough description of the meaning of Lean leadership and determine the characteristics required for effective Lean
leadership. This can occur by the identification of facilitators and barriers to the implementation of Lean healthcare and the determination as to how leaders can use this knowledge to foster a successful transformation process. Lean is always implemented in complex cultural contexts. Thus, an understanding of the complex interactions between Lean transformation and cultural dimensions of organisations, like routines and rules, is necessary. Finally, there is a lack of examples of tools used and case studies of Lean implementation in healthcare. These case examples are required to supplement the empirical evidence base and increase our understanding of Lean leadership.

From this, the primary research questions and the related sub-questions of this thesis are:

I. Whether and how can healthcare organisations benefit from lean practice?
   A. How can we better understand the complex interactions and cultural implications of Lean transformation in healthcare?
   B. What examples of tools used and case studies of Lean implementation in healthcare can be provided?

II. How can Lean leadership help to overcome the organisational barriers to effectively implement and sustain a lean transformation?
   A. What facilitators and barriers to the implementation of Lean healthcare can be identified and how may leaders use this knowledge to ensure the transformation process as successful as possible?
   B. How can lean leadership be defined and what characteristics are required for effective Lean leadership in comparison with existing leadership models?
Study design

The primary research questions and the related sub-questions of this thesis were addressed by a series of six case studies, each with a different approach and methodology. Overall, in each case study, we followed a combination of quantitative and qualitative research approaches.

**General**

In general, a mixed methods study was designed, based on a ‘complementary strengths’ stance (Greene, 2007), sometimes called multi-method research (Morse, 2003). This means that for individual studies different research methodologies have been used, “each conducted rigorously and complete in itself in one project” (Morse, 2003).

We began by systematically reviewing existing literature on Lean practice in healthcare. We investigated whether and how healthcare organisations benefited from Lean practice, how the applications of Lean principles and tools in the complex dynamics of Lean transformation were evaluated, how healthcare organisations were prepared for detailed Lean implementation, which factors influenced the implementation of Lean in healthcare, how Lean leadership was defined and what characteristics were required for effective Lean leadership in comparison to existing leadership models.

In the subsequent case studies, mixed methods, including quantitative (questionnaires, surgical case study, and outcome measurements) and qualitative methods (observations, interviews, document analysis) were carried out to obtain data from medical, surgical, and nursing professionals, and hospital leaders and other staff (Klazinga et al. 2007). One of the studies was carried out as an (auto)ethnography: this study examines how the lean leader experiences the implementation of lean in the context of cultural aspects of his organisation (Denzin, 2000). Ethnography studies the everyday experiences of people in the context of the social processes within organizations (Ybema et al., 2009). Autoethnography is a highly personalized account that draws upon the
experiences of the researcher for the purposes of extending sociological understanding (Sparkes, 2000). Autoethnography can be seen as an approach to learn from singular experiences and to gradually develop experiential expertise (Visse & Niemeijer, submitted). In general, autoethnographic texts democratize the representational sphere of culture by locating the particular experiences of individuals – in this case the Lean leader - in tension with dominant expressions of discursive power (Neumann, 1996). In this thesis, autoethnography shines a different light on the particular experience of ‘learning lean’ and the challenges that evokes.

**Datacollection and -analysis**

The datacollection process was cyclic and emergent/iterative, meaning that steps naturally evolved during the research process. During the data analysis process, we compared and combined the findings of the various methods. The outcomes of the quantitative and qualitative studies were regarded as equally important.

An overview of the data collection methods and outcome measures per study is presented in table 1.
Table 1. Overview of data collection methods and outcome measures.

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Chapter</th>
<th>Approach and data collection methods</th>
<th>Outcome measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>Longitudinal case study: A digital counter recorded door movement during surgical procedures during 8 months.</td>
<td>The relevance of and the possibility for a reduction of door movement during surgery by lean management methods in general and an A3 intervention in particular. This intervention stimulated dialogue and encouraged knowledge-sharing and collaboration between specialized healthcare professionals and this resulted in a thorough root-cause analysis that provided synergy in the countermeasures - with, according to respondents, a sustainable result.</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>A before-after case study: a Lean mapping tool, Makigami, was used in an operating room at a large surgical department in the Netherlands.</td>
<td>A focus on process led to a reduction in transfers and errors, which indicate a higher quality of care.</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>A before-after case study: We applied and evaluated the principles and tools of Lean thinking, especially VSM processes, to improve the process of delivering care to patients referred for oesophageal cancer.</td>
<td>Our results suggest that the VSM method, based on Lean thinking, can help to better arrange the care processes for patients</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>Survey study: A survey was conducted among employees of an operating theatre (OT) in a Dutch university medical centre</td>
<td>The results showed positive correlations between both leadership styles and the implementation of lean healthcare. Moreover, the results indicated a strong correlation between workforce flexibility and the implementation of lean healthcare.</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>Qualitative Study with Semi-structured interviews in one of largest teaching hospitals</td>
<td>The evidence obtained in this study shows that, from the perspectives of participants, leadership management support, a continuous learning environment, and cross-departmental cooperation play a significant role in successful lean implementation. The results suggest that a lean training programme contributed to positive outcomes in personal and professional skills that were evident during the first four months after programme completion.</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>This ethnographic case study provides auto-ethnographic accounts based on experiences, participant observation, interviews and document analysis.</td>
<td>Characteristics of Lean leadership were identified to establish an understanding of how to achieve successful Lean transformation. This study emphasises the importance for Lean leaders to 1) go to the gemba, to see the situation for one’s own self, 2) empower healthcare employees and 3) be modest. All of these are critical attributes in defining the Lean leadership mindset.</td>
</tr>
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</table>
Theoretical framework: Lean philosophy, Lean leadership and Lean tools

*Lean philosophy*

During the last decades, different quality management concepts, including Total Quality Management (TQM), six sigma, Lean have been applied by many different organisations. These concepts all refer to the quality evolution in Japan after the World War II. Liker, in his 2003 book “The Toyota Way,” emphasizes that the Toyota Production System is not just a set of tools, but rather it is a sophisticated system in which all parts (Figure 3) reinforce each other and contribute to a bigger whole (Lander and Liker, 2007; Liker, 2003; Emiliani, 2006). This sophisticated system includes culture, the understanding of individuals, and human motivation. Toyota’s success is “…Ultimately based on its ability to cultivate leadership, teams, and culture, to devise strategy, to build supplier relationships, and to maintain a learning organization” (Liker, 2003). In “The Toyota Way,” Liker describes 14 Management Principles that encompass, in his view, the “Toyota Way.” He divides those 14 principles in four categories, Problem Solving, People and Partners, Process, and Philosophy into what is known as the “4P-model.” A graphical representation of the model is shown in Figure 2 (Liker, 2003).

The Lean approach was developed in an automobile industry and its application in healthcare is often regarded as counterintuitive. Therefore, translating Lean principles into the healthcare language so its tools and techniques are adapted and owned by the healthcare staff is crucial. A majority of companies implementing lean do focus their efforts on second level “process improvement” activities (Figure 3, Liker, 2003; Womack and Jones, 1994; Ohno, 1988). Thus, their efforts focuses on principles 2 to 8 (process improvement - flow) through redesigning processes, creating flow to move information and material, leveling the workload, creating customer pull throughout their operations, eliminating waste, adjusting to build-in quality, standardizing tasks and process steps using repeatable methods, introducing visual controls, reducing reports, and using reliable
technologies to support their worker (Liker, 2003; Monden, 1998; Ohno, 1988; Schonberger, 1982).

The first category listed by Liker (2003, Figure 3), “philosophy - long term thinking,” focuses on the principle to have all management decisions based on a long-term philosophy, sacrificing short term financial goals, if necessary. Liker (2003, p. 37) describes the philosophy as: “Work, grow, and align the whole organization toward a common purpose that is bigger than making money.” Using this long-term vision, every subsequent decision is based on the goal to generate value for the customer, the economy, and society (Pius et al., 2006; Liker, 2003).

While Toyota’s ultimate focus is the customer, Liker’s (2003) third category “people and partner (Figure 3),” stresses the importance of employees and partners of an organization. The execution of principles 9 to 11 (people and partners - respect, challenge, and grow them) should be achieved by growing leaders from within the organization (Liker and Meier, 2007; Liker, 2004). Growing leaders from inside the organization implies that current leaders have to be seen
as role models of the company’s philosophy (e.g., the foundation of the pyramid). These leaders are held responsible and accountable for training other exceptional individuals and to grow teams to work towards the common goal while following Toyota’s philosophy (Liker and Convis, 2011; Liker, 2003). In fact, Toyota strives to treat their employees as their most valuable asset (Emiliani, 2007; Liker and Meier, 2007; Liker, 2003; Ohno and Mito, 1988). Based on this principle, Toyota invests heavily in the future of the company by investing into employee development. However, not only company employees are valued, but so are external partners and suppliers, which are tightly involved in development and training programs at the Toyota Motor Corporation (Liker and Meier, 2007; Liker, 2004; Spear, 2004). Liker and Meier summarize Toyota’s commitment to their partners as “Respect your extended network of partners and suppliers by challenging them and helping them improve” (Liker and Meier, 2005).

The fourth category in Figure 2, e.g. **Category 4**, labeled “problem solving,” deals with the creation of a learning organization through continuous improvement initiatives focused on solving the root causes of problems. Category 4 includes principles 12 to 14 (problem solving, continuous improvement, and learning) which describes the need for solving problems by seeing in person at the source what happens, referred to as "go and see ("genchi genbutsu" in Japanese)." Liker (2003) emphasizes that even senior managers and executives should go and see to understand the actual situation (called “Gemba” in Japanese, meaning “actual place”). Once the root cause of a problem is identified and alternative solutions have been designed, a decision as to how to solve the problem is made. Discussing the problems and possible solutions jointly with all employees is referred to as “Nemawashi” in Japanese. This process includes the gathering of employee ideas to broaden the range of possible solutions and to achieve consent on the path to be taken (Liker and Meier, 2007; Liker, 2003; Ohno, 1988). To become such a learning-organization requires standardized and stable processes and the use of continuous improvement (Kaizen). Additionally, organizational knowledge has to be conserved through reflection sessions (“hansei” in Japanese) at key milestones. Furthermore, the development of standardized best practices,
of a stable workforce, and the establishment of succession and promotion plans are critically important according to Lewis (2006) and Liker (2003).

Spear and Bowen, in 1999, described the Toyota Production System (TPS) from a different viewpoint than Liker (2003). Spear and Bowen (1999) described the TPS as a framework of four activities, also known as the “4 rules of the TPS.” These four rules consist of 1) guide the design, 2) operation, 3) administration, and 4) improvement of all activities for all services or products within Toyota. The first rule is about the way people have to do their work at Toyota. Thus, “All work shall be highly specified as to content, sequence, timing, and outcome” (Spear and Bowen, 1999). This rule specifies in detail what Toyota expects from their worker in a particular job. Thus, deviations from the specifications become instantly clear and the problem can be corrected by the worker or supervisor. The second rule is “Every customer-supplier connection must be direct and there must be an unambiguous yes-or-no way to send requests and receive responses” (Spear and Bowen, 1999). The rule describes the supplier-customer relationship between each person and applies internally as well as externally. In fact, this description specifies exactly who is responsible to provide whom with a specific good or service, in what quantity, and at the right time. This rule is applied throughout the entire value chain and includes all stakeholders involved. The third rule is “The pathway for every product and service must be simple and direct” (Spear and Bowen, 1999). Rule 3 describes explicitly how the value chain has to be constructed to allow every product and service to flow along a specified and simple path. Finally, the fourth rule is “Any improvement must be made in accordance with the scientific method, under the guidance of a teacher, at the lowest possible level in the organization” (Spear and Bowen, 1999). This rule specifies how improvements have to be made. There is more to continuous improvement than just identifying and fixing problems. At Toyota, people explicitly get taught on the job how to design improvement efforts. Most notably, Toyota’s improvement efforts are always structured as experiments with a clearly articulated and verifiable hypothesis (the scientific method). Using this method, clear expectations as to a specific outcome are documented (Towill, 2007; Spear
Rule number four also describes specifically who is responsible for the improvement. At Toyota, workers do the improvements at their workstations with assistance of their supervisors. Supervisors do improve their work on their own with assistance of their managers and so forth (Spear, 2004; Spear and Bowen, 1999). Liker points out that, “Lean is not about imitating the tools used by Toyota in a particular manufacturing process. Lean is about developing principles that are right for your organization and diligently practicing them to achieve high performance that continues to add value to customer and society” (Liker, 2003). Several authors also stress that, although the initial focus in lean thinking has been the shop floor, the Toyota principles apply to any organization (Womack and Jones, 2003; Liker, 2003; Ohno, 1988). In fact, Womack and Jones state:

“a popular misconception is that lean is suited only for manufacturing. Not true. Lean applies in every business and every process. It is not a tactic or a cost reduction program, but a way of thinking and acting for an entire organization.”

**Purpose, process, and people**

Womack, in one of his newsletters (2006), strongly recommends that senior executives of companies contemplating a lean transformation should investigate three fundamental business issues: Purpose, process, and people.

What is the ‘why’ of lean? To define the **purpose** of a business, two questions need to be answered (Womack, 2010; Womack, 2006): 1) what does the business need to do to prosper and survive in the future and 2) what does the business need to do to better to satisfy the customer? Womack (2006) points out that addressing the second question first, often solves the issue of what the business needs to do to prosper and survive. Womack (2010) further states that “… I’m often amazed that there seems to be little or no connection between current lean projects and any clearly identified business purpose.” Once the business’ purpose is defined, the organization needs to assess and evaluate the **processes** of providing value to the customer. Value stream maps (VSMs) serve this purpose.
The current state of processes mapped in a VSM shows all the process steps currently required to deliver value to the customers (Womack, 2006; Rother and Shook, 1999). The VSM also shows the flow of information that controls the entire value chain of a product or service. Finally, each process step in the value chain should be evaluated as to whether the process is valuable, available, capable, flexible, and adequate (Womack, 2010). Processes that are in alignment with the business' purpose can only be created by teams that are led by a person (people) responsible for the entire value stream, called a value stream manager (Womack, 2010; Emiliani, 2007; Liker and Meier, 2007). Therefore, when thinking about lean transformations, management has to consider the following questions: 1) do all important processes have someone responsible to constantly evaluate, question, and continuously improve the process’ value stream in terms of business purpose? And 2), is everyone that belongs to the value stream actively engaged in improving and operating it towards the defined business purpose (Womack, 2010)?

**Lean leadership**

**Management versus leadership**

The terms ‘manager’ and ‘leader’ are frequently used in the literature, which is rich in discussion about differences between the two.

In many organisations, the term ‘Management’ is used to describe the level of hierarchy to which employees are accountable, which rewards or disciplines and which decides to implement change. An employee rarely has a meeting scheduled with a ‘leader’. Yet the literature recognises that good leadership is essential to drive business improvement and this invites a question about the difference, if any, between managers and leaders. Whilst there is considerable debate in the literature, management and leadership can be considered as two different roles (Kotter, 2008, Yukl and Heaton, 2002). Management focuses on providing work structure for individuals through controlling and coordinating activities whilst leadership implies a social influence process, capable of facilitating change. Leadership requires a learning strategy (Heifetz & Laurie, 1997). According to
Zaleznik (2004), a leader, from above or below, with or without authority, has to engage people in confronting the challenge, adjusting their values, changing perspectives, and learning new habits. However, the same individual may provide leadership whilst undertaking managerial activities (Northouse, 2012), the viewpoint used in this thesis. Leadership has to take place every day. It cannot be the responsibility of the few, a rare event, or an once-in-a-lifetime opportunity.

**General theories of leadership**

Leadership can be defined as:

> “the process by which one person sets the purpose or direction for one or more other persons, and helping them to proceed competently and with full commitment.” (Jaques and Clement, 1991)

However, there is neither a uniform specification for good leadership nor a recognised route to achieve the competencies of a good leader. A number of leadership theories have been proposed which include transformational, transactional, servant and self-managed (team) styles of leadership.

The key to **transformational leadership** is the ability to change (or transform) followers. Motivation is provided by making followers aware of the importance of specific goals, encouraging them to place the interests of the team or organisation above their own self-interest but encouraging followers to be aware of their own need for personal development and accomplishment (Bass, 1999). Transformational leaders provide a realistic vision of the future which is shared by followers. They inspire, provide intellectual stimulation and consider followers as individuals with unique needs.

In contrast, **transactional leadership** recognises an ‘exchange’ between leader and follower in which the latter receives reward (financial or recognition) for achieving standards defined by clear performance criteria but will be reprimanded for underperformance. Followers are expected to perform precisely as expected by a transactional leader whilst a transformational leader motivates followers to achieve more than what would normally be expected (Hater and Bass, 1988). However, transformational leaders may also practice transactional leadership,
rewarding good performance and responding to suboptimal performance, but remaining mindful of the ‘bigger picture’ and how much more individuals could achieve (Jones and George, 2003).

**Servant leadership** theory considers a leader as a servant, meeting the needs of followers. There are similarities between transformational and servant leaders as both provide vision, engender trust, act as role models, show respect for individuals and value the importance of listening, teaching and the personal development and empowerment of followers (Stone et al., 2004). Importantly, however, transformational leaders attempt to align their own and followers’ needs with the organisation’s objectives whilst servant leaders concentrate on the personal development of their followers (Bass, 2000; Stone et al., 2004).

The responsibility for daily activities is increasingly being given to teams with a multi-skilled workforce rather than individuals (Yukl and Heaton, 2002; Poksinska et al., 2013). It is therefore important to identify ways in which leadership may be provided in such situations as all groups and teams need leadership (Jones and George, 2003), particularly if teams are expected to improve their performance (Pearce and Conger, 2003). **Self-managed** teams may have external leaders who coach, facilitate and educate in support of self-management, or internal leaders who help to coordinate team members’ activity (Yukl and Heaton, 2002; Poksinska et al., 2013). However, leadership may be shared by team members and indeed effective shared team leadership, with appropriate external support, can improve team performance (Carson et al., 2007). Shared leadership as applied to teams has been described as:

> “a dynamic, interactive influence process among individuals in groups for which the objective is to lead one another to the achievement of group or organisational goals or both. This influence process often involves peer, or lateral, and at other times involves upward or downward hierarchical influence.” (Pearce and Conger, 2003)

In this way, active participation and empowerment of all members of an organisation can be realised. Having reviewed some of the general theories of leadership, we now consider ways to characterise Lean leadership.
Characterisation of Lean leadership

A definition of Lean leadership is provided by Dombrowski and Mielke (2013):

“a methodical system for the sustainable implementation and continuous improvement of [Lean production systems]. It describes the cooperation of employees and leaders in their mutual striving for perfection. This includes the customer focus of all processes as well as the long-term development of employees and leaders.”

These authors describe five basic principles of Lean leadership (Figure 4).

Figure 4. Lean leadership model (Dombrowski and Mielke, 2013).

1. Improvement culture

A Lean leader should support a process of continuous improvement to try and achieve perfection. The term used by Toyota to describe this is kaizen (Japanese: ‘change for the best’) (Liker, 2004). In a no-blame culture, the root cause of any failure is sought so as to prevent recurrence. This requires support, provision of
necessary resources and encouragement of employees to contribute ideas, as it is they that most thoroughly understand the vulnerabilities of business processes.

2. Self-development

Leaders act as role models for their employees and therefore need to develop themselves and their values before they can influence others successfully. Mentors can be very helpful in supporting self-development.

3. Qualification

Lean leaders challenge, encourage and empower employees to solve problems themselves on a daily basis rather than rely upon managers/leaders to provide solutions. This supports the principle of continuous improvement.

4. Gemba

Gemba (Japanese: ‘the real place’) refers to the shop floor or the place where value is added. The gemba principle (genchi genbutsu - Japanese for ‘go and see’) requires Lean leaders to visit the shop floor regularly to enable them to fully understand processes. There are five golden gemba rules (Dombrowski and Mielke, 2013):

Go to gemba first: when a problem arises

Check: look for root causes of the problem

Take temporary countermeasures: to ensure an immediate, albeit possibly expensive, solution to the problem is found for the customer

Find the root cause: the 5-Whys technique can be applied here

Standardise: permanent countermeasures are taken, alongside the development of standards.

5. Hoshin kanri

Hoshin kanri means ‘direction management’ in Japanese. With continuous improvement activities decentralised, an enhanced system is required to ensure there is alignment between individual team activities and the long-term goals of
the organisation. Each team is made aware of its contribution to the overall
direction of the organisation.

Lean leadership requires support from appropriate managerial practices and
tools. Such a Lean management system has been proposed and comprises four
main elements (Mann, 2010):

**Leader standard work** includes activities such as a daily visits to the shop-floor
(*gemba walk*)

**Visual control** is the display of information, which enables immediate
understanding of how a process is performing. Visual management is a system for
organizational improvement that adds a new dimension to the processes,
systems, and structures and appeals directly to the high level of visual literacy that
exists among today’s workforce. Visual management establishes and reinforces a
direct link between people and performance in organizations, and improves the
knowledge, skills, and abilities of employees, as they learn and retain information
more quickly and easily.

**Daily accountability** describes regular meetings during which follow-up of tasks,
responsibilities and opportunities for improvement are discussed

**Discipline** may be required to ensure the above three elements take place as
planned.

The abovementioned characteristics of Lean leadership can now be considered
alongside general leadership theory to enable comparisons to be drawn between
the two.

**Lean tools**

The literature makes available many tools and models that have been developed
using Lean philosophy and which have been used in a huge variety of settings to
improve organisational performance. Later in this document, the role of
leadership in the Lean transformation process and the use of Lean transformation
tools will be discussed in specific case studies. It is therefore appropriate to
consider some of the tools used to implement Lean practice at this stage.
**Value stream map**

The value stream map (VSM) is the principal analysis tool of Lean philosophy. This tool is a process flowchart containing information about the key people, equipment, information exchanges, speed and continuity of flow of processes required to deliver a product or service. The VSM encompasses the entire value chain and provides a holistic and visual picture of a process. Typically, process steps are represented by boxes, flow between steps as thick arrows and information flow by thin arrows, with the time for each process and between each process being documented (Figure 5).

![Value stream map diagram](image)

**Figure 5. Simplified example of value stream map: patient journey for blood test and result.**

Critically, the VSM has been designed to distinguish between the value-adding and non-value-adding activities which lie at the core of Toyota’s Lean philosophy, thus enabling a focus on activities which can be improved through problem-solving (Jimmerson et al., 2005; Van den Heuvel et al., 2006). The VSM originally used in manufacturing is readily adapted to most healthcare situations. Thus, in
healthcare, a doctor’s interview with a patient to obtain essential information adds value to the process (patient journey) whilst a non-value-adding step would be a patient waiting to see the doctor. Examples of the use of the VSM will be considered later.

**A3 report**

The A3 report is a highly visual, thorough and systematic problem-solving guide presented on an A3-sized sheet of paper (30 cm × 42 cm). The components are (Figure 6) (Jimmerson et al., 2005):

<table>
<thead>
<tr>
<th>The problem</th>
<th>Target condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>As perceived through the customer/patient’s eyes</td>
<td>Chart of new ideal process to be achieved through countermeasures</td>
</tr>
</tbody>
</table>

**Background**

- Context and importance

<table>
<thead>
<tr>
<th>Current condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chart of current process derived from direct observation</td>
</tr>
</tbody>
</table>

**Cause analysis**

- Derived from 5-Whys and/or fishbone diagram

<table>
<thead>
<tr>
<th>Implementation plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>What?</td>
</tr>
</tbody>
</table>

**Follow-up plan**

- Performance anticipated
- When to follow-up and measure

<table>
<thead>
<tr>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Measurement and date</td>
</tr>
<tr>
<td>• Variance from predicted measure</td>
</tr>
</tbody>
</table>

**Figure 6. A3 Problem-solving report template (adapted from Jimmerson et al., 2005).**

**Statement of the problem**: as perceived through the eyes of the customer/patient

**Current condition**: a chart showing what is happening at present, derived from direct observation
Cause analysis: key problems are detected and root causes identified - asking “why?” five times (5-Whys method) and/or use of a fishbone diagram (see below) are common approaches.

Target condition: a chart showing an improved process achieved through countermeasures.

Implementation plan: actions required to achieve the target condition.

Follow-up plan: this predicts the performance of the improved process and describes the plan to measure the improvement.

Important to the successful use of the A3 report is the use of a coach who takes team members through the process (Jimmerson et al., 2005). A coach would encourage direct observation to establish the current condition, advise on chart construction, ensure the analysis has fully identified root causes of the problem, encourage all relevant stakeholders to be involved and support recommended changes, ensure the target condition is as close to the ideal as possible and make sure the implementation plan and follow-up process come about.

Fishbone diagram

The fishbone diagram (also known as an Ishikawa diagram or cause-and-effect diagram) is a useful visual tool to analyse the root causes of a problem (Ishikawa, 1963). Causes can be grouped into major categories to provide structure to the analysis (Figure 7).
Makigami

*Makigami* (means ‘roll of paper’ in Japanese) is a far-reaching type of VSM, designed to map processes in complex environments such as in laboratories, offices or hospitals where the product is not directly visible (Makigami Info). This is also a highly visual tool (Figure 8) in which coloured notes are attached to a large wall chart, and includes four main components:

- Activities performed by different stakeholders
- Communication methods used (documents, electronic media etc.)
- Analysis of time
- Problems identified

**Figure 7. Fishbone diagram template.**
As with the A3 report, a systematic series of steps is used, commencing with the development of a ‘bird’s eye view’. This is followed by the preparation of a Makigami current state process map from which identification of problems can be derived (‘deep loss analysis’). Subsequently a ‘loss-free’ Makigami future state process map is designed, which adds value to the customer, and which is then implemented.

Using the process, one contributor observed:

In only 6% of the situations where something goes wrong, it can directly be assigned to a person. In the other 94% is due to the system where this person was acting in.

**5-S methodology**

This technique originated in Japan and was one of the techniques used for ‘Just in Time’ manufacturing, in which flow of items through a process was optimised to reduce the need for excessive inventory. Five Japanese words have been adapted into English language (there are variations): sort, straighten, scrub, systematise and standardise.
These words provide a method of organising a work space to achieve maximum efficiency and effectiveness through easy identification and storing of items, maintenance of the work space and ensuring the system continues to work (Kruskal et al., 2012).

Having now discussed the background to Lean philosophy and presented an overview of the Lean transformation process and some of the tools used to implement Lean processes, it is now appropriate to explore ideas about Lean leadership itself.

**Outline of thesis**

The results of the studies are presented in chapters 2 to 7. The chapters are written as separate articles and can be read independently of each other. As a consequence, the content of chapters in some parts shows overlap.

**Chapters 2-4 give recent case examples to support the efficacy of Lean when used in healthcare.**

A simple example of how Lean thinking can be applied to healthcare is provided in **Chapter 2 (Patient Safety in the Operating Theatre: How A3 Thinking Can Help Reduce Door Movement)**. This study focused on one specific issue, door movement during orthopaedic surgery within an operating theatre. Research suggests that the flow of personnel into and out of an operating theatre contributes to the development of surgical site infections, which has an associated impact on patient safety, cost and quality of care. A multidisciplinary team used A3 reporting and a fishbone analysis, which resulted in a reduction in scrub room door movements of 78%, from 24 to 4 movements per hour.

In operating theatres, the scheduling of nurses is a challenging and complex task. Staffing needs vary with type of surgical procedure, from day to day and shift to shift. Last-minute problems such as insufficient or too many staff and no guarantee of appropriately trained staff being present during surgery can lead to increased workload and frustration among staff. Yet patient safety must be
assured. Improving efficiency in such a complex environment lends itself to the application of Lean principles and use of Makigami. In Chapter 3 (A focus on throughput: Lean improvement of nurse scheduling in the operating theatre), use of this technique alongside a fishbone analysis reduced a baseline 7-day scheduling error rate of 35 down to 2 errors and ensured the right nurse with the right qualifications was scheduled for the right surgical procedures.

Patients with oesophageal cancer are often not diagnosed until relatively late in the disease process and higher rates of morbidity and mortality occur because of delays between diagnosis and surgical treatment. In Chapter 4 (Lean process mapping techniques: improving the care process for patients with oesophageal cancer) a Lean approach was used to reduce the delay between time of diagnosis and surgical treatment for patients with oesophageal cancer. Using VSM principles, the care pathway was found to be disorganised and possibly introduced medical errors. The process reduced the number of steps required to commence treatment from 128 to 103, reduced variability through standardisation and reduced the delay to surgery by 3.5 weeks.

Chapters 5-7 contribute to an understanding of the complex dynamics of Lean transformation, factors influencing the implementation of Lean in healthcare and the characterisation of Lean leadership.

In Chapter 5 (The role of leadership and workforce flexibility when implementing Lean healthcare), a statistically analysed, survey-based methodology was employed after recent implementation of Lean practices in an operating theatre to identify factors which influenced the transformation process. There was a significant positive correlation between the extent to which Lean healthcare processes and results were present (and implemented) and both the level of transformational leadership of supervisors and level of team leadership. A strong positive correlation was found between the implementation of Lean healthcare and workforce flexibility. From this analysis, the authors conclude that good transformational leadership style and workforce flexibility improve the chance of successful Lean transformation.
To contribute to the knowledge base on barriers and facilitators to the implementation of Lean healthcare in hospitals, Chapter 6 (Experiences of leaders in the implementation of Lean in a teaching hospital) describes the findings from semi-structured, in-depth interviews with healthcare professionals who were directly involved with Lean implementation, three months after a Lean Training Programme. Top management support including their daily presence on the work floor and their ability to act as role models in a continuous learning environment were found to be important facilitators. Barriers included resistance to change, lack of multidisciplinary collaboration and functional/professional silos. Successful Lean implementation requires all professionals to be involved. Departmental boundaries have to be crossed and the focus should be on the Lean process rather than simply ‘implementing’ facts.

The study in Chapter 7 (An ethnographic case-study perspective on Lean leadership) aimed to identify leadership behaviours and qualities, which are important to support Lean transformation. In-depth interviews were conducted with representatives from all levels of the hierarchy involved with Lean implementation at a teaching hospital. A framework for successful Lean leadership is presented. Sustained Lean transformation relies on a cultural change for employees and leaders. Leadership success can be achieved through appreciating the softer side of interpersonal relationships and appreciating the importance of gemba, being able to empower others and showing sincere humility.

This thesis ends with a General Discussion, Chapter 8, that integrates the findings of the chapters in the context of the research question.
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Chapter 2

Patient Safety in the Operating Theatre: How A3 Thinking Can Help Reduce Door Movement

Simons, F. E., Aij, K. H., Widdershoven, G. A., & Visse, M.

Abstract

Objective Research has often stressed the significance of reducing door movement during surgery for preventing surgical site infections. Lean interventions may contribute to this. This study investigated the possible effect of a lean A3 intervention on the reduction of door movement during surgery in a university medical center in the Netherlands.

Design Over the course of eight months, a digital counter recorded door movement during 8,009 surgical procedures. In addition, we aimed to reduce door movement in one operating room for orthopedic surgery by a lean A3 intervention. This intervention was executed by means of an A3 report that promotes structured problem solving based on a Plan-Do-Check-Act cycle.

Results The number of door movements per surgical procedure ranged from 0 to 555, with a mean of 24 door movements per hour across 26 specialisms. The A3 intervention resulted in a decrease of door movements by 78 percent, from a mean of 24 to a mean of 4 door movements per hour during orthopedic surgery at one OR.

Conclusions This paper shows the relevance of and the possibility for a reduction of door movement during surgery by lean management methods in general and an A3 intervention in particular. This intervention stimulated dialogue and encouraged knowledge-sharing and collaboration between specialized health care professionals and this resulted in a thorough root-cause analysis that provided synergy in the countermeasures – with, according to respondents, a sustainable result.

Keywords lean, A3 method, door movement, surveillance, monitoring, operating room
Introduction

To improve surgical safety, researchers have become increasingly interested in the influence of the surgical environment on surgical site infections (SSIs). In addition to the increasing mortality and morbidity caused by SSIs, as stressed by Burkitt, Mor, Jain et al. (2009), SSIs are associated with excessive costs per infection that vary between €1,000 per superficial SSI to €20,000 per deep SSI (Schriek-de Loos et al., 2008); these costs refer to direct hospital costs such as prolonged hospitalization, additional diagnostics, medication and revision surgery (Schriek-de Loos et al., 2008). SSIs have a significant impact on healthcare costs and an adverse impact on quality of care, which shows the importance of prevention interventions such as the Dutch safety management system that focuses on four major points of prevention: antibiotic prophylaxis, avoiding hair removal, perioperative normothermia and hygiene discipline.

Hygiene discipline as specified by the Dutch safety management system stresses the significance of limiting door movement during surgery. Although the direct impact of door movement on SSIs has not yet been supported by randomized studies, scholarly literature has demonstrated that traffic flow into and out of the operating room (OR) is an important factor in the development of SSIs; traffic flow, in turn, has been associated with door movement. For example, Lynch et al. (2009) stressed the negative impact of a high rate of traffic flow on the sterile environment of the operating room, and door movement has also been correlated directly with an elevated level of airborne bacteria-carrying particles in the OR (Andersson et al., 2012). Additionally, door movement causes disturbance in the airflow as well as in the preservation of the necessary temperature during surgery (VMS, 2013). Andersson et al. (2012) therefore suggest that traffic flow patterns should be analyzed to reduce traffic flow into and out of the OR in order to prevent SSIs.

Research has demonstrated that lean, the term used to describe the principles and methods of the Toyota Production System that aims to preserve value with less work (Krafcik, 1988), can have a significant effect on traffic flow in the OR
ELMC, 2013). For example, the Exempla Lutheran Medical Center reduced door movement during surgery with the use of a 4-day rapid improvement cycle – a *lean* method (ELMC, 2013). This indicates that *lean* may also be effective for reducing door movement during surgery, and hence raises the question of whether other *lean* methods could help address this problem as well. For example, the A3 intervention, based on a Plan-Do-Check-Act cycle that promotes structured problem solving, is another *lean* method that is widely used (Sobek and Jimmerson, 2004; Brandao de Souza, 2009; Shook, 2009; Jimmerson, 2007; Sobek & Smalley 2011; Jimmerson et al., 2005).

Only a few studies have examined the effect of *lean* on door movement in the OR (Lynch et al., 2009; Panahi et al., 2012; Parikh et al., 2010; Young & O’Regan, 2010; Pryor & Messmer, 1998), and no studies have discussed the reduction of door movement in the OR as an effect of an A3 intervention. This paper reports on the results of door movement monitoring during surgery in the OR theatre of a university medical center in the Netherlands. Moreover, this paper reports on the effects of an A3 intervention to reduce door movement.

**Methods**

**Setting**

This 2-phased study was performed at the OR theatre of a 733-bed university medical center located in Amsterdam, the Netherlands. Approximately 16,000 surgical procedures are performed annually in the OR theatre of this medical center. The OR theatre consists of 16 ORs in which we monitored door movement during surgery: phase 1 of this study. The study’s second phase, the A3 intervention, solely focused on door movement during orthopedic surgery performed in OR number 3. A multidisciplinary team of orthopedics was eager to start with *lean*, in context of *lean* implementation at the entire OR theatre, and their orthopedic operations were for the majority performed in OR number 3. This OR has four doors: the patient entrance, patient accompanist entrance, and the
entrances to the scrub room and the setting room, which all differ in size and can all be opened and closed during surgical procedures.

**Phase 1: Monitoring door movement**

Over the course of eight months, from June 2011 through January 2012, a digital counter recorded door movement during 9,089 surgical procedures at the 16 ORs. The counter only recorded door movement during surgery; that is, from first incision until closure of the wound. The collected data for each door movement included date, time, sensor ID, door type and room number; the collected data for each surgical procedure consisted of the start- and end date, start- and end time, duration, room, specialism, specialist, operation code and operation name. Patient consent was not sought since no medical information was disclosed. Data was excluded for analysis if measurement-errors of the monitoring system occurred or if a surgical procedure took less than 10 minutes. Eventually, our analysis was based on a dataset of 8,009 surgical procedures. The data were subjected to a Pearson correlation coefficient between the variables; in addition, we drew a linear regression curve.

**Phase 2: lean A3 intervention**

Parallel to door movement monitoring at the entire OR theatre, the effect of an A3 intervention on door movement was monitored for 12 months, from May 2011 through April 2012, in an operating room for orthopedic surgery (OR3). The intervention used the A3 report: a method used by Toyota to capture the problem, analysis, improvement actions, and action plan on a large sheet of paper, size A3. The A3 report was instituted for this study since it provides a methodical approach based on Plan-Do-Check-Act (PDCA) cycle to address and solve complex problems by a multidisciplinary team. It is one of the traditional tools of the Toyota Production System that is easily applicable to health care in contrast to for example the tools Kanban, Single Minute Exchange of Die, Pull and Just-in-Time, and is feasible for employees with very little time for actual problem-solving. Moreover, the A3 report is a form of visual management that provides a framework for dialogical learning and embeds the change process, often
visualized by a metric. The A3 intervention is characterized by various steps: clarifying the problem, specifying the current situation, determining the target condition, analyzing the root cause(s) and taking countermeasures (Kimsey, 2010). These steps were completed one-by-one by a multidisciplinary team that consisted of an orthopedic surgeon, an anesthesiologist, a surgical assistant, a quality coordinator that was mentored by a lean coach during the entire period. The number of door movements – the intervention metric – was visible on a digital screen within the OR during each orthopedic surgical procedure. In addition, a printout of the door movements’ weekly trend was visible opposite OR3 and was sent by e-mail to the team concerned.

**Results**

**Phase 1: Door movement at the OR theatre**

During a period of eight months, a sum of 272,805 door movements was recorded in 8,009 surgical procedures. An analysis of door movement per door type showed that 71 percent was concerned with the scrub room door, followed by the setting room with 24 percent. The patient entrance and the patient accompanist entrance caused 5 percent of the door movements.

The number of door movements per surgical procedure ranged from 0 to 555, with a mean of 32 door movements across 26 specialisms. The mean of door movements per hour was 24; Figure 1 shows the mean of door movements per hour plotted against five indicator surgeries as specified by the Dutch safety management system (VMS, 2013).

As can be deduced from the scatter plot in Figure 2, there was a linear relation between the variables *number of door movements* and *surgical duration (in minutes)*. Analyses of these variables performed on the data revealed a significant correlation ($r = 0.86, p<0.01$); that is, as the duration of the surgical procedure increased, the number of door movements increased. No other variables approached significance in relation to door movement.
Phase 2: the A3 intervention

As prescribed in a previous section, the multidisciplinary team that was assembled for the A3 intervention firstly defined the problem – the possible consequences of door movement on patient safety, costs and quality of care – and subsequently investigated the current situation. The current situation showed that door
movement of the scrub room door in OR3 occurred between 15 and 20 times per hour during surgery. The three other doors (the patient entrance, patient accompanist entrance and the setting room door of OR3) were deemed negligible for analysis. In addition, data analysis showed a difference between surgeons in the amount of door movement: a range of 10 to 27 door movements per hour, depending on the surgeon. After the team mapped the current situation, they defined the ideal state as zero door movements during each surgical procedure. They then determined the target condition to be zero door movements between the incision and closing of the wound, only allowing door movement for specific clinical reasons, namely a need for X-rays, unexpected materials, instruments or blood products; breaks or service shifts of employees; emergencies; and/or supervision for the orthopedist or anesthetist.

In order to reach the target condition of zero door movements, the multidisciplinary team analyzed the gap between the current and the target condition with an *ishikawa* diagram, also known as a fish-bone diagram or cause-and-effect diagram (Ishikawa & Loftus, 1990). This diagram used the major categories *people*, *machines*, *methods* and *materials* to analyze the reasons for door movement. In total, the team identified 13 root causes and based on the *ishikawa* diagram and subsequent dialogue specified three they felt required full attention first. Actions for improvement were taken for each of these three root causes (see Table 1).

The actions for improvement were implemented at the end of February 2012 and evaluated after one month in a plenary meeting by the team concerned. The metric showed a decrease of 78 percent of door movements to a mean of four door movements per hour during orthopedic surgery at OR3. Figure 3 shows the trend of door movement per hour during the total period of the A3 intervention and extended with 6 months follow-up.
Table 1. Overview of three root causes resulting from an Ishikawa diagram and the actions for improvement.

<table>
<thead>
<tr>
<th>Root cause</th>
<th>Actions for improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unclearness among the OR team members with respect to the policy of entering and leaving during surgery.</td>
<td>The orthopedic surgeons determine whether staff may walk out of the OR during surgery. Prior to the start of this measure, a meeting with the head of orthopedics, the head of the OR and all orthopedists was set up to discuss the implementation of this measure. All OR staff and anesthesiologists active in OR3 were informed by e-mail prior to this measure. Per March 1st, 2012 the measure was put in progress at OR3 for orthopedic surgery.</td>
</tr>
<tr>
<td>The telephone number used within OR3 was not visible outside the OR for OR staff. As a result, the door had to be opened for communication.</td>
<td>The right telephone number used within OR3 was made visible outside the OR.</td>
</tr>
<tr>
<td>The team experienced the warning sign not to walk in during surgery as not powerful enough.</td>
<td>Revision of the warning sign that is suspended at the door of OR3.</td>
</tr>
</tbody>
</table>
Discussion

This study aimed to assess the use of an A3 intervention in the reduction of door movement during surgery in a Dutch university medical center. The first phase of this study revealed that all surgical specialisms dealt with a relatively high number of door movements per hour (n=24); the second phase showed that the number of door movements reduced with the use of the lean A3 method: during orthopedic surgery, the number of door movements decreased by 78 percent.

The study results should be interpreted in context and require follow up research. The A3 intervention was applied in one OR – used for orthopedic surgery – in one institution. While this limited context does indicate the possible effectiveness of lean, further research is required to establish a more comprehensive notion of the use of the A3 intervention for the reduction of door movement. For example, as this study was not designed to investigate the causal relationship between door movement and SSIs, statistical analysis on SSIs was not feasible; future studies could incorporate medical information to help gain a more comprehensive understanding of the impact of door movement on SSI. However, despite its contextual limitations, this study does indicate a need for a reduction of door movements in OR theatres in order to reduce the risk of the development of SSIs. In addition, our A3 intervention offered a valid result: a reduction of door movements by 78 percent.

Our study shows that all specialisms at the medical center dealt with a relatively high number of door movements per hour (n=24). This result corroborates with previous findings of the studies of Parikh et al. (2010), who reported on approximately 40 door movements per hour for pediatric orthopedic surgery; Andersson et al. (2012), who reported a door movement rate of 12.9 per hour for full-length orthopedic trauma surgery; Young et al. (2010), who reported a mean of 19.2 door movements per hour for cardiac surgery; and Lynch et al. (2009), who reported a door movement rate of 5-87 per hour for cardiac, orthopedic, neuro, plastic and general surgery. Door movement is a focal point of attention for the Dutch health inspectorate, as is evident from the numbers it allows for
door movement in its audits: >5 = insufficient, 3-5 = moderate, 2 = sufficient, 0 = good (Ishikawa & Loftus, 1990). The high rate of door movement during surgery we found may therefore support the decision of the Dutch health inspectorate to make door movements a focal point in the category hygiene discipline of the Dutch safety management system, as our results indicate that the actual amount of door movement far exceeds the targets set by the inspectorate.

An important finding of our study was the reduction of the number of door movements by 78 percent (note: an average of 4 door movements per hour) as a result of the lean A3 method. This method led to a clear problem statement and a description of the then current situation. As the next step of an A3 intervention prescribes, the team collectively determined a feasible target condition. Next, the gap between the target condition and current situation was unraveled by an in-depth analysis using an Ishikawa diagram. This analysis showed three major root causes: unclear policy regarding entering and leaving during surgery, not possible to communicate by telephone and an unclear warning sign not to enter the OR during surgery. This root-cause analysis resulted in three major actions for improvement, which resulted in a sustainable reduction of door movement.

Previous studies have addressed the importance of interventions on door movement (e.g. Lynch et al., 2009; Andersson et al., 2012; Parikh et al., 2010; Young & Regan, 2010). These studies suggest improvement of parts, as for example the use of a warning sign or automatic door counters, and recommend future studies to analyze reasons for door movement as this has been hypothesized to be a requisite for the success of an intervention. Lynch et al. (2009) noted that common reasons for door movement were personnel entering or leaving for breaks, information issues, and supply issues. These reasons were also identified in our Ishikawa diagram, yet the main root cause seemed to be unclearness among the OR team members with respect to the policy of entering and leaving during surgery. As the surgeon is held responsible for the outcome of surgery, which includes SSIs, a learning process among our team members led to the conclusion that the surgeon is primarily responsible for the reduction of door movement during surgery. As a result of this learning process, the team members
determined this responsibility clearly to be one of the surgeons. This could be considered the major factor in the sustainable decrease of door movements during surgery in our study: clearly assigned responsibilities. Two other root causes this study discerned, seem to be supportive measures: we postulate that the door counter can be used as a tool to help monitor and visualize improvement and the warning sign as a constant reminder for all employees in the OR theatre. These tools thus support the creation of a shared sense of responsibility of the team that supports the surgeon’s lead. The measured effect of this combination of improvement activities provides support for the premise that a root-cause analysis leads to an in-depth debate among healthcare professionals and that synergy – rather than a focus on parts – aids sustainable improvement.

In general, our findings suggest that structured problem-solving with an A3 report in a team may be seen as a dialogical process which alters behavior, either directly or indirectly. This supports the idea of the Dutch safety management system that debates about traffic flow may contribute to behavioral change (VMS, 2013). The A3 report in this study consisted of steps that stimulated dialogue and encouraged knowledge-sharing and collaboration between colleagues to reduce door movement. Although this was not part of this study, the A3 intervention may in fact have resulted in an increased awareness of our healthcare professionals. In our case it even resulted in surgical procedures without any door movements, but this occurrence of zero door movements can also be due to the short duration – yet never shorter than 10 minutes – of the surgical procedures included in our study. Parikh et al. (2010) reported that if the total surgery duration increases, the maximum number of personnel in the OR increases, which, in turn, increases the total number of door movements; we found a similar positive correlation between surgical duration and door movement. More research is needed to add to a general understanding of the association between A3 thinking, behavioral change and learning theories, but our results suggest that by providing an infrastructure in the form of an A3 report, the learning process between various health professionals has been encouraged.
Conclusion

This paper shows the relevance of and the possibility for the reduction of door movement during surgery by the \textit{lean} A3 intervention method. We conclude that the reduction of door movement can be achieved by the use of \textit{lean} methods: this study focused on an A3 intervention and showed a sustainable reduction of door movement by 78 percent. In addition, we found that the A3 intervention stimulated dialogical learning and encouraged knowledge-sharing and collaboration between various specialized health care professionals. This resulted in a thorough root-cause analysis that provided synergy in the countermeasures – with a sustainable result. The successful effect of an A3 intervention in reducing door movement could be usefully explored in further research.
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Chapter 3

A focus on throughput: Lean improvement of nurse scheduling in the operating theatre


Abstract

The utilization of operating theatres and efficiency of nurse scheduling has an impact on patient outcomes, hospital finances and clinical effectiveness. To date, research has tended to focus on the output rather than on the process of nurse scheduling. We report on use of the Lean mapping tool, Makigami, in operating room (OR) nurse scheduling. This study was conducted at a large surgical department in the Netherlands. A multidisciplinary team of nine health-care professionals used Makigami, including five steps: (1) mapping the current state of OR nurse scheduling, (2) setting the ideal state and the first target condition, (3) performing a fishbone analysis, (4) conducting actions and (5) mapping the revised process of OR nurse scheduling. The current OR nurse scheduling process showed 44 transfers, 42 documents and 64 types of waste, which collectively led to 35 errors in 7 days. The first target condition was to guarantee quality of care: the right employees, at the right time, in the right place without errors. The revised process, as a result of the action plans that emerged through the fishbone analysis, led to an outcome of two errors in 7 days with a reduction in waste of 41%. The use of Makigami led to an optimized OR nurse scheduling process: the right OR nurses, with the right qualifications, were scheduled for the right surgical procedures. A focus on process led to a reduction in transfers and errors, which indicate a higher quality of care.

Keywords nurse scheduling processes; Lean management; Makigami; fishbone analysis.
Introduction

The operating theatre (OT) of a teaching hospital is a critical and costly resource in the delivery of health care (Meredith et al., 2011). Usually comprising several operating rooms (ORs), the overall utilization and working efficiency of the OT is an important consideration for health-care managers because these factors have a significant impact on patient outcomes, hospital finances and clinical effectiveness. It is a challenge to balance clinical requirements with the need for process flexibility, standardization and efficiency in busy hospital environments with numerous stakeholders. As a result, clinical governance/quality management systems (activities designed to monitor, review and improve the quality of care) are necessary, and the responsibility for overseeing these usually rests with hospital managers (Freeman, 1984). In the OT, typical examples of quality management activities include using standardized procedures and resource forecasting, such as appropriate allocation of equipment and nursing staff (Weinbroum et al., 2003; Cardoen et al., 2010).

There are a number of validated quality management systems that lend themselves to health care. One of the most popular systems is Lean; with its origins in Japan, Lean is designed to improve the efficiency of processes by eliminating unnecessary activities in terms of variation (in Japanese: mura), overload (muri) and waste (muda) (Radnor et al., 2012; Stepaniak, 2010; Schwekhart and Dembe, 2009).

The identification and elimination of waste to optimize process flow can be achieved by a Lean process mapping system known as value stream mapping (VSM), which was originally developed by the automobile manufacturer Toyota. Womack and Jones (2003) define a value stream as “the specific actions required to design, order, and provide a specific product, from concept to launch, order to delivery, and raw materials into the hand of the customer”. They describe VSM as “identification of all the specific activities occurring along a value stream for a product or product family” (Womack and Jones, 2003). VSM can thus be seen as a technique to identify, reduce and eliminate waste and errors that prevent the
smooth flow of products and information through a value stream. From a practical perspective VSM involves outlining the key stakeholders, resources, activities and processes on a chart. It provides an understanding of how resources are utilized and highlights any inconsistencies. It is a useful communication tool in visualizing products or services for all staff to review, and value-adding and non-value-adding activities can be readily and systematically identified. Processes can then be revised by omitting non-value-adding elements. A comprehensive type of VSM is Makigami (Makigami Info). Makigami (which is Japanese for a roll of paper) is especially designed for mapping processes in complex environments were the product is not directly visible or physical, for example in offices, laboratories or hospitals. This is with the aim of providing a better service or creating a product that adds value for the customer or, in the context of health care, the patient.

The transfer of Lean principles to clinical settings means that health-care managers should be concerned with the input, output and throughput of their processes to steer and realize improvements that increase value for the patient. Several studies have shown that Lean methods can be used to optimize clinical workflow. In 2011 Kuo et al. proposed a new method, the Lean Six Sigma System, to improve workflow in post-operative settings. In a systematic review, DelliFraine et al. (2010) examined the evidence for Lean methods leading to improved clinical outcomes, cost-effectiveness and clinical effectiveness. In the case of caring for patients with hip fractures it has been shown that Lean methods are associated with more efficient patient flow from admission to discharge, with reduced mortality and waste (Yousri et al., 2011). An example of such a process is patient scheduling, the efficiency of which is of vital importance to the patient and also to the medical team (Wojtys et al., 2009). The use of the Lean method has also been shown to improve OR efficiency in terms of time management (Oma et al., 2011).

Most research into the benefits of Lean and other quality improvement systems in the OR have tended to focus on outputs rather than on the processes of OR planning, patient scheduling or nurse scheduling. In other hospital areas, scheduling of nurses using their experience is known to have an impact on clinical effectiveness (Oldenkamp, 1996; Ernst et al., 2004; Butler et al., 2012). In the OR,
the scheduling of nurses is particularly challenging because of the way in which staffing needs vary with surgical procedures, from day to day and shift to shift, and therefore it is an interesting environment in which to test the utility of Makigami. As far as the authors are aware, no published study has assessed the use of Makigami to improve OR nurse scheduling. In this study we test the application of Makigami to reduce waste and improve clinical effectiveness during the process of OR nurse scheduling. The rationale behind using Makigami was that in the existing situation patient safety could not be guaranteed and last-minute changes were found to lead to a high workload and increased annoyance among staff. These problems occurred due to daily problems such as shortage of staff on a given day, or abundance of staff on other days, and no guarantee of qualified (trained) staff being present during surgery.

Materials and Methods

**Design**

In this study we observed the application of Makigami to nurse scheduling in the OR of a teaching hospital.

**Study site and participants**

This study was conducted at the VU University Medical Center OT, which has 16 ORs and employs 289 OR staff. In 2012 the OT had an annual volume of 13 527 patients and 18 176 surgical procedures, of which 14 762 are elective.

A multidisciplinary team of nine health-care professionals was involved in mapping the current state of the OT using Makigami. The team, accompanied by a Lean methods consultant, consisted of various health-care professionals: the head of the OT, an OR nurse, the team lead of surgical assistants, a scheduler, a nurse specialist (orthopaedics), a day coordinator, a workplace trainer and a secretary. The team members were selected based on their involvement in the process of OR nurse scheduling. This approach was chosen because continuous improvement efforts have been shown to be most effective when employees who are directly
involved in the work develop solutions to problems that they deal with on a daily basis (Karia and Asaari, 2006).

The team had an introductory meeting that explained Lean thinking and were subsequently introduced to the Makigami method that was going to be used to map the process. The Makigami technique was applied at the OT to eliminate non-value-adding waste from the process of OR nurse scheduling. The focus was set on the entire process of scheduling from the annual blueprint to the day of surgery. The establishment of the final schedule depends on various information sources, but the process examined in this study solely shows the process that is arranged by the OT.

**Makigami 1: mapping the current state**

The current-state Makigami was made in three sessions that took 8 hours in total, using a Makigami chart with handwritten notes and post-it stickers. The Makigami chart consisted of four elements: 1) activities performed by different professional roles, 2) documents and figures used in the communication process, 3) records of activity duration and 4) identified problems and waste. An activity was classified as waste if it could be categorized according to one of the seven most common contextual wastes proposed by Toyota, namely overproduction, waiting, transportation, over-processing, inventory, motion or defects (Vinodh et al., 2010). The Makigami chart was created by following the steps of the information-route process of OR nurse scheduling. First, the identified steps were organized by professional role. The group then identified the waste per process step and quantified the types of waste before recording the steps of the process that added value.

Parallel to mapping the current-state Makigami, the problems that occurred on a daily basis as a result of the OR nurse scheduling process were monitored. The day coordinator assessed the process, focusing on three issues: the right employees, allocated to the right place, at the right time. The assessment was based on direct observations over 7 days spread out over 2 months. This direct observation was in line with the Lean methodology “to go and see” (in Japanese: *genchi genbutsu*),
with the aim of truly understanding what happens on the work floor. The assessment pre-intervention took place in April–May 2012 and assessments were also made following the improvement efforts in May–June 2013.

**Makigami 1: the ideal state and the first target condition**

Next to mapping the current state of the OR nurse scheduling process, the team also mapped the ideal state. The ideal state is intended to provide direction for the process and should contain only value-adding steps in succession: the right things, at the right place, at the right time, in the right quantities, without waste and leading to the outcomes desired by the patient. In order to map the ideal state, value from the patient’s perspective was defined. Next, the ideal state was stated and a first target condition was set, upon which various actions were plotted. Together, the mapping of the current state and the ideal state are referred to as Makigami 1.

**Makigami 2: actions and renewed process**

During the process, the team had a meeting once every 2 months. During each meeting, the gaps between the current situation and the target condition were analyzed and discussed. A fishbone analysis (Ishikawa diagram) assisted in the gap analysis. This fishbone analysis can be applied to any type of problem solving to identify all possible root causes. As a result of each meeting, actions were plotted and discussed at the meeting thereafter. After a period of 17 months a new Makigami, referred as Makigami 2, was constructed with the team to capture the renewed OR nurse scheduling process.
Results

*Makigami 1: the current state*

The current-state Makigami (Makigami 1) was created and graphically organized on a Makigami chart. Figure 1 shows a photograph of the Makigami wall chart. The Makigami showed 78 procedural steps in which 44 transfers took place. Table 1 outlines the assessment of the current state, which shows the transfers, the number of figures and documents, and the waste within the process.

Figure 1. Photograph of the Makigami 1 process map.

Table 1. Makigami process: number of transfers, documents and figures, and amount of waste.

<table>
<thead>
<tr>
<th>Process</th>
<th>Total number</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Makigami 1</td>
<td>Makigami 2</td>
</tr>
<tr>
<td>Transfers</td>
<td>44</td>
<td>39</td>
</tr>
<tr>
<td>Documents and figures</td>
<td>42</td>
<td>36</td>
</tr>
<tr>
<td>Waste</td>
<td>64</td>
<td>38</td>
</tr>
</tbody>
</table>
The outcome following 7 days of measurement, which had the goal to identify the number of errors and changes made due to the scheduling process, identified 19 defects in scheduling the right employees, 8 defects concerning the timing of employee scheduling and 8 defects concerning the location of employee scheduling (Table 2).

Table 2. The number of errors arising in Makigami 1 and 2.

<table>
<thead>
<tr>
<th>Error (waste)</th>
<th>Makigami 1</th>
<th>Makigami 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Right employees</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under qualification</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Over qualification</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>No employee scheduled for hand wash instruction</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Not enough employees scheduled</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Wrong employee name on schedule</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Office day for specialized OR nurses not scheduled</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Right time</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agreements with employees unknown to day coordinator</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Employee rostered while not scheduled</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Right place</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employee scheduled at wrong place</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Employee not scheduled while rostered</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td>35</td>
<td>2</td>
</tr>
</tbody>
</table>

**Makigami 1: the ideal state and the target condition**

The first step of setting the target condition was to map patients needs. As research has shown that the difficulty with the Lean technique in health care is the specification of end-user, or patient, needs (Womack and Jones, 2009), the team mapped the various users of the process. For each of these – the patient, nurse assistant, specialist or day coordinator – the question, “What is the need of the user?” was answered. Next, the team created the ideal state by answering the question, “What does the ideal process look like?” The team developed eventually
four main themes: pull planning, no waste, scheduling of student nurses, and process and allocation of functional roles. Within these themes, various ideal sub-states were formulated. In order to reach the ideal state a first target condition was set. The first priority was given guaranteeing quality, which meant the right people, at the right time, in the right place. Moreover, this target condition had the outcome measure of no errors or changes made due to the scheduling process.

**Makigami 2: actions and renewed process**

The Makigami 2 process map was created and graphically organized on Makigami paper. Figure 2 shows a photograph of the Makigami 2.

![Makigami 2 process map](image2.jpg)

**Figure 2. Photograph of the Makigami 2 process map.**

This Makigami showed 72 procedural steps in which 39 transfers took place. Tables 1 and 2 summarize the assessment of the renewed process, showing the transfers, the number of figures and documents, and waste within the process. The outcome 7 days post-measurement, which aimed to identify the amount of errors and changes made due to the scheduling process, identified two defects in scheduling the right employees, no defects concerning the employees scheduled
at the right time and no defects concerning employees scheduled in the right place (Table 2).

Discussion

Nowadays, the majority of hospitals are confronted with increasing demands to reduce costs and yet improve safety, efficiency and quality of care. To guarantee quality and clinical effectiveness in the OT the quality of OR nurses should be ensured. The aim of this study was to analyse the scheduling process for OR nurses in real practice with the use of Makigami Lean mapping tool. The literature on nurse scheduling and its role in clinical effectiveness is quite extensive (Burke et al., 2004; O’Neill et al., 2011; Ernst et al., 2004; Rönnberg and Larsson 2010; Staggs and Dunton, 2013).

The results of our study indicate that Makigami can assist in optimizing OR nurse scheduling in a high-volume hospital setting and help to identify waste and indicate relevant improvements. Application of this method was found to reduce outcome errors by 90% and waste in the process by 41%. Furthermore, the existing processes used to schedule OR nurses had evolved without specific attention to process and design. The Makigami tool assisted our team members in better understanding and identifying who was responsible for doing what work in the scheduling process. This insight enabled the team to review that process and to improve it considerably.

In addition to the 90% reduction of errors and 41% reduction of waste, it is likely that the Makigami tool also taught the team members the importance of a multidisciplinary approach. This assumption is supported by previous VSM research in which the importance of cultural change has been reported (Yamamoto and Bellgran, 2010). It can be difficult for workers, particularly those who have been in positions for a long time, and with deeply engrained work habits, to accept new guidelines for work processes because they believe that they already know how to perform their role correctly. The team members and OR nurses lacked an awareness of the power of Lean VSM techniques. However,
workers will follow new guidelines when they understand the rationale behind them (Jimmerson, 2009).

We found that one of the most significant benefits of using VSM was visualization of waste. The research team also found that reducing transfers (11%) and the number of documents used to schedule OR nurses (14%), better use of existing scheduling software and a decrease in manual scheduling benefitted the OR nurses because it lead to higher-quality schedules while the employee in charge of scheduling reported to enjoy the positive benefits of fewer repeated tasks.

We identified a number of challenges; for example, the demand for information and requirements varied between the OR nurses in charge of nurse scheduling. The monitoring and resolution of this situation was found to be a challenge. We also found that the incentives of various stakeholders were not always aligned, making it a challenge to involve the different stakeholders in the process. We therefore recommend that educational applications should be introduced in parallel to train OT management and employees in charge of scheduling. A further challenge was related to coverage of demand. The OR environment is less standardized than that of an automobile factory, where Lean methodology was conceived. Changing patient mix, evolving needs of the OT and no reliable way to estimate future demands were all factors in this regard.

This case study has a number of limitations. First, its scope was limited to observation of one specific clinical process only; therefore, the findings may not be representative of other clinical processes. However, our study illustrates the potential for further effective application of Lean methods, in particular the Makigami, to the health-care environment. Second, the study was performed in a large hospital, a referral centre, in the Netherlands. Therefore the processes studied may not be applicable to smaller units. Finally, the observations are qualitative, without statistical support, and were collected over a short space of time. Further, longer-term, studies looking at different processes are needed. We also suggest that future work could examine other OR personnel as well. The number of attending OR nurses is only one of many components influencing the
performance of an OT. To gain a better understanding and to identify areas for improvement it will be necessary to extend this study to anaesthetists and recovery nurses as well. We also suggest developing quality- and patient-oriented scheduling solutions that offer new opportunities for research on systems design for OT scheduling.

In general, this study adds further evidence that Lean techniques such as VSM can improve OR scheduling processes and therefore are useful management systems with which to improve the quality of care. Our findings suggest that, as a specific type of VSM, Makigami can help to identify current processes and performance. We found Makigami to be a focused and structured improvement tool that can help visualization of scheduling-process improvements in hospital practice. Previous studies of VSM have also shown its utility when applied to dynamic, high-volume surgical settings to identify waste and promote improvements in existing processes (Cima et al., 2011).

**Conclusion**

VSM and Makigami are based on simple and structured problem-solving concepts. These Lean concepts promote continuous improvement, allowing monitoring and measurement of the effectiveness of change. Although our results indicate that the use of the Makigami enhanced the OR nurse scheduling process, challenges still remain. This study, however, achieved its purpose in showing that the Lean method – specifically the application of Makigami – is effective as a means of reducing waste and for standardizing processes in OR nurse scheduling.
References


A FOCUS ON THROUGHPUT


Chapter 4

Lean process mapping techniques: improving the care process for patients with oesophageal cancer

K.H. Aij, G.A.M. Widdershoven, M. Visse

Abstract

Objective This paper tests the hypothesis that the value-stream mapping (VSM) method, based on Lean thinking, could help streamline the care process for patients with oesophageal cancer.

Design Case study.

Setting and participants One of the largest tertiary referral centre for oesophageal cancer in The Netherlands.

Interventions We applied and evaluated the principles and tools of Lean thinking, especially VSM processes, to improve the process of delivering care to patients referred for oesophageal cancer.

Results Evaluation at the start of the project revealed that the care pathway was unsystematic and might introduce medical errors. Application of VSM principles in the Lean context improved the process by cutting the number of individual steps needed to begin treatment from 128 to 103 and minimized variability by applying standardization. The implementation of Lean techniques improved the delivery of clinical care to our patients with oesophageal cancer by reducing the time it took to start treatment by 3.5 weeks.

Conclusions Our results suggest that the VSM method, based on Lean thinking, can help to better arrange the care processes for these patients. We believe that these principles can be applied to much of the care administered in this setting and to other areas of health-care delivery.

Key words Lean, oesophageal cancer, value-stream mapping, process improvement
Introduction

Although the Netherlands has an excellent health-care system, Dutch hospitals still struggle to provide fully optimal patient care (Spear, 2005; Weinstock, 2008). This may be due to a combination of factors, such as increasing care intensity, difficulties with filling medical vacancies and the resulting heavy workloads for medical staff (Rogers et al., 2004). As these factors may underlie suboptimal delivery of patient care, hospitals face the challenge of improving these processes at an organizational level.

Studies have shown that processes and quality in health-care can be improved by applying Lean methods (Graban 2011, De Bucourt et al., 2012; Brown and Duthe, 2009; Melanson et al., 2009; Rutledge et al., 2010). Lean is a quality-improvement philosophy that aims to create more value with fewer resources. It seeks to identify and eliminate waste by using tools such as the value-stream map (VSM) (Van den Heuvel et al. 2006). Creating a VSM can support in discovering and eliminating wastes, inefficiencies and errors that otherwise prevent the smooth flow of products or information through a system (the value stream). Practically this involves charting stakeholders, resources, activities and processes to allow the systematic identification, and elimination, of steps in a process that don’t add value (non-value-adding activities, NVAs). In due course, the value stream consists of a refined series of value-adding steps that, depending on the context, delivers a valuable product or service to the customer (Kim et al., 2007), or, in the case of health care, the patient. The Japanese Toyota Motor Corporation was the first organization to use VSM techniques and to implement Lean concepts and tools (Uker, 2004). Since then, Lean methods such as VSM have spread from the manufacturing industry to service industries such as banking, insurance and hotel management, and they are increasingly being applied in health-care settings (Teichgräber and De Bucourt, 2012; Grove et al., 2010; Serrano Lasa et al., 2009; Singh Gill, 2012).

This increasing use of Lean tools in medical settings implies that Lean now forms an integral part of the quality management system in many Dutch hospitals.
However, the Lean concept and its application in medicine are still poorly understood and literature on the subject is scarce (Yousri, 2011). Moreover, some researchers argue that there are significant gaps in the literature on health-care quality improvement with Lean, and that there is only scant evidence to show that Lean tools actually and validly improve health-care quality (DelliFraine et al., 2010; Joosten et al., 2009).

To further investigate the benefits of Lean the Oncology Surgery Department at VU University Medical Center Amsterdam (VUmc) decided to introduce the process-improvement ideas of Lean thinking in an effort to improve the care process for oesophageal cancer patients. It is well known that the majority of patients with oesophageal cancer are not diagnosed until a relatively advanced stage (Lang and Konda, 2013), and an internal audit showed that our department was no exception. There is ample evidence that delays between diagnosis and surgery in oesophageal cancer result in higher overall rates of morbidity and mortality (Grotenhuis et al., 2010) so it is important, wherever possible, to direct efforts to reduce delays between the first outpatient visit, diagnosis and surgical treatment (Sikkema et al., 2010; Spahos et al., 2005). Because Lean approaches have had successful outcomes in earlier studies at VUmc (Aij et al., 2013), and in other hospital settings (Teichgräber and De Bucourt, 2012; Grove et al., 2010; Serrano Lasa et al., 2009; Singh Gill, 2012), the department chose to use a Lean approach to reduce the delay between point of diagnosis and treatment for patients with oesophageal cancer.

The aim of this study was to investigate whether the use of Lean techniques, in particular VSM, can improve the care process for oesophageal cancer patients by shortening the time between diagnosis and start of treatment.
Methods

Setting

VUmc Amsterdam, the Netherlands, is a tertiary referral centre for patients with oesophageal cancer. After the diagnosis of oesophageal cancer in a referring hospital, almost 95% of patients (approximately 120 patients per year) in The Netherlands are referred to the VUmc outpatient clinic for surgical assessment and surgery. VUmc has two departments with 30 beds each for oncology and gastroenteral surgery patients and, due to cuts in government spending, VUmc is expected to need to double the number of treatments for oesophageal cancer in the future.

VUmc introduced a Lean management quality-improvement project in February 2012, one component of which was to specifically use VSM to improve the efficiency of the oesophageal cancer care pathway. As already discussed, VSM has proven worthwhile in other hospital processes by creating capacities that can be used to optimize patient monitoring and improve patient safety and quality. By helping to redefine processes and eliminating NVA activities, our target was to reduce throughput time, which was also expected to increase levels of patient satisfaction.

Team formation

Out of the participating departments involved in care for patients with oesophageal cancer – surgery, oncology, radiology, thoracic surgery, anaesthesiology, operating room (OR), intensive care, gastroenterology polyclinic and OR scheduling – a VSM review team was constructed, based on specialization and department, that consisted of 12 members. The team was headed by an executive member of the hospital leadership board, two value-stream experts (for training and coaching) and a care professional with the authority and responsibility to allocate the organization’s resources (who could make decisions, arbitrate solutions, plan the project and select the processes that would be mapped; this person had a firm grasp of what achievement was being targeted).
The team also was complemented by two professionals from the oncology surgery and radiology departments, two facilitators and one coordinator. Finally, there were also representatives from the workforce ‘on the floor’ (medical staff, nurses, secretaries and radiotherapists).

**Rationale for choosing the oesophageal care pathway**

The VSM system was applied to the care program for patients with oesophageal cancer based on the following anticipated advantages: the treatment planning and delivery procedures have a standard that is well accepted by the department faculty and staff; the input information necessary to initiate therapy is not always available; and departmental leadership made the choice for this patient group. The treatment of patients with oesophageal cancer is highly demanding for both patients and hospital staff and therefore any unnecessary burden needs to be eliminated. The treatment planning and delivery procedures are complex and involve many care professionals from different disciplines. Furthermore, cancelling surgical procedures has consequences for organization and OR capacity.

**The present state**

Once the team was formed, the team had to “go and see” (*genchi genbutsu* in Japanese): they went to the *gemba*, the place where work is actually done, to see what really happens. It took the team in total 100 hours to capture enough reliable data to fully understand the process. As part of the process map they integrated findings from a time-motion assessment, stopwatches were used to calculate the total time taken for one patient to go through the entire process, based on components including patient waiting time, processing time and walking time to and from all the relevant locations (e.g. car park, hospital entrance, front desk, policlinic) that the typical patient would travel, and interviews were used to identify any efficiency problems. The VSM team additionally mapped the current process by hand. The team followed the value stream of oesophageal cancer treatment; that is, from when the patient enters the hospital to when the patient is discharged. At each stage the team captured the following data: 1] the lead
time, 2] materials or inventory, 3] resources (e.g. staff), 4] current problems, 5] current key performance measures, 6] information stream and 7] possible waste. After the VSM was created (a paper wall chart with coloured post-it notes that showed the current value stream) the team critically reviewed it by reflecting upon and highlighting the observations and conclusions from their “gemba” (experience), sorted by observations in the clinic and the policlinic. The team then addressed hazards and the risks in both the process design and the redesign in order to achieve acceptable risk levels. For each process step in the value stream, the team identified non value adding steps (NVA) and/or barriers to improving the efficiency or safety of the surgical process. They then designed interventions that addressed the barriers to efficiency or safety. Figure 1 shows the VSM and Table 1 the various process steps.

Table 1. Procedural steps of the current-state VSM.

<table>
<thead>
<tr>
<th>Identify key process steps for delivering product/service to patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Utilize information from “go and see” <em>(genchi genbutsu)</em></td>
</tr>
<tr>
<td>● Include key metrics with each step</td>
</tr>
<tr>
<td>● Include lead time and cycle time data</td>
</tr>
<tr>
<td>● Identify undesirable parts of the process</td>
</tr>
<tr>
<td>● Determine data gaps that need to be collected</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Identify flow of information from end user to beginning of process</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Include systems that provide information</td>
</tr>
<tr>
<td>● Record the frequency and type of information</td>
</tr>
<tr>
<td>● If information is your “product”, can you identify the origin of information?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Determine whether the value-stream steps add value or do not add value</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Analyse waste and determine improvements</th>
</tr>
</thead>
</table>

| Develop an action plan to make improvements                        |
Figure 1. The oesophageal cancer care pathway.
**Mapping the future state**

The team designed a future-state VSM, which is an often radically different series of process steps that allows the delivery of value to the patient faster, with fewer defects, using fewer resources. A future-state value stream was constructed by determining whether any of the steps in the process could be executed with less waste or whether they could be eliminated altogether. After designing the future state, the team created a detailed work plan for implementing the process improvements to make that proposed process a reality. Members of the team were assigned to specific tasks with timelines to drive the implementation of the process with optimal efficiency. Evaluation of the success of VSM has been carried out by measuring the reduction of NVA steps. Subsequently, improvements were made by elimination of identified waste and errors from the care pathway.

**Results**

The VSM visualization tool assisted the practitioners in better understanding and identifying what work was carried out in the care process for patients with oesophageal cancer and how that work was performed. This, in turn, enabled them to review that care process critically and improve it.

Evaluation of the existing process by the team revealed that the care pathway of patients with oesophageal cancer was a rather disordered process. An assessment of the present-state VSM demonstrated that only 17 out of 128 (13.3%) processes in the care pathway for patients with oesophageal cancer genuinely added value. Out of the remaining 128 processes, seven were identified as unnecessary and 104 as being necessary but NVA activities. Based on a clear future-state analysis, the team was able to identify considerable improvements to the preoperative process. The process improvements after observation of the present state were: to define process step milestones based on historical preoperative process times, administrative functions and administrative preoperative tasks to occur before the day of surgery, redesign of admission processes to ensure appropriate prioritization, and consolidated and streamlined OR nursing assessment documen-
Table 2. Objectives of work streams, findings and process improvements.

<table>
<thead>
<tr>
<th>Work stream</th>
<th>Objectives</th>
<th>Process improvements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Streamlining the preoperative process</td>
<td>To design scheduling processes that support improved OR use</td>
<td>• Creating defined process-step milestones based on historical preoperative process times</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Finishing isolated administrative functions and designed administrative preoperative tasks before the day of surgery</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Redesigning admission processes to ensure appropriate prioritization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Consolidating and streamlining OR nursing assessment documentation</td>
</tr>
<tr>
<td>Reducing collection of redundant information</td>
<td>To reduce redundancy in the capture, entry and reporting of patient information</td>
<td>• Analysis of every data element captured or viewed across the entire perioperative process</td>
</tr>
<tr>
<td>Employee engagement</td>
<td>To improve employee engagement and satisfaction across all surgical service departments</td>
<td>• Preprocedure checklist implemented</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• OR briefings implemented</td>
</tr>
<tr>
<td>Reducing non-operative time</td>
<td>To improve the efficiency of the non-operative processes and patient flow</td>
<td>• Mapping of existing processes to identify redundancies and waste</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Standardizing preoperative nursing activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Redefining roles and responsibilities to facilitate patient flow</td>
</tr>
</tbody>
</table>
Regarding documentation, our VSM evaluation highlighted that significant delays for patients were caused by the waiting time for the collection and inspection of paperwork and medical records. Consequently, transition to the next step in the care process could not occur until the medical records were ready. Table 2 provides examples of barriers that were identified and the solutions implemented.

Subsequently, the process improvements were implemented. By making the processing of paperwork/medical records more efficient the door-to-theatre-time could be reduced from 13.5 to 10 weeks and value-adding activities increased by about 24%. As a result, the total duration of the care process was reduced considerably. Overall, the team’s future-state map revealed that the number of steps needed to initiate operating procedures could be reduced to 103; the number of value-added steps could be increased from 17 to 21 while the 104 NVA

Table 3. A comparison between the results of the measures: pre-Lean and post-Lean application

<table>
<thead>
<tr>
<th>Measures</th>
<th>Pre-Lean</th>
<th>Post-Lean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door-to-theatre time (weeks)</td>
<td>13.5</td>
<td>10</td>
</tr>
<tr>
<td>Care process steps:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Value-added steps</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>- NVA steps</td>
<td>104</td>
<td>80</td>
</tr>
<tr>
<td>- Unnecessary steps</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Identified potential patient safety risks</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>Identified information errors</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Transfers</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>Lack of standardized protocol</td>
<td>9</td>
<td>3</td>
</tr>
</tbody>
</table>
steps could be cut by over 23% to 80 steps. The identified potential safety risk was reduced by 71% and the information errors were reduced by almost 92%. A summary of the results is shown in Table 3.

Overall, during the process improvements, active participation of team members was unfortunately not 100%; in particular, one department did not participate completely, and team members who missed introductory training/briefing sessions later reported that this caused them to lack some knowledge on how to apply and confidence in the VSM method. There were also reports of some local barriers. For example on allowing employees time away from their usual work to participate in the VSM process, and concerning suggestions regarding changing existing practices. The team reported that management should have been more assertive and supportive in bestowing employees with the authority and responsibility to attend the project meetings – especially because employees familiar with the everyday work processes are those closest to the problem – and allowing them make the necessary changes in a timely manner. Despite this, one key observation of our evaluation was that the VSM approach generally did result in consensus between the participating team members and it is likely that this buy-in from a range of stakeholders enabled subsequent change to be implemented without too much resistance.

Figure 2. The VSM chart.
Discussion

The purpose of this case study was to monitor and evaluate an example of Lean as a quality-improvement tool in practice. Our study at VUmc shows how Lean can be used to improve suboptimal care processes for patients with oesophageal cancer. The application of Lean methods in the manufacturing sector has been highly successful; our results indicate that VSM is a valuable tool in the health care setting too, and can be applied to a care process for patients with oesophageal cancer, leading to significant improvements in hospital practice. The findings suggest that VSM can help practitioners in learning to identify waste and visually see the process from beginning to end, with the use of a dedicated team, by following the steps of the process.

In general, this study adds further evidence to the literature on quality improvement in health-care, by showing that VSM can actually and validly foster health-care quality (Teichgräber and De Bucourt, 2012; Serrano Lasa et al., 2009; Singh Gill, 2012). We found VSM to be a focused and structured improvement tool that can lead to genuine and concrete care-process improvements in the delivery of patient care. Previous studies of the application of VSM have also shown that making a process visible by mapping, triggers critical thoughts that help improving the process (Platchek and Kim, 2012; Kim et al., 2007). Both Emiliani (2003) and Swank (2003) argue that focusing employees’ efforts on the value-creating activities desired by customers result in shorter lead times and fewer defects and errors.

The introduction of the careful observational techniques of VSM may result in long-term, durable improvements and new knowledge about the care process. This knowledge may empower staff at every level to create solutions to improve the quality of patient experiences. This observation is supported by previous research into mapping processes; for example, Martin (2002) found that during the mapping process insights develop, and, according to Teichgräber and de Bucourt (2012), these insights are the most significant benefits of using process mapping techniques such as VSM. According to Teichgräber and de Bucourt
(2011), “mapping does not only lead to better processes, but it also leads to a consensus that enables and enhances implementation”. Our study also showed that consensus was built, which contributed to the implementation of process improvements.

Although our results indicate that VSM enhances the care process of patients with oesophageal cancer, some challenges still remain. As with any new initiative there are a number of challenges and barriers that need to be addressed. Despite the goal of creating optimal collaboration between team members in the oncology surgery setting, and the finding that this was generally the case, one department was unable to/did not participate fully and actively. Furthermore, we identified that the management could have been more active in empowering and authorizing employees to make necessary changes. It has been argued that team members in a VSM should have a working knowledge of the VSM method. In our case not every member was able to participate in the introductory training; the consequential lack of knowledge and confidence was reported by some group members to be a barrier to the success of the initiative. VSM – like any other Lean tool – is human-centred. It therefore requires active participation of all parties involved. Constructive feedback and a non-judgemental attitude towards incremental process improvements can help teams to identify and eliminate waste. Practitioners of VSM should therefore jointly and iteratively pursue sources of waste in an attempt to reduce it, and team members should communicate their achievements to other colleagues as a means of providing encouragement. There have been similar findings in other studies.

This study has a number of limitations. It describes the application of a process mapping technique in one setting, which might not be necessarily comparable with other settings. While it supports the premise that VSM based on Lean thinking can help streamline the care process, it does not provide effects of the process mapping on patient care itself. To study effects on patient care, we suggest that future work should focus on outcome measures such as mortality, and length of hospital stay as a result of VSM techniques.
In conclusion, evaluation at the start of the project showed that the oesophageal cancer care process was highly fragmented, and involved variation entailing risks of medical errors. Application of VSM principles in the Lean context improved the process by cutting the number of individual steps needed to start treatment from 128 to 103 and minimizing the variability by applying standardization. VSM proved to be a valuable tool for improving the process of delivery of care to patients with oesophageal cancer. We expect these principles can be applied to other forms of care and other areas of health-care delivery.
References


[Accessed 18 December 2013].


Chapter 5

Lean healthcare from a change management perspective. The role of leadership and workforce flexibility in an operating theatre

L. van Rossum, K.H. Aij, N. van der Eng, W. ten Have
Abstract

Purpose Lean healthcare is used in a growing number of hospitals to increase efficiency and quality of care. However, healthcare organizations encounter problems with the implementation of change initiatives due to an implementation gap: the gap between strategy and execution. From a change management perspective, this research aims to increase scientific knowledge regarding factors that diminish the implementation gap and make the transition from the ‘toolbox lean’ towards an actual transformation to lean healthcare.

Methodology A cross-sectional study was executed in an operating theatre (OT) of a Dutch university medical centre. Transformational leadership was expected to ensure the required top-down commitment, whereas team leadership creates the required active, bottom-up behaviour of employees. Furthermore, professional and functional silo’s and a hierarchical structure were expected to impede the workforce flexibility in adapting organizational elements and optimize the entire process flow.

Findings The correlation and regression analyses showed positive relations between the transformational leadership and team leadership styles and lean healthcare implementation. The results also indicated a strong relation between workforce flexibility and the implementation of lean healthcare.

Value With the use of a recently developed change management model, The Change Competence Model, we suggest leadership and workforce flexibility to be part of an organization’s change capacity as crucial success factor for a sustainable transformation to lean healthcare.

Keywords Lean Healthcare, Transformational Leadership, Team Leadership, Workforce Flexibility, Change Capacity, The Change Competence Model
Introduction

Healthcare organizations are increasingly forced to adapt to developments in medical information, technologies, and relationships with other (healthcare) systems (Brandao de Souza and Pidd, 2011). In consequence, the healthcare sector is subject to continuous change (Adler et al., 2003; Dahlgaard et al., 2011). Simultaneously with these changes, healthcare organizations are forced to maintain and improve performance, quality of care and patient satisfaction (Brandao de Souza and Pidd, 2011; Dahlgaard et al., 2011). Patient safety is also a focal point, as is clear from one of the most influential reports in healthcare of the last two decades: "To err is Human: Building a Safer Health System” (Kohn et al., 2000). This report by the Institute of Medicine ensured that patient safety became a primary concern in the healthcare sector.

Healthcare organizations can improve patient safety, quality of care, efficiency, patient satisfaction and performance by applying lean principles (Brandao de Souza and Pidd, 2011; Dickson et al., 2009; Jimmerson et al., 2005; Womack and Jones, 2003; Young et al., 2004). Lean principles stem from the Japanese manufacturing industry and are centred on creating more value with less work by enhancing existing organizational processes and structures (Kim et al., 2006; Womack and Jones, 2003). Lean can be described as “an integrated system of principles, practices, tools, and techniques focused on reducing waste, synchronizing work flows, and managing variability in production flows” (De Koning et al., 2006).

Business management techniques such as lean were traditionally seen as a discipline distinct from healthcare management. This has changed over the last ten years as the value of integrating business management techniques into healthcare management has gained recognition as a means of delivering higher quality and more efficient care (Trisolini, 2002). In this context, Ben-Tovim et al. (2008) stress that the basics of process improvement, and therefore the lean principles (value, stream, flow, pull and perfection) are as appropriate for healthcare as they are for other service and manufacturing industries. The term
“lean healthcare” has emerged in recent years, reflecting the stronger focus on efficiency and patient satisfaction within the healthcare environment (Dahlgaard et al., 2011). Patients should be considered as primary customers, and the obvious application seems to lie in eliminating delays, repeated encounters, errors and inappropriate procedures (Young et al., 2004). A ‘lean toolkit’, including Value Stream Maps, Andon indicators for process control, Kanban cards for inventory control, and Jidoka or human supervised automation, is often used for quality improvements that eliminate waste from healthcare delivery processes (Kaplan et al., 2014). These lean tools can produce significant process improvements, yet healthcare organizations often, instead, go through a process of ‘trial and error’ and find it difficult to achieve sustainable change results and long-term improvements in quality and safety whilst simultaneously lowering costs (Adler et al., 2003; Dahlgaard et al., 2011; Kaplan et al., 2014; Mazzocato et al., 2010; Samuel and Novak-Weekley, 2014). Kaplan et al. (2014) state that a clear lesson from the current, still early, stage of lean health care is that in order to achieve sustainable change results, it is insufficient to simply implement lean tools and that an organizational transformation based on lean principles is required.

This requirement for an organizational transformation brings our study into the field of change management, as the difficulty in successfully implementing a change initiative or transformation program such as lean healthcare and thereby achieving long-term change results can be explained by the strategy-to-performance gap or implementation gap. The term implementation gap refers to the discrepancy between an organization’s strategy for change and its actual implementation (Floyd and Woodridge, 1992; Mankins and Steele, 2005; Sull, 2007). Research shows that the implementation gap can occur when the organization is mainly concerned with input and output, but little attention is given to the throughput of change initiatives (Ten Have et al., 2011). It seems that with lean healthcare, the implementation gap occurs as the primary focus is on implementing technical lean tools (input) and short-term outcomes (output) (Kaplan et al., 2014; Mazzocato et al., 2010), rather than on developing an in-depth understanding of the socio-technical factors that enhance the complete
change process; the organizational transformation required (throughput) (Joosten et al., 2009; Kaplan et al., 2014). A more holistic change perspective is thus required in order to obtain long-term improvements in core processes with lean healthcare and realise the transformation required (Kaplan et al., 2014; Mazzocato et al., 2010). We use the following definition of lean healthcare that highlights the more holistic character of the sustainable implementation of lean healthcare:

“Lean healthcare is a management philosophy to develop a hospital culture characterised by increased patient and other stakeholder satisfaction through continuous improvements, in which all employees (managers, physicians, nurses, laboratory people, technicians, office people etc.) actively participate in identifying and reducing non-value-adding activities (waste)” (Dahlgaard et al., 2011)

In more detail, the literature emphasizes that, in order to create a healthcare system possessing sustainable success in improving quality and lowering costs, technical lean activities must be part of a comprehensive management system that is supported by committed leadership and a supportive institutional culture (e.g. Kaplan et al., 2014; Mann, 2009; Samuel and Novak-Weekley, 2014; Steed, 2012). However, statistical evidence for the specific aspects of committed leadership or of a supportive institutional culture that positively affect sustainable lean healthcare results are still absent from the literature (Crema and Verbano, 2013; Holden, 2011; Steed, 2012). We take a change management perspective in order to determine the specific leadership characteristics and institutional culture factors that are part of the change process (throughput) which are expected to reinforce the transformation of the organization to a state in which it produces long-term lean healthcare results. Our detailed expectations are that transformational leadership and team leadership as well as workforce flexibility will be specific variables that will diminish the implementation gap and thus contribute to a sustainable transition to lean healthcare. With the use of a change management model, we show that transformational leadership, team leadership and workforce flexibility strengthen the change capacity and therefore foster the transition to a sustainable lean healthcare system. We report on a quantitative
case study executed in an operating theatre (OT) of a Dutch university medical centre. An OT is an unique and high-risk environment that makes lean healthcare even more complex in comparison to other units in a healthcare organization (Undre et al., 2006). Statistical evidence on factors in the change process to lean healthcare will help to reduce the implementation gap in this complex environment and enable the transformation based on lean principles. This, in turn, will stimulate the achievement of desired healthcare outcomes such as reduced numbers of delays and errors (Adler et al., 2003).

The following sections elaborate on the variables transformational leadership, team leadership and workforce flexibility and their expected relationships with a lean healthcare implementation.

**Conceptual framework**

*Transformational Leadership*

Leadership is mentioned in various papers as enabler or inhibitor of successful lean implementation (e.g. Brandao de Souza and Pidd, 2011; Doss and Orr, 2007; Jimmerson et al., 2005; Kaplan et al., 2014; Mann, 2009; Samuel and Novak-Weekley, 2014; Steed, 2012; Young et al., 2004; Womack et al., 2005). Doss and Orr (2007) and Mann (2009) even suggest that leadership is the missing link between an academic approach to lean systems and the actual transformation of an organization toward lean practices. Leaders and senior management play a crucial role in establishing governance conditions across department boundaries, supporting a thorough and long-term vision of value-producing processes and holding everyone in the organization accountable for commitment to lean transformation (Mann, 2009). In the specific context of lean healthcare, full management support and commitment are also defined as key factors for enabling staff to make improvements and obtain sustainable results (Crema and Verbano, 2013; Grove et al., 2010; Steed, 2012). Grove et al. (2010) mention transformational leadership as necessary for overcoming the barrier of poor leadership that impedes the successful and sustainable implementation of lean
healthcare. In the successful case of ThedaCare, the shift from an autocratic leadership style concentrated on management by objectives to new leadership competences that included mentoring, facilitating and teaching and leaders that express their experiences and vision throughout the organization is seen as determining factor for their magnificent lean healthcare results (Toussaint and Berry, 2013). This can be paralleled in the literature where the distinction is made between transformational leadership and transactional leadership styles (Bass, 1985). Senior management can create a vision that is widely understood that inspires company employees, encourages desirable behaviour and strengthens the organization’s capacity for change (Klarner et al., 2008; Oxtoby et al., 2002). Klarner et al. (2008) call this transformational leadership. A transformational leadership style facilitates and carries out transformation in changing situations with great impact such as the implementation of lean healthcare. By defining a specific need for change, creating new visions and mobilizing commitment to those visions, a transformational leader is able to transform an organization (Den Hartog et al., 1997). Transactional leadership, in contrast, consists of pure exchange between leader and follower. It is characterized by the leader clarifying performance criteria, stating expectations and determining what followers receive in return. A transactional leader accomplishes their followers to perform exactly as expected, whereas a transformational leader inspires their followers to do more than what was formerly expected (Hater and Bass, 1988).

Likewise, the need for a transformational leadership style during lean healthcare implementation is reinforced by studies conducted by Jimmerson et al. (2005) at Intermountain Health Care (IHC; Salt Lake City) and Dickson et al. (2009) where they studied the transformation to lean healthcare in the emergency departments of four hospitals. In both studies, transformational leadership characteristics such as drive and commitment of senior management, reassured workers that the implementation of lean principles was not just another management trend. Transformational leadership, appeared to be a key factor for securing sustainable and successful change in the hospitals applying lean principles.
Team leadership

The concept of transformational leadership creates top-down commitment from senior management, which is required for a successful transformation to lean healthcare. However, besides top-down commitment, a bottom-up approach to implementing solutions is also needed (Grove et al., 2010). Essential to lean healthcare is that all employees must be aware of the daily generation of waste because they need to identify where improvements can be made in quality and efficiency of care. Moreover, staff should also be held responsible for implementing solutions (Grove et al., 2010). To reinforce their enthusiasm for identifying waste and proposing improvements, they must engage in all the processes of the organization (Kim et al., 2006). Senior managers should thus be strongly committed but simultaneously understand the fact that because employees are directly involved in the details of work, they often have better insight into what needs improvement. Therefore, units should be authorized and empowered to self-manage toward an ideal level of functioning (Jimmerson et al., 2005), where improvements are implemented through employees identifying appropriate leaders and problem solvers inside the organization (Crema and Verbano, 2013). Literature regarding self-management shows that if multifunctional teams have the responsibility to improve their own tasks, team leadership is needed (Carson et al., 2007; Pearce and Conger, 2003). Team leadership, or shared leadership, is “a dynamic, interactive influence process among individuals in groups for which the objective is to lead one another to the achievement of group or organizational goals or both. This influence process often involves peer, or lateral, and at other times involves upward or downward hierarchical influence” (Pearce and Conger, 2003). Team leadership increases the power of all employees and is dispersed among the organization’s members rather than focused on a single appointed formal leader (Carson et al., 2007; Pearce and Conger, 2003). The authorization of key (team)players throughout the organization or department as effective leaders seems to promote active participation by all employees and the use of all their capabilities. Thus, such authorization is a necessity for the bottom-up strength of an organization or
department that is applying lean healthcare (Kim et al., 2006). Team leadership will increase the level of involvement and strengthen the organization’s bottom-up dynamics in order to create a culture of identifying waste, proposing improvements and implementing solutions.

**Workforce Flexibility**

Besides the vital role of appropriate leadership, it is stressed that a supportive institutional culture is needed in order to create a healthcare system that has sustainable success in improving quality of care and lowering costs using lean principles (e.g. Kaplan et al., 2014; Mann, 2009; Steed, 2012). The literature review of Crema and Verbano (2013) of lean health management highlights the importance of replacing a frequently dominating hierarchical blame and shame culture for a culture that is characterized by safety, continuous improvement, learning and multidisciplinary work. First, the hierarchical structure within healthcare organizations can form a barrier against implementation of lean healthcare as it constrains the bottom-up behaviour required of all employees (Brandao de Souza and Pidd, 2011). Second, healthcare organizations deal with functional and professional silos – structures of fragmented care and professional practice – that can create barriers against optimization of work processes and structures (Brandao de Souza and Pidd, 2011; Grove et al., 2010). Lean healthcare teaches that optimizing the performance of an individual unit or “silo” is insufficient; the entire process flow must be improved that requires the cooperation of all operating units if meaningful and sustained performance improvement is to be achieved (Kim et al., 2006). In this light, Walley (2003) states, specifically for the emergency care system, that it is essential that the entire staff is flexible and multi-skilled enough in order to respond to daily demand changes and adjust to the many different types of patients entering the system. Dickson et al. (2009) strengthen this assumption as they found empirical evidence at four emergency departments that the workforce flexibility reinforces the sustainable implementation of lean healthcare. Hence, autonomous working in different silos or disciplines, and a traditional hierarchical structure in healthcare organizations, may hinder staff flexibility in adapting procedures,
processes, behaviour and skills when implementing lean healthcare and optimizing the total process flow (Drucker, 1994; Thakur et al., 2011). Autonomous working and hierarchies may reinforce institutionalism and reduce the flexibility of the workforce in changing to an efficient organizational framework that enables optimization of the entire process flow. We define the workforce flexibility required as “the dynamic capability of the firm in the sense that it is focused on adapting employee attributes - such as knowledge, skills, and behaviours - to changing environmental conditions” (Bhattacharya, et al., 2005). For a sustainable transition to lean healthcare, the optimization of work processes and structures requires a structure with the right degree of workforce flexibility so that individuals from different units or disciplines can work collaboratively regardless of barriers that are created (Samuel and Novak-Weekley, 2014).

**Hypotheses**

We focus on transformational leadership at senior management level and team leadership as leadership styles expected to positively relate to a lean healthcare implementation. We define lean healthcare implementation as the sustainable transition to a culture characterised by increased satisfaction among patients and other stakeholders through continuous improvements in which all staff at all levels actively participate. Moreover, we also expect workforce flexibility to positively relate to a lean healthcare implementation, as it enables healthcare organizations to adapt organizational elements in order to optimize the entire process flow and create the accurate institutional culture. This leads to the following hypotheses:

*Hypothesis 1 (H1):* Transformational leadership at senior management level is positively related to the implementation of lean healthcare.

*Hypothesis 2 (H2):* Team leadership is positively related to the implementation of lean healthcare.

*Hypothesis 3 (H3):* Workforce flexibility is positively related to the implementation of lean healthcare.
Method

Case description and participants

We used a cross-sectional survey-based methodology because we required a relatively large number of respondents in order to generate statistical evidence. The operating theatre (OT) of a Dutch medical university centre was used as a research site as it is one of the larger OTs in the Netherlands and thus accurately represents an OT environment. The OT of the hospital surveyed initiated the implementation of lean healthcare 18 months before the study was carried out. The 18 month lead in the implementation ensured the researchers that the lean healthcare implementation could be investigated properly. A process improvement team started work in the entire OT to address issues by defining and targeting performance and metrics for improvement. The implementation of lean healthcare was fostered by a cross-functional process-improvement team consisting of OT employees and aided by an external consultant. With a total of 380 employees, the OT is the largest department of the teaching hospital and consists of multiple sub-divisions. The respondents were asked to complete a 69-item survey, which was distributed by e-mail to all OT employees (n=380). After two weeks, a reminder e-mail was sent to those who had not yet responded or who had responded incompletely. All respondents were informed about the confidentiality and anonymity of the survey. Off the 380 potential respondents, 103 employees supplied enough information for analysis, providing us with an overall response rate of 27%. As the respondents were distributed evenly across all functions represented in the OT the respondents reflected the general population of an OT (Brick and Kalton, 1996). The average age of the respondents was 40.1 years, with a standard deviation of 10.6 years. The majority of the participants were women (70%), and their tenure with the organization was somewhat dispersed (M = 8.5 years, median = 5 years, SD = 7.9 years).

As theory suggests that a transformational leadership style is of particular importance at the senior management level when implementing lean healthcare in order to realise the top-down commitment required (Dickson et al., 2009;
Jimmerson et al., 2005), questions assessing transformational leadership referred to “my direct supervisor”. In contrast to transformational leadership, team leadership was focused on all employees and was assessed by questions that referred to “my team members”. We coded respondents as hierarchical level 1 and hierarchical level 2 in order to test differences in transformational leadership among the two existing senior management levels in the OT. These include a) head of the operating theatre and b) unit leaders. As the unit leaders as well as the administrative staff report directly to the OT head, these respondents were coded as hierarchical level 1. Their responses assessed the degree of transformational leadership of the OT head. Consequently, the remaining respondents were medical employees reporting directly to one of the unit leaders and were coded as hierarchical level 2. Their responses assessed the degree of transformational leadership of unit leaders.

**Survey validity**

The cross-sectional survey was developed to test the three hypotheses measuring relationships between transformational leadership, team leadership, workforce flexibility and a lean healthcare implementation. All the measures were collected on a 7-point Likert scale with the following response possibilities: 1 (*fully disagree*), 2 (*disagree*), 3 (*slightly disagree*), 4 (*neither disagree nor degree*), 5 (*slightly agree*), 6 (*agree*), 7 (*fully agree*). To assess the internal consistency of each scale, Cronbach’s alpha was calculated. To ensure content validity, the multi-item scale for each construct in the questionnaire was developed in three stages. First, a preliminary set of existing scales and their items was collected based on an extensive literature review. Second, as the items had to be translated into Dutch, the back-translation technique was applied. A professional translation agency translated the items into Dutch and a native English speaker then translated them back into English. No irregularities were found when evaluating the equivalence of meaning between the original and the back-translated English versions. Therefore, no adjustments were made to the Dutch version of the questionnaire. Finally, all 69 translated items were discussed with a lean healthcare consultant from the OT and a university researcher. Modifications were made to assimilate
their submissions, and face validity was assessed based on these responses. To ensure content validity, all the items were formulated to focus the respondent on the target of interest.

**Dependent Variable**

**Implementation of lean healthcare**

To assess the lean healthcare implementation following our definition we used the method of Dahlgaard et al. (2011) ‘A System for Assessing and Improving Healthcare Organizations’. Dahlgaard et al. (2011) designed and tested a questionnaire for assessing the existing organizational lean culture of hospital departments applying lean healthcare indicators. We included in our current questionnaire all items assessing the level of ‘lean’ which included both dimensions ‘Lean Processes’ and ‘Lean Results’ measuring the implementation of lean healthcare focused on the actual organizational transformation based on lean principles, not measuring technical lean tools.

To ensure clarity among all of the respondents, some of the items were adjusted to the specific context, and lean-specific concepts were introduced. For example, the concept of “flow and pull” was briefly explained prior to the related item. All questions referred to the respondent’s perception of the extent to which lean healthcare processes and results were present and implemented in the OT. Sample items included “The operating theatre is continuously striving to reduce waiting time for patients or projects” and “Patient satisfaction has been improved during the last 3 years”. The overall reliability of the construct implementation of lean healthcare was .93, with M = 4.27 and SD = .69.

**Predictors**

**Transformational leadership**

Transformational leadership was assessed using the leader behaviour questionnaire (LBQ) developed by Cox and Sims (1996), and further analysed by Pearce, Perry and Sims (2001). Because our study examines transformational leadership style, we used all items from the LBQ on transformational behaviour.
To strengthen the examination of transformational leadership, we subsequently added all items of two dimensions (Pearce and Sims, 2002): (a) having high performance expectations and (b) using inspirational communication. Items were modified to reflect the unique aspects of the research site. For example, the term “my team leader” was changed to “my direct supervisor” in all items in order to assess the transformational leadership of senior management. An example item is “My direct supervisor expects me to give 100% all the time.” The reliability in the present study was .95, with M = 4.82 and SD = 1.16.

**Team leadership**

The perceived existence of team leadership was assessed by the shared leadership perception survey (Wood, 2005). Wood derived questions from the theory of Porter-O’Grady and Wilson (1995) as well as from Hiller’s (2002) leadership questionnaire. The scale showed good psychometric validity in Wood’s study, and all items of the four dimensions were identified: (1) Joint completion of tasks; (2) Mutual skill development; (3) Decentralized interaction among personnel; (4) Emotional support. The four dimensions consisted of 19 items that were used in the present study, a sample item is: “Team members encourage one other during challenging times at work”. Three items were reversed-scored because the questions sought to determine a more directive nature of leadership, as opposed to team leadership (Wood, 2005). Cronbach’s alpha for this scale was .89 with M = 4.53 and SD = 0.87.

**Workforce flexibility**

The construct of workforce flexibility was used for measuring the dynamic capability of a firm to adapt its employee attributes. Bhattacharya et al. (2005) developed a questionnaire. We included all items in our study measuring two dimensions: (1) Skill flexibility and (2) Behaviour flexibility. Items were subsequently modified to reflect the unique aspect of the healthcare context as well as the perceptions of the respondents. For example, terms such as “our firm” were changed to “the operating theatre” and “customer requirements” were changed to “patient needs.” A sample item is: “Employees of the operating...
theater are capable of putting new skills to use within a short time.” Cronbach’s Alpha for this scale was .90 with $M = 4.44$ and $SD = .82$.

**Correlations and power calculation**

The reliabilities were all 0.89 or above and all correlations between scores were significant (Table 1). Thus all three predictors have a reasonably strong and positive relationship with the dependent variable, implementation of lean healthcare. But there also is overlap among the predictors.

**Table 1. Correlations and descriptive statistics for the main variables. On the diagonal are Cronbach’s alphas.**

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<tr>
<td>1. Implementation of lean healthcare</td>
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<td>2. Transformational Leadership</td>
<td>4.82</td>
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<td>0.54**</td>
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<td>3. Team Leadership</td>
<td>4.53</td>
<td>0.87</td>
<td>0.55**</td>
<td>0.44**</td>
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<td>4. Workforce Flexibility</td>
<td>4.44</td>
<td>0.82</td>
<td>0.60**</td>
<td>0.28**</td>
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** p < .01 level

The power of a study refers to the chance that you will find an effect when there is one. Many disciplines hold a .80 power level as a minimum, meaning that you will have a 20 percent chance that you will conclude that there is no effect when in fact there is one. The power levels for the three predictors in our study where .97 (transformational leadership), .58 (team leadership) and 1.00 (workforce flexibility). As we found an effect for team leadership, this relatively low power level of team leadership appeared to be powerful enough.
Findings

Test of Hypotheses

A linear regression analysis was conducted in order to test the hypotheses. In table 2, the results are presented. The combination of all three predictors explains 53% of the differences in how the implementation of lean healthcare is perceived and is significantly different from 0 ($F[3; 99] = 37.07; p < .0001$). Each individual predictor also has a significant, specific and positive relationship with the dependent variable, confirming all three hypotheses. A histogram of the residuals shows no marked departure from a normal distribution, and the value of the Durbin-Watson statistic lies near the expected value of 2, implying independent observations. A scatterplot of residuals versus predicted values shows no sign of heteroscedasticity, and also no marked outliers are visible (the standardised residuals lie between -2.70 and 2.61).

Table 2. Results of the linear regression analysis.

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<td>Multiple R = 0.73</td>
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<td>Durbin-Watson = 2.21</td>
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<td>Transformational Leadership</td>
<td>0.34</td>
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<td>Team Leadership</td>
<td>0.20</td>
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<td>Workforce Flexibility</td>
<td>0.40</td>
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Of the three predictors, workforce flexibility has the strongest relationship with implementation of lean healthcare, but the betas differ not much. These results signify that all three aspects are important in getting the best result in the transformation to lean healthcare. Besides the three parent variables, the variation between the correlations of the dimensions underneath each construct is noteworthy. Some factors appear to have a slightly stronger influence on the implementation of lean than others (see Table 3). However, none of these underlying dimensions contain an outlier value.
Table 3. Means, Standard Deviations and Inter-Correlations

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<td>1 Implementation of lean healthcare</td>
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<td>2 Process</td>
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<td>3 Results</td>
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<td>4 Transformational Leadership</td>
<td>4.82</td>
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<td>5 Performance Expectations</td>
<td>5.22</td>
<td>1.17</td>
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<td>6 Challenge to status quo</td>
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<td>7 Vision</td>
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<td>8 Idealism</td>
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<td>9 Inspirational Communication</td>
<td>4.98</td>
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<td>10 Team Leadership</td>
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<td>11 Joint completion of tasks</td>
<td>4.32</td>
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<td>12 Mutual Skill Development</td>
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<td>13 Interaction among personnel</td>
<td>4.47</td>
<td>1.10</td>
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<td>14 Emotional Support</td>
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<td>15 Workforce Flexibility</td>
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**Additional analyses**

In addition to the hypotheses, some additional analyses were carried out to investigate differences between respondents coded as hierarchical level 1 and hierarchical level 2. An independent t-test (2-tailed) was conducted to investigate these differences in transformational leadership. A significant difference was found between hierarchical level 1 (M = 6.07, SD = .11) and hierarchical level 2 (M = 4.77, SD = 1.15), t(101) = 10.15, p < .01. This result implies that the head of OT was perceived to be a more transformational leader than the unit leaders. On team leadership and workforce flexibility, there were no differences between the hierarchical levels (n=101 in both cases, hierarchical level 1 t = .49, hierarchical level 2 t = -1.34). On the implementation of lean healthcare, however, there was a significant difference between hierarchical level 1 (M = 4.70, SD = .23) and hierarchical level 2 (M = 4.25, SD = .88), t(101) = 3.01, p = <.05. This implies that unit leaders and administrative staff (respondents coded as hierarchical level 1) regarded the implementation of lean healthcare as more positive than the other medical employees (respondents coded as hierarchical level 2). The relationship, however, between the three variables – transformational leadership, team leadership and workforce flexibility – and the implementation of lean healthcare was not significantly different between the two hierarchical levels conducting a moderated regression analysis.

**Discussion**

Healthcare organizations have difficulties in successfully implementing lean healthcare and achieving sustainable change results by improving quality and safety whilst simultaneously lowering costs (Adler et al., 2003; Dahlgaard et al., 2011; Doss and Orr, 2007; Joosten et al., 2009; Kaplan et al., 2014; Samuel and Novak-Weekley, 2014). Current literature argues that instead of implementing merely technical lean tools, an organizational transformation based on lean principles is required for sustainable change success (Kaplan et al., 2014). Specific attention should thus be given to socio-technical aspects concerning the
throughput that enhance the complete change process and diminish the implementation gap which occurs between an organization’s change strategy and the actual implementation (Floyd and Woodridge, 1992; Joosten et al., 2009; Mankins and Steele, 2005; Sull, 2007). From a change management perspective, we argue that appropriate leadership styles and workforce flexibility are success factors in the transition from technical “lean tools” to the required transformation defined as a hospital culture characterised by increased patient and other stakeholder satisfaction through continuous improvement. In more detail, we hypothesized that transformational leadership at senior management level, team leadership and workforce flexibility at all levels contribute to the implementation of lean healthcare, seen as the actual organizational transformation based on lean principles.

All three of our hypotheses were substantiated. Our cross-sectional study in an OT indicate a strong positive relationship between a transformational leadership style at senior management level and the implementation of lean healthcare. This indicates that senior management containing transformational leadership characteristics benefit the sustainable transition to lean healthcare. Furthermore, team leadership also showed a strong positive relationship with the implementation of lean healthcare, indicating that team leadership among all employees in an OT also promotes a successful transition to lean healthcare. We argue that transformational leadership at the senior management level seems to create the required top-down commitment that inspires employees to obtain sustainable lean healthcare results, whereas team leadership among all employees will continuously strengthen bottom-up dynamics of identifying waste, proposing improvements and implementing solutions in an OT. Moreover, the analysis showed that workforce flexibility also has a strong positive relationship with the implementation of lean healthcare. It demonstrates the importance of flexibility of the entire workforce when implementing lean healthcare. Workforce flexibility to change seems to enable an institutional culture where an efficient organizational framework is created within the OT so that individuals from different units or disciplines can work collaboratively regardless of barriers that
are created. It stimulates the required multidisciplinary work and optimization of
the entire process flow.

Transformational leadership at the senior management level, team leadership and
workforce flexibility at all levels in an OT are thus indicated as success factors
when implementing lean healthcare and make the transformation to a healthcare
system supported by committed leadership and an supportive institutional culture
that enables sustainable success (e.g. Kaplan et al., 2014; Mann, 2009; Samuel and
Novak-Weekley, 2014; Steed, 2012). These success factors create top-down
commitment, bottom-up strength for implementation and an efficient
organizational framework in an OT. Lean teaches that sustainable results can only
be achieved by the optimization of the entire process flow. In this light, we expect
our findings to be applicable to the OT as ‘silos’ but simultaneously to all other silos
that are part of the entire care process that need to be optimized when
implementing lean healthcare. Nevertheless, our findings also have great value in
the specific high-risk environment of an OT where surgical work consists of
complex interdisciplinary interactions between highly specialized professionals.
The strong interdependent nature of surgery demands a high level of shared
understanding among members about their respective roles, tasks and objectives
throughout the process and their responses to unexpected clinical events (Healey
et al., 2004). Increasing performance and achieving sustainable change results by
implementing lean healthcare in this complex environment is fundamental in
safer, more efficient and better surgical work.

The variables we showed were success factors and as being part of the change
process (throughput), seem to diminish the implementation gap between merely
lean tools (input) and achieving the healthcare system based on lean principles
that has sustainable success in improving quality of care and lowering costs
(output). To add an in-depth change management perspective to these findings,
we use a change management model that gives a more detailed insight into an
organization’s change processes and the success factors for the implementation
of lean healthcare.
Change Competence Model

Models can be used to better understand research findings (Shafer et al., 2005). We use the recently developed Change Competence Model (Ten Have et al., 2011; Ten Have et al., 2015) as a change management model to add extra meaning to our findings regarding the implementation of lean healthcare. The Change Competence Model identifies five meta factors that hinder or facilitate change. These factors are: Rationale, Effect, Focus, Energy and Connection (see figure 1, The Change Competence Model). It is crucial that all factors are developed to the level required. In fact, to attain successful change, an organization should align or balance its ambition (change vision) with its possibilities to realize the organizational change (change capacity) (Ten Have et al., 2015).

Figure 1. The Change Competence Model (Ten Have et al., 2015).

The organization’s change vision is determined by Rationale and Effect, the vertical lemniscate of the model. Rationale is the reason behind the change. It must be understood on a cognitive level (for example an understandable strategy) and must also resonate on a more affective level to elicit the necessary sense of
urgency (Bruch and Vogel, 2011; Kotter, 1995). The Effect factor includes the tangible and intangible change results for the organization and its employees. It also incorporates factors, such as monitoring and feedback, that anchor the results in the organization (Ten Have et al., 2015). The factor Connection refers to the specific management of the change initiative, such as the type of change strategy that will, or must, be used and the unity between coexisting change initiatives and related interventions. Connection also includes the pacing and sequence of implementation.

Our findings appear to relate to the Energy and Focus factors of the model. The combination of these two factors can be regarded as the organization’s capacity for change – the horizontal lemniscate of the model. The factor Energy refers to the preparedness and readiness for change among the organization’s members. Preparedness and readiness can be strengthened by appropriate and supportive leadership, inspiration and professional autonomy (Ten Have et al., 2015). We considered transformational leadership at the senior management level and team leadership throughout the entire OT as appropriate and supportive leadership styles that create inspiration and stimulate the professional autonomy that is needed which, in turn, stimulates successful implementation of lean healthcare.

In our research, we also considered workforce flexibility of caregivers to be a success element for lean healthcare. According to the Change Competence Model, workforce flexibility is part of the factor Focus. Hence, Focus concerns the organizational elements that serve as the framework for aligning behaviour with the change goals and with organizational missions such as the implementation of lean healthcare (Ten Have et al., 2015). These organizational elements, among others, include hard aspects such as structures and systems, but also soft ones such as rituals and exemplary behaviour (Ten Have et al., 2015). The rigidity of these elements determines the organizational flexibility of an organization. Our findings indicate that workforce flexibility in an OT enables the creation of an organizational framework adequate that supports the institutional culture needed for a sustainable lean healthcare implementation. Hence, procedures, processes, behaviour and skills can be adapted and aligned in order to optimize the entire
process flow and will be hindered least by different silos or disciplines and a traditional hierarchical structure in an OT.

By linking our findings to the factors Focus and Energy of the Change Competence Model, it can be argued that the variables transformational leadership at the senior management level, team leadership and workforce flexibility throughout an OT are elements promoting the change process towards the sustainable implementation of lean healthcare by successfully becoming part of an OT’s capacity to change. Preparedness and readiness (Energy) as well as the flexibility of the OT (Focus) are strengthened by the respectively appropriate leadership characteristics and workforce flexibility. These success factors strengthen the change capacity of an OT as crucial components in the change process from implementing technical lean tools towards the actual transformation based on lean principles with sustainable change results.

**Practical implications**

We suggest that the use of transformational leadership at the senior management level and team leadership styles together with a flexible workforce make a strong contribution to the change capacity of an OT that is implementing lean healthcare. As the change capacity increases, the more likely it becomes that organizations can overcome the trial and error process that is often experienced and achieve sustainable change results with lean healthcare. Healthcare managers in an OT can use these findings when applying lean healthcare to analyse the organization’s change capacity in terms of appropriate leadership styles and the right degree of workforce flexibility, determine which interventions are needed and improve the outcome of existing care processes. It alerts managers to the importance of these socio-technical factors that give insight into the change process and diminish the implementation gap, allowing the healthcare organization to make the transition from a “toolbox lean” to the actual and sustainable improvement of quality of care.

Regarding leadership, healthcare managers should ensure that at the senior management level, leaders possess or develop transformational leadership
characteristics. In addition, team leadership needs to be stimulated at every level within the OT. The latter implies that key (team)players throughout the organization should be authorized to be effective leaders and identify areas of waste. Combining transformational leadership and team leadership will increase Energy which, in turn, strengthens the organization’s capacity to change (Ten Have et al., 2015). Moreover, healthcare managers need to establish an adequate organizational framework that enables the organization to adjust and align organizational elements in such a way that lean healthcare implementation is successful and that the desired outcomes can be achieved. We have shown that workforce flexibility is an important factor in creating this appropriate framework, or Focus. Flexibility of the workforce will enable the organization to enforce multidisciplinary work across and within silos, minimize sub-optimization, and adapt behaviour, skills and processes for the successful implementation of lean healthcare. Managing the change process towards a successful implementation by strengthening Energy and Focus and thus the change capacity will make the difference between technical lean tools and the actual transition to lean healthcare. Finally, we argue that these practical implications, besides the context of an OT, shall also be applied to other units or ‘silo’s’ being part of the entire care process.

Limitations and future research

A limitation of our study is that there was no baseline measurement from before lean healthcare implementation in the OT. The comparison of a baseline measurement with a follow-up measurement would give valuable insight into the progress of lean healthcare during implementation and would be able to identify latent factors that might influence the organization and the implementation of lean healthcare. Moreover, such a longitudinal study is recommended for detecting causality between variables. From a managers’ perspective, it is useful to know which factors have a stronger causal relation with the implementation of lean healthcare than others. Such knowledge enables managers to choose the most effective and efficient interventions. Our results, however, do not allow
attribute of causality to the correlations. Future research conducting a longitudinal study should overcome this shortcoming.

Furthermore, although the respondents included in our study resemble the general OT population by function, it is unclear whether the same can be said for other, psychological characteristics. This is because not everyone from the OT participated in the study. Due to time constraints, we were not able to test for a non-response effect. Future research, therefore, should investigate this possibility. We furthermore expect our findings to be applicable to different units or silos within healthcare. Future research should further investigate this generalizability. Future research should also focus on how to overcome low response rates of surveys in healthcare settings because it appears not to be confined to our study (Aitken et al., 2008; Templeton et al., 1997), and some even say that it is a trend, or becoming so (Wiebe et al., 2012).

Another limitation applies to our observation that lean healthcare is not a clear-cut construct. This study operationalized the construct through survey questions, yet the construct remains ambiguous since the possibility exists that not every possible aspect of lean healthcare was incorporated. In addition, the questionnaire was based on perceptions and did not make use of numbers, such as key performance indicators. This could have rendered subjectivity in our examination of lean healthcare implementation in the OT we surveyed.

Future research should further investigate the effects of transformational leadership on lean healthcare implementation between different levels of management seniority. We showed that the head of the OT was perceived as a more transformational leader than the unit leaders. However, no effect was found between these two senior management levels within the positive relationship between transformational leadership and the implementation of lean healthcare. Future research could focus on the different positions of managers and leaders and their impact on the success of lean healthcare. In addition to the effect of transformational leadership, other leadership styles could also be investigated in the context of lean healthcare. For example, Poksinska et al., (2013) mention
servant leadership being part of lean leadership as well as transformational leadership and self-managed teams. Furthermore, future research could further investigate the findings from the Change Competence Model we used in this research. We suggested that the current findings are part of the change process as they strengthen an organization’s change capacity. However, more scientific research is needed into the causal influence of these variables on the organization’s change capacity and their consequent effect on lean healthcare.

Conclusions

In summary, we conclude transformational leadership at the senior management level, team leadership and workforce flexibility are success factors in enabling an OT to make the transition from the merely theoretical approach of implementing lean tools to the actual transformation to lean healthcare. These appropriate leadership styles stimulate top-down commitment and enable the professional autonomy required. Moreover, the right degree of workforce flexibility will determine to what extent organizational elements such as behaviour, procedures, systems and structures can be adjusted so that lean principles can be implemented across functions and silos and total processes are optimized. In particular, healthcare organizations need to focus on the structure of different professional and functional silos and the hierarchical structures that can impede optimization of the entire process flow. Taken altogether, the appropriate use of leadership and sufficient flexibility within an OT’s workforce as part of the change process (throughput) will strengthen the organization’s change capacity and therefore diminish the implementation gap that impedes a successful lean healthcare implementation.
References


Chapter 6

Experiences of Leaders in the Implementation of Lean in a Teaching Hospital: Barriers and Facilitators in Clinical Practices


Abstract

Objectives To date, experiences of leaders in the implementation of lean after a lean training programme have not been systematically investigated within teaching hospitals. Existing studies have identified barriers and facilitators only from an improvement programme perspective and have not considered the experiences of leaders themselves. This study aims to bridge this gap.

Design Semi-structured, in-depth interviews.

Setting One of largest teaching hospitals in the Netherlands.

Participants 31 medical, surgical, and nursing professionals with an average of 19.2 years of supervisory experience. All professionals were appointed to a Lean Training Programme and were directly involved in the implementation of lean.

Results The evidence obtained in this study shows that, from the perspectives of participants, leadership management support, a continuous learning environment, and cross-departmental cooperation play a significant role in successful lean implementation. The results suggest that a lean training programme contributed to positive outcomes in personal and professional skills that were evident during the first four months after programme completion.

Conclusion Implementing lean in a teaching hospital setting is a challenge because of the ambiguous and complex environment of a highly professionalised organisation. The study found that leadership management support and a continuous learning environment are important facilitators of lean implementation. To increase the successful outcomes of leadership actions, training should be supplemented with actions to remove perceived barriers. This requires the involvement of all professionals, the crossing of departmental boundaries and a focus on meaning-making processes rather than simply ‘implementing’ facts. Therefore, this research suggests that programme participants, such as staff members and leaders, can mutually explore the meanings of lean thinking and working for their own contexts. By entering this shared learning process (e.g., learning on the job) the ownership of lean implementation could also increase.
Introduction

Lean improvements have been initiated in hospitals throughout the world for the benefit of patients, employees and hospital organisations. In the Netherlands, budget constraints and the growing patient population have urged healthcare organisations to improve efficiency and reduce costs while maintaining quality (Slobbe et al., 2007; Al et al., 2005). In addition, the focus on the quality of patient care has been increased by health inspectorate accreditation organisations. As a result of this focus, health care leaders need to focus on efficient, patient-centred operations and continuous quality improvements (Øvretveit, 2005). One possible way to achieve this is by implementing lean; however, an organisation cannot become lean overnight: lean projects in other industries have shown that the application of lean practices requires perseverance and top-down commitment combined with bottom-up implementation (Womack and Jones, 2003; Ben-Tovim, 2007; Radnor et al., 2006). These requirements imply the crossing of departmental boundaries, collaboration and a high-quality training programme (Ballé and Régnier, 2007; De Souza and Pidd, 2011; Mazur et al., 2010).

A recent study of McConnell et al. (2013) shows that patient outcomes can be improved by a lean management system. Yet, little is known about the barriers and facilitators - defined as factors that influence lean implementation - that are encountered during the implementation of lean within hospital settings. (De Souza, 2009; Robinson et al., 2012; Burgess and Radnor, 2013). Various psychology studies and studies of patient safety education have shown that 40 to 50% of the intended actions after training are never executed or are only partially implemented (Holland and Meyers, 2010; Salanova et al., 2010). This finding may also apply to the outcomes of a lean training programme (LTP). However, few studies have discussed the barriers and facilitators that may be encountered in follow-up actions after an LTP in a hospital setting.

The aim of this paper is to provide insight into the barriers and facilitators that are encountered in implementing lean within clinical practices. This paper explores the experiences of team leaders after they attended an LTP to improve their management skills and behaviour to aid in the implementation of lean.
Methods

Setting

The study was conducted at the VU University Medical Center (VUmc), a 733-bed academic hospital located in Amsterdam, the Netherlands. The VUmc employs 5,610 full-time staff operating within a current budget of €301 million. In 2010, the VUmc had 27,096 admissions performed 24,729 outpatient treatments and received 322,696 visits to its outpatient units, of which 122,120 were first contacts. The Dutch Institute for Accreditation in Healthcare (NIAZ) accredited the VUmc by an external audit in the fall of 2010. Subsequently, the VUmc adopted lean as a philosophy for continuous improvement. Roth (2006) describes lean as:

“lean is not a program or an outcome, nor does it reside at an executive level or within the workforce. Lean is a way of operating that spans from executive strategy setting for developing people and managing business growth to the commitment of the workforce to continuous improvement.”

During the first wave of lean implementation, after careful debate and commitment from hospital leadership, the selected pilot departments included two surgery wards, the operating theatre of the VUmc and an affiliated outpatient psychiatry clinic. Subsequently, each of the 35 team leaders of these departments, who were targeted as key players, participated in a four-day LTP. In this study, we understood leaders to be those people who were team leader by occupation with a minimum of 3 years of experience. The total programme consisted of 16 hours of plenary and group sessions that were led by various lean experts. The aim of the LTP was to increase the team leaders’ knowledge and skills concerning lean management, with the central goal of transforming these skills and knowledge into leadership behaviours in day-to-day practice. The key themes included 1] an introduction to lean thinking and working, 2] management by standards, 3] solving problems and 4] lean leadership. The learning goals of each theme are displayed in Table 1. At the end of the LTP, all participants were asked to formulate at least one action point for improving their work using lean as an improvement philosophy.
Table 1. The key themes and the content of the four-day LTP.

<table>
<thead>
<tr>
<th>Key themes</th>
<th>Content of LTP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction to lean thinking and working</td>
<td>- What is lean? The VUmc definition</td>
</tr>
<tr>
<td></td>
<td>- The different types of waste</td>
</tr>
<tr>
<td></td>
<td>- Learning to recognise waste</td>
</tr>
<tr>
<td></td>
<td>- Operational management as a driver of continuous improvement</td>
</tr>
<tr>
<td>2. Management by standards</td>
<td>- How to formulate metrics/critical process indicators</td>
</tr>
<tr>
<td></td>
<td>- The use of visual management</td>
</tr>
<tr>
<td></td>
<td>- 5S as a lean tool</td>
</tr>
<tr>
<td></td>
<td>- Stand-ups as a daily routine</td>
</tr>
<tr>
<td>3. Solving problems</td>
<td>- The benefits of standardisation</td>
</tr>
<tr>
<td></td>
<td>- Asking the appropriate questions for problem solving</td>
</tr>
<tr>
<td>4. Lean leadership</td>
<td>- What is lean leadership?</td>
</tr>
<tr>
<td></td>
<td>- A leader’s standard work</td>
</tr>
</tbody>
</table>

**Qualitative study approach**

A qualitative study approach was chosen to elicit in-depth insight into the perspectives of the participants concerning the barriers and facilitators that they encountered after the LTP, as qualitative research methods are helpful in addressing matters that concern organisational behavior (Ehigie and Ehigie, 2005). [17] Moreover, a study concerning employee perspectives requires a qualitative approach to enhance understanding of the context, personal experiences and interpretations of participants.

**Participants**

The participants were selected for an interview if they formulated at least one action point for improvement after completing the LTP. Eventually, 31 healthcare
professionals, who were all the head of their team, with an average of 19.2 years of leadership experience, were selected. More than half (18) of the respondents were part of the operating theatre, one-third (9) belonged to the surgery ward and the remainder (4) were part of the mental hospital.

**Data collection**

The participants were invited to a semi-structured, in-depth interview three months after the LTP. The semi-structured interviews allowed for new issues to be mentioned during the interview by the respondents (Lindlof and Taylor, 2011). Prior to conducting the interviews, we created an interview guide that contained open questions (Table 2).

**Table 2. Interview guide.**

1. What is your opinion of the lean training programme in which you have participated in terms of its content and organisation?
2. What action did you envisage to execute as a result of the lean training?
3. Have you succeeded in executing the envisaged action?
4. To what extent has the execution of the action been successful?
5. Which factors facilitated the execution of your action?
6. To what extent have these facilitating factors contributed to the execution of your action?
7. Which factors obstructed the execution of your action?
8. To what extent have these various factors obstructed the execution of your action?
9. Have you already envisaged new actions that should be addressed by means of lean (whether or not they emerged from previously mentioned actions)? If yes, what actions are you considering?

This guide provided consistency in the interviews, ensuring that the same general topics were addressed by each of the respondents. The respondents chose a favourable date, place and time for the interviews, which were conducted by the first author. Prior to the interview, the interviewees were informed about the
anonymity and confidentiality of the information. The length of the interviews ranged from 23 to 84 minutes, and the interviews were audio recorded with permission from the interviewees. All recordings were transcribed literally (ad verbatim) prior to the data analysis.

**Data analysis**

First, we investigated the extent to which actions were executed. The following categories were used: 1) fully executed, 2] partially executed and 3] not executed. An action was classified as partially executed if a leader had taken action but had not yet reached the goal or if some of the required actions had not yet been taken thus far. Second, we investigated how the team leaders had experienced the lean programme. Experiences, barriers and facilitators were analysed with an inductive thematic analysis approach (Saldana, 2013). The first four interviews were used to capture key patterns, which were used to assign labels (codes) to text fragments (open coding). The data that were extracted from the text fragments were subsequently analysed using a constant comparison method (Pope et al., 2000; Boeije, 2010). Subsequently, axial coding was used to develop a framework of categories that focused on the barriers and facilitators that summarised the raw data and conveyed the key themes and processes (Table 3). Axial coding assigns codes to categories. To ensure the reliability and accuracy of the data analysis, consistency checks were performed by two different researchers (the first and the second author). In addition, member checks of the results of the analysis with the respondents were performed to enhance the credibility of the findings.
Table 3. Barriers to and facilitators of lean implementation.

<table>
<thead>
<tr>
<th>Barrier/Facilitator</th>
<th>Meaning</th>
</tr>
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<tbody>
<tr>
<td>Senior management support and commitment</td>
<td>Leaders are important in acting as role models to exemplify the desired behaviours for lean implementation. As with all change and improvement programmes, support and commitment from senior management is critical to a lean initiative. The ‘management commitment’ barrier referred to whether top management was involved in lean implementation, spent time in the workplace to supervise the process as part of their support and provided the necessary resources to implement lean in the workplace.</td>
</tr>
<tr>
<td>Resources</td>
<td>Because the availability of resources is a primary concern in health care organisations, it must be properly considered when implementing lean. The ‘resources’ barrier has two meanings. The majority of the respondents mentioned that implementation was hindered because of insufficient available time. Others mentioned that a lack of personnel resources hindered the implementation.</td>
</tr>
<tr>
<td>Strategy and purpose</td>
<td>One of the drivers for the success of lean is to have a clear, well-communicated strategy. Constant changes in an improvement strategy inhibit the continuity of potentially successful programmes.</td>
</tr>
<tr>
<td>Resistance to change</td>
<td>Resistance to change is a significant problem in any improvement programme in any organisation. Resistance deserves special attention from those attempting to implement lean because staff empowerment, which is a key issue in lean theory, is needed for engaging health care professionals.</td>
</tr>
<tr>
<td>Multidisciplinary collaboration</td>
<td>Collaboration (or the lack thereof) within a multi-disciplinary team was experienced as a barrier in most cases.</td>
</tr>
<tr>
<td>Functional and professional silos</td>
<td>The fragmentation of health care organisations into silos (professional or functional) imposes a major barrier to the flow of patients, goods and information and consequently to the implementation of lean techniques in an organisation.</td>
</tr>
<tr>
<td>Training and education</td>
<td>The successful implementation of lean requires employees to be effective problem solvers and learners, thereby eliminating errors and making operating improvements. The knowledge that is acquired in the LTP and the transfer of this knowledge into practice were perceived as constituting a barrier. Moreover, this barrier referred to the lack of experience in the principles, methods and tools of lean thinking and working.</td>
</tr>
</tbody>
</table>
Results

Action points

A total of 31 respondents indicated that they had taken action on 159 formulated action points (mean per respondent: 5.5), with 117 (74%) action points executed and 65 of those 117 (56% of all executed action points) fully executed. The executed action points included expanding lean knowledge, using lean tools (e.g., 5S, stand-ups, value stream mapping (VSM)), measuring key performance indicators, adjusting one’s own work structure, learning to recognise waste, asking ‘Why’ five times, improving care processes/eliminating waste, giving co-workers time for improvement, involving senior management, improving the culture, and educating colleagues about lean. Some respondents (n=6) reported their future intended action points as a follow-up to the original executed action points that resulted from the LTP. Figure 1 provides an overview of the envisaged action points and the degree to which the actions were implemented.

Figure 1. Overview of the envisaged and executed action points.
Experiences with the lean training programme

In general, the majority of the participants experienced the LTP as helpful; they indicated that they had acquired new skills that were necessary for lean thinking and working. These skills had been taught during LTP training exercises, which were rated as valuable by the majority of the respondents. However, although this ‘learning by doing’ during the training sessions was beneficial, some respondents noted that ‘training on the job’ might result in better outcomes: this could be linked to the finding that most participants found it difficult to apply the acquired skills and knowledge in their jobs. Some participants stated that the workplace environment was a significant factor that influenced the extent of this training transfer to the workplace.

The majority of the respondents suggested that lean coach interventions (e.g., consultation, observation, coaching) between the four half-day training sessions may be helpful to transfer the acquired skills and knowledge to their actual work practices. The respondents also suggested a pre-course briefing with each participant’s manager as a means of initiating a discussion on how to apply the principles, techniques and skills that were learned after they returned from training. One participant stated that “a pre-course briefing sends a powerful message that the organization is serious about seeing the benefits of training.” Another suggestion was to introduce the programme or deliver one or more components of the programme to the participants’ supervisors or managers. These suggestions were motivated by the difficulty of executing the intended actions after the LTP, as reported by the respondents. One respondent stated that “if the training programme does not ultimately change workplace behaviour, then the money and time spent on training is simply wasted.”

Most participants actively engaged in the subject matter because they recognized the purpose of learning lean. The organisational objectives of the programme were clearly described to the participants at the beginning of the programme. This information was experienced as helpful in showing how the programme related directly to the day-to-day work of the participants. Nevertheless, one participant
stated that her new role expectations after the training programme were not clearly communicated to her: “I was left wondering why my superior nominated me for the programme.”

The participants also appreciated the interpersonal interaction in the training, in which goals and aspirations were shared, experiences were discussed and work practices were demonstrated. The participants explained that these interactions resulted in shared learning between the LTP participants in their workplace.

Despite the positive evaluation, some respondents experienced challenges concerning the timing of the LTP. These respondents would have preferred to attend the LTP in the morning or afternoon rather than in the early evening, given the low level of alertness after a day of work. Furthermore, some respondents proposed reading and exercises between meetings to prepare for the training programme.

**Perceived barriers and facilitators**

Barriers and facilitators were defined as factors that influence the implementation of lean from the perspectives of participants. The participants addressed issues that were primarily related to internal organisation and leadership. Occasionally, the participants cited environmental factors; however, these factors were not considered in the analysis because organisations and leaders have little control over them when implementing lean.

**Senior management support and commitment**

The participants noted that it is important for lean implementation that team leaders, supervisors and management exemplify the desired behaviour. Participants characterised this behaviour as ‘the support and commitment of senior management’. The *barrier* ‘lack of management commitment’ refers to whether top management was involved in lean implementation, spent time in the workplace to supervise the process as part of their support, and provided the necessary resources to implement lean in the workplace. One participant offered the following explanation: “The problem is that top management sits in their ivory
towers. They trust that everything will work out fine on the work floor. I think there is too much distance between management and their teams because they are always busy, busy, busy.” Another respondent stated the following: “I think that motivation is very important because if management stops giving support, lean will fall apart.” In contrast, the respondents who noted that leaders served as role models for the desired behaviour considered management support to be a facilitator of lean implementation.

**Resources**

The respondents considered sufficient resources, such as time to make improvements, sufficient staff resources, and financial support for employee training, to be critical to a successful lean implementation. The majority of the respondents noted that the implementation was hindered by insufficient available time. One respondent stated that “one of the main barriers is time. That is the main hindrance. I find it very disappointing that after the training, you have a positive attitude towards change, but in your daily routine, you become rapidly consumed by day-to-day things, and then the intentions and training will fade away very easily.” Another respondent noted that getting staff released from workloads and other work pressures with dedication of time to make the necessary improvements, as well as the availability of an effective facilitator on the work floor are important success factors.

**Strategy and purpose**

Important facilitators of lean implementation include a compelling vision and a clear and well-planned strategy. According to the participants of our study, objectives, purposes and goals must be evident for everyone involved. One participant stated that “senior management must know for sure what they want to achieve [with lean], how to achieve it, and know which aspects [for implementing change] must be taken into account.” The participants also agreed that a lack of integration of a lean strategy with the overall hospital strategy and other organisation-wide programmes is a major barrier.
Resistance to change

Several participants perceived their own staff’s lack of motivation to change as a barrier to lean implementation. Resistance to change is a significant problem in any improvement programme in any organisation; however, the participants of this study stated that resistance deserves special attention in lean implementation because staff empowerment is perceived as essential for engaging health care professionals. One respondent explained that “by empowering employees, team leaders can build on a nurturing environment in which employees can learn, improve and effectively implement goals.”

Multidisciplinary collaboration

A lack of multidisciplinary collaboration within a team was experienced as a barrier. Multidisciplinary collaboration requires teamwork. To function well, team members must work towards a common goal, communicate clearly with other team members, and understand one another’s roles. Communication breakdowns appeared to increase because of cultural and organisational differences between professionals. Several participants noted that not all team members shared a common language for making sense of each other’s actions. One participant stated the following: “The problems that demand a multidisciplinary approach are very frustrating problems. You are confronted with difficult collaboration [not the same understanding of each other’s roles and communication problems] between physicians and operating staff.”

Functional and professional silos

Some participants indicated that the fragmentation of the care process into different professional and functional departments – silos – imposes a major barrier to the flow of patients, goods and information, and consequently to the implementation of lean techniques in the organisation. Silos can be important for accomplishing specific, focused tasks; however, although fragmentation in silos undoubtedly improves specific skills, some participants argued that this fragmentation presents a challenge in determining how to be effective while still
maintaining professional competencies. One leader stated that “sometimes you experience problems outside your circle of influence, and then you are stuck with a problem because you have not established an infrastructure that reflects collaborative work with other departments.” According to our respondents, the optimal means of interacting effectively across silos is to build personal connections and establish common goals as well as to support those people who are willing to reach across boundaries and celebrate successes.

**Training and education**

The transfer of knowledge acquired from the LTP into practice was also perceived as a barrier. The participants cited the lack of knowing how to use lean tools in daily practices as a barrier. One participant said that “not knowing how to use lean tools, such as “5 Whys”, is a barrier. You may try using the “5 Whys” tool to determine which area you can improve.” Furthermore, the respondents pointed to their lack of experience in the principles, methods and tools of lean thinking. Many respondents suggested that coaching during implementation and site visits to other lean organisations (e.g. Scania, Toyota) would be helpful.

**Discussion**

The purpose of this study was to investigate the experiences of hospital leaders (middle management) in implementing lean after attending an LTP. This study also aimed to provide further insight into the barriers and facilitators that may be encountered when implementing lean within a clinical practice. The results indicate that the involvement of top management and the creation of a shared learning environment are important factors in the successful implementation of lean; in addition, we observed a need for a holistic lean philosophy.

In general, the findings suggest that the daily presence of top management on the work floor is a key factor in the success of lean implementation. Most participants of our study experienced a lack of involvement of top management, and many wanted leaders to be present in daily settings more frequently and to function as
role models. We feel that by doing so, leaders could increase ownership of the processes and encourage and empower employees to participate in lean. Previous studies of lean implementation have also reported a relationship between the success of lean implementation and management leadership behavior (Boeije 2010; Bahensky et al., 2005; Fillingham 2007; Aherne 2007; Massey and Williams, 2005; Nelson-Peterson and Leppa, 2007). Top management should be more involved and must take ownership of lean programmes (Kotter, 2007).

According to our study, a lack of vision and strategy regarding how to integrate lean with the overall hospital strategy is a major barrier to lean implementation. Lean implementation in the Dutch context began with techniques: leaders attempted to implement isolated parts of the lean system without understanding the entire philosophy. However, the literature has shown that lean philosophy and techniques require the adoption of the entire system in a holistic manner, rather than applying techniques in a piecemeal fashion (Womack and Jones, 1996). The comments of our participants also indicate that LTPs might be more effective if they are established as a multi-dimensional activity: not merely creating a list of lean tools and methodologies and learning how to use them, but also applying a certain hierarchy. This means that to learn advanced tools or methodologies, people must first learn the basics and then build from there. We believe that achieving this hierarchical approach requires an understanding of all aspects of implementing lean. While some tools and methodologies can be presented in a classroom, others must include exercises or a practical portion of training to show the relation with other aspects of lean.

The findings of this study demonstrate that the participants experience challenges in applying the acquired knowledge in practice, and they articulated a need for training on the job. This is in keeping with the well-supported idea that some lean tools can, arguably, only be learned by applying them in real work situations, so-called ‘learning by doing’ (Fillingham, 2007; Dickson et al., 2008; Kaplan and Patterson, 2008; Jimmerson et al., 2005; Manos et al., 2006; Aherne, 2007; Esain et al., 2008; Panchak, 2003; Persoon et al., 2006; Achanga et al., 2006). It may be hypothesised that the added value of "learning by doing" may lie in the dialogical
process of sharing insights, knowledge and challenges, which gives context to lean procedures. This importance of dialogical learning in lean has also been addressed in other studies (Martínez Leon et al., 2010). We suggest that mixing training on the job with a continuous learning environment – as suggested by our participants – may facilitate dialogical learning, encourage collaboration between colleagues and thus facilitate the transfer of learning goals to daily practices.

The findings of our study show that sole attention for assigning ‘appropriate’ roles and rules, strategies and training programme, does not lead to improvement in the implementation of lean.. According to the study participants, physicians and operating staff are highly trained individuals who act with autonomy, whereas lean culture requires teamwork and collaboration (Endsley et al., 2006; Spear, 2006). Therefore, solely establishing an ‘appropriate’ hierarchy and a set of roles does not appear to be sufficient. In addition, acknowledgement of the complexity and ambiguities of daily practices in organisations, could enhance lean implementation (Weick, 1995; Czarniawska, 2009). This implies leaders to focus more on the lean meaning-making process through several participants involved rather than on implementing lean solely as a fact.

**Conclusion**

Implementing lean in a hospital setting is a challenge because of the ambiguous and complex environment of a highly professionalised organisation. This study investigated a wide range of barriers to and facilitators of lean implementation in a clinical setting. The study found that involvement of top management (e.g. consolidation of lean with the overall hospital strategy), the daily presence of leaders on the work floor and their function as a role model are important facilitators of lean implementation. To increase the successful outcomes of leadership intentions and actions, training should be supplemented with actions to remove perceived barriers, most of which are related to sufficient resources, such as time to make improvements. The successful implementation of lean actions by leaders requires the involvement of all professionals, the crossing of
departmental boundaries and a focus on meaning-making processes rather than simply ‘implementing’ facts. Therefore, this research suggests that programme participants, such as staff members and leaders, can mutually explore the meanings of lean thinking and working for their own contexts. By entering this shared learning process (e.g., learning on the job) the ownership of lean implementation could also increase.
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Chapter 7

Lean leadership: an ethnographic study

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Abstract

Purpose  The Lean leadership model supports professionals with a leading role in implementing Lean. This article presents a case study focusing specifically on leadership behaviours and issues that were experienced, observed and reported in a Dutch university medical center.

Design/methodology/approach  This ethnographic case study provides auto-ethnographic accounts based on experiences, participant observation, interviews and document analysis.

Findings  Characteristics of Lean leadership were identified to establish an understanding of how to achieve successful Lean transformation. This study emphasises the importance for Lean leaders to 1) go to the *gemba*, to see the situation for one’s own self, 2) empower healthcare employees and 3) be modest. All of these are critical attributes in defining the Lean leadership mindset.

Originality/value  In this case study Lean leadership is specifically related to healthcare, but certain common leadership characteristics are relevant across all fields. This article shows the value of an auto-ethnographic view on management learning for the analysis of Lean leadership. The knowledge acquired through this research is based on the first author’s experiences in fulfilling his role as a healthcare leader. This may help the reader examining his/her own role and reflecting on what matters most in the field of Lean leadership.

Keywords  auto-ethnography, healthcare practice, Lean leadership, Lean management, management learning

Article Classification: Special issue on medical leadership: Case study
Introduction

In recent years there has been an increase in the use of Lean principles and methods – the concept of improving value and reducing waste – in the healthcare sector, as means of improving care processes. The clinical practice literature suggests that this has been a positive experience (Graban, 2011; de Bucourt et al., 2012; Brown and Duthe, 2009; Melanson et al., 2009; Rutledge et al., 2010), however several authors have argued that Lean only makes a lasting contribution if its use enhances the problem-solving abilities of healthcare professionals, teams and, ultimately, entire institutions, and that leadership is essential in accomplishing this lasting contribution (Mann, 2009; Simon and Canacari, 2012; Morrow et al., 2012; Davis and Adams, 2012; Baird et al, 2011; Dombrowski and Mielke, 2013).

This article uses ethnographic research to show how the first author, Head of Anaesthesiology and Surgical Care at a large Dutch teaching hospital, spent his first 2 years on the job putting theory into practice or, in other words, moving from Lean knowledge to an improved culture. The implementation of Lean in an organization requires behavioural change, which in turn demands leadership qualities and the ability to make sustainable change (Keiser, 2012; Mann, 2012); an improvement culture is part of this behavioural change (Dombrowski and Mielke, 2013). Focusing on the processes and experiences in the work environment and applying the underlying theory to reinforce the lessons learned involves reflection on one of Lean’s important basic principles: going to the gemba. That is, improvements should be based upon practical experience in the gemba, the place where the product or service becomes of value to the customer (Mazur, 2003) or, in healthcare terms, the patient. Going to the gemba means that “Lean leaders should go to the shop floor frequently in order to truly understand the processes and to make the right decisions” (Dombrowski and Mielke, 2013). This corresponds with theories of organization which state that to understand activities of organizing we must immerse ourselves in work-floor processes and be present on the work floor (Ybema et al., 2009; Weick and
Browning, 1986). One useful way to study work practices is ethnographically (Ybema et al., 2009) because it provides an insider point of view (Ellis and Bochner, 2000; Boyle and Parry, 2007).

Lean does not provide a template for leadership and no studies relate findings to a Lean leadership model. However, Mann (2012) presents a useful Lean management system that supports successful implementation of Lean and its sustainability. The identification of leadership attitudes and behaviours that serve leaders in this practice setting will help them support their colleagues’ personal growth and sense of value. The aim of this study was to identify and define leadership requirements and traits that are important in supporting organizations through Lean transformation.

**Background**

**Defining Lean**

Womack first coined the term “Lean production” to describe the manufacturing philosophy used in the 1980s by the Japanese automobile manufacturer Toyota (Womack and Jones, 2003). At its heart is the idea of creating maximum value for the client and a minimum of waste using the fewest possible resources (Simon and Canacari, 2012).

However, experience has shown that focusing solely on the implementation of Lean tools without also bringing about a change in organizational culture rarely, if ever, results in true and lasting improvement (Mann, 2009; Simon and Canacari; Morrow et al., 2012; Davis and Adams, 2012; Baird et al., 2011; Dombrowski and Mielke, 2013). Liker (2008) cautions that the Lean tools and techniques of the Toyota production system do not hold the key to Toyota’s success; instead, Toyota’s success is based upon its ability to maintain a learning organization through the cultivation of leadership, teams and culture, diverse strategy and supplier relationships (Liker, 2008).
The successful implementation of Lean is dependent on context and situation (Papadopoulou and Özbayrak, 2005). Lean is about more than merely introducing measures to reduce waste, improve efficiency and standardize processes. In fact, their implementation accounts for only 20% of the effort needed to achieve a Lean transformation. The remaining 80% is effort made by managers of change (Mann, 2009), who face the challenge of altering the mindset of leaders and employees (Dombrowski and Mielke, 2013). Effective Lean leadership is also essential for Lean transformation to be effective over the long term (Dombrowski and Mielke, 2013; Mann 2012; Keiser, 2012).

**Current theory on Lean leadership for change**

Leadership can be defined as the process by which one person sets the purpose or direction for one or more other persons, and helps them to proceed competently and with full commitment (Jaques and Clement, 1991). The differences between leaders are huge, and the similarities usually too general to allow for conclusions. Quite simply, leadership cannot be reduced to a simple formula. In addition, there is no common route to good leadership: studies lack clear evidence of any particular consistent personality qualities of great leaders (Jaques and Clement, 1991).

Leadership is especially important when organizations experience change, which is inevitable when implementing Lean. Ongoing process changes, as part of continuous improvement, are generally incremental and not seen as transformative in themselves. However, Lean introduces large or transformative changes when elements of an organization change; this in turn requires a change in leadership and culture, the latter being difficult to achieve and sustain (Mann, 2012; Keiser, 2012).

Organizational transformation offers a paradox: no significant change occurs unless the top (management) drives it, and no significant change occurs if the top (management) drives it. This becomes even more problematic if one takes into account, with Senge (1996) and Schein (2010), that three levels of leaders (executive, network and line) and three cultures (operator, engineering and
executive) are required to communicate, accept and understand each other, and collaborate to effect change. Daft and Armstrong (2009) suggest that leadership for change requires leaders with the appropriate personal qualities, skills and methods but do not specify what these are. Jacques and Clement (1991) define leadership as a function of responsibility associated with a role such as a manager’s, and suggest that good leadership relies on competence in role rather than a generic aptitude for leadership. Thus there is no consensus as to what specific leadership styles and competencies are important for change.

However, there is close correlation between leadership actions for Lean transformation and for generic transformative change (Aij et al., 2013); the crucial element required for effectiveness of leadership is overall competence. Mann (2009, 2012) contends that a Lean management system is required for the successful and sustainable implementation of Lean. Within the proposed Lean management system, Mann (2012) identifies four principal elements: 1) leader standard work, 2) visual controls, 3) daily accountability and 4) leadership discipline. Here the management system is structured by providing guidelines to itemize a leader’s work into a daily routine with suggested frequencies and durations for leader activities such as daily start-up meetings, production checks on the floor, review of trend charts, continuous-improvement meetings, process monitoring, process auditing and floor time. Visual controls are emphasized as fundamental for process performance tracking and assessment. Similarly, the daily accountability process employs a visual system for exposing problems and ensuring that problems are solved. This ultimately serves as a driver of continuous improvement and as an aid for the leader’s discipline (Mann, 2012). Recognizing the importance of leadership in Lean and Lean implementation, Mann (2012) emphasizes the role of leadership as a process within Lean and provided a framework for leaders. Mann supports the view that an organization’s culture is a product of its management system. He argues for the absolute need for a Lean management system with explicit definitions of leaders’ roles, work processes and schedules. Such a management system will produce and support a Lean culture with the same level of standardization and discipline (Mann, 2012).
Methods

Setting
This study was conducted at the VU University Medical Center (VUmc), a 733-bed academic hospital in Amsterdam, The Netherlands. The Dutch Institute for Accreditation in Healthcare (NIAZ) accredited VUmc following an external audit in 2010. Subsequently, VUmc adopted Lean as a tool for continuous improvement. During the pilot phase, Lean was implemented in two surgical wards and the operating theatre at VUmc and an affiliated outpatient psychiatry clinic. Between 2010 to 2014 Lean became a core strategic programme at VUmc.

Qualitative data collection
A qualitative, ethnographic approach was used. Ethnography studies the everyday experiences of people and makes us more aware and understanding of the social processes within organizations (Ybema et al., 2009). This research is based on the personal experiences of the author (auto-ethnography) and interviews to collect observations and insights from other healthcare leaders. “Auto-ethnography is a highly personalized account that draws upon the experiences of the researcher for the purposes of extending sociological understanding” (Sparkes, 2000). Data collection from auto-ethnographic narratives has been validated (Ellis and Bochner, 2000; Boyle and Parry, 2007).

Interviews
In total, six in-depth interviews were conducted: these were with three team leaders (representing the departments of cardiology, oncology and nephrology), the Lean programme manager, the operating theatre manager and the medical head of the orthopaedic surgery department. These persons represent the range of organizational hierarchy involved with Lean at VUmc and so a range of experiences, opinions, motivations and interpretations could be collected. A short and semi-structured topic guide was used that focused on the traits/competencies of Lean leadership in different situations, as observed by the
interviewees. Such a technique has been previously validated for collecting data in organizations (Ehigie and Ehigie, 2005). Established interviewer techniques were used to obtain deep and meaningful insights in terms of interviewee motivation and insight (Garb et al., 2002; Bell and Brymann, 2007).

**Observations**

Observation data were recorded by KHA by making notes about important events reported by interviewees. The events and statements recorded were then cross-checked against other sources such as official organization documents, meeting minutes, organizational memos and newsletters to identify and match other details. However, in some cases they were based solely on participants’ memories. In order to prevent validity issues and to enhance the trustworthiness of this research we tried to match these memories with information from other documents and shared our notes with other colleagues to comment, offer interpretations and identify areas needing clarification. We used selected input from others, but in this paper we have not included specific responses or reactions to the research so readers’ perceptions are not unduly influenced.

**Analysis**

Analyses focused on identifying consistent themes in terms of excerpts, quotations or passages from records, official reports and surveys. This approach, based on ground theory, is known to increase the level of accuracy and reliability of qualitative research (Labuschagne, 2003). Our study involved analysis of memos, emails, strategy deployment documents and Lean training documentation. This method proved useful, an example being to validate differences in opinion between leaders and less senior staff members.

**Results**

We found three common characteristics of importance for Lean transformation, that is going to the *gemba*, employee empowerment and modesty. To illustrate these findings, reflexive accounts are presented for each characteristic, along with supportive interviewee responses, where appropriate.
Going to the gemba

First author’s auto-ethnographic vignette (recorded at around 1 year)

When I wanted to start with Lean at VUmc, I choose a project-based approach and I scheduled a couple of Lean training sessions. The idea was that I launched the plan and my employees would report their progress. Quickly, I rejected that idea. There was a big gap between how I thought it would be and what I heard from my employees. I thought that there would be daily measurement of performance indicators, which would be visually managed on the work floor. In fact, only two managers had actually implemented Lean and some visual management boards were still unused.

My Lean coach advised me to spend time on the work floor. During the early months I did this on a weekly basis. I walked around for 1–1.5 hours in the different departments of the operating theatre and I noted things that caught my attention (e.g. damaged equipment, staff rummaging for items, distracting noise from machinery). With help from my Lean coach I concluded that it was impossible to improve things by myself. I needed to get everyone more committed.

I spent 8 hours per week on the work floor. I became more targeted. It was not useful to walk the same round over and over again. It seemed better to work with themes. Our hospital had already defined patient safety themes. This resulted in theme routines, such as checks on fire safety. During those checks, I asked questions. What are the procedures? Does everyone know them? How do we know when a fire extinguisher is still working?

To convince my manager of the benefits of Lean, I needed to change my own way of seeing and thinking. To reduce resistance among my employees I spent time on the work floor and took the lead during improvement meetings. Later I included my employees more in the Lean process, by setting the example. I showed that I wanted to discover the solutions to problems with help from my colleagues. Those conversations were not always easy. Sometimes people were willing to talk, but sometimes they were too busy. I learned that I could easily walk with them during their tasks without interfering with the primary process. Employees perceived my
walking with them as a way of me controlling their job and they were not used to that. It took time to build trust for the approach.

(Note: the author’s learning experience of going to the gemba took around 4 months in total.)

In Japanese, *genba* – or the more commonly used word *gemba* - means “actual place”. In the Lean context, it refers to the place where value is actually created (Fine et al., 2009). Lean focuses on being on the work floor and seeing the problems for one’s self. The majority of study respondents confirmed this. This first-hand experience supports leaders to determine areas for improvement. To some extent, this study found that the leadership team increased their work floor visits, which allowed them to discover problems and to find many points for improvement. For example, the operating theatre nurses discussed and implemented, with the team leader, many improvements that helped in decreasing the time taken to locate equipment in storage rooms.

Every manager interviewed stated that they spent almost all his/her time on the work floor, apart for the time needed for meetings, emails, trips and phone calls. Generally, going to the *gemba* was viewed positively (Table 1). Managers mentioned they were able to solve problems more quickly, as well as achieving increased alignment of goals and, more importantly, becoming part of the *gemba* itself. Usually, managers find themselves focusing upon measures and indicators, whereas being in the *gemba* actually makes them experience what is going on. The autoethnographic vignette presented above illustrates this, as well as other respondent accounts: “The manager will see problems with his own eyes (...)”. This may create a shared understanding between managers and employees of what the problem is and the possibility to exchange their perspectives on the best solutions. Going to the *gemba* thus not only supports quick solutions, but fosters mutual understanding between “critical players” (study respondent).

Respondents reported on objections against going to the *gemba* as well (Table 1). Several managers commented on the lack of necessity to “talk about the same
issues all over again” (study respondent) and experienced being short of time. Others believed “their” people don’t need their input. And lastly, there are managers who had access to sufficient information. These managers did not explicitly address relational dimensions of their work, creating support and commitment through, for example, eliciting the perspectives of their team. We will elaborate on this in the Discussion section.

Table 1 Examples of positive responses and objections to going to the *gemba*

<table>
<thead>
<tr>
<th>Positive responses</th>
<th>Objections</th>
</tr>
</thead>
<tbody>
<tr>
<td>“<em>Gemba</em> walks allow me to quickly identify problems on floor, and help to very quickly solve the myriad of small problems that plague all operations.”</td>
<td>&quot;But I’m already out of the floor all the time anyway.”</td>
</tr>
<tr>
<td>“<em>Gemba</em> walks foster alignment of goals by demonstrating the importance of the metrics to all the associates.”</td>
<td>&quot;We already have a daily production meeting. This will mean we will talk about the same issues all over again.”</td>
</tr>
<tr>
<td>“They force the manager out of his office, away from his email, and out to the shop where the real action [the <em>gemba</em>] is. The manager will see problems with his own eyes, hear about problems directly from the operating associates, and can take immediate action to help correct them.”</td>
<td>&quot;I'm very busy. I don't have time to do a <em>gemba</em> walk every day.”</td>
</tr>
<tr>
<td>“They bring together the critical players in an operating room (operators, managers, nurses, medical doctors, etc.) so that it is easier to take quick actions to solve small, but nagging, problems. Each person hears the same description of the problems, and each can immediately offer their expertise to help resolve them. The speed with which problems can be resolved can be dramatically increased compared to traditional problem solving.”</td>
<td>&quot;It's too loud on the shop floor to hear anything. We need to meet where we can hear each other.”</td>
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<tr>
<td></td>
<td>&quot;My people already know what they have to do. They see the visual metric board every day. They don't need me to look at it. Besides, I get the same data emailed to me every day.”</td>
</tr>
<tr>
<td></td>
<td>&quot;I already have a fantastic communication system of voicemails, which I listen to while driving in to work. The communication presented in the <em>gemba</em> walk is all a duplicate of what I already know.”</td>
</tr>
</tbody>
</table>
Empowerment and trust

First author’s auto-ethnographic vignette (at 9 months)

Managers implementing Lean will experience resistance. People feel judged and criticized. Some get angry. I learned to keep the dialogue open. I indicated problems and pointed out that the solutions, initially proposed by management, did not work. I asked what they thought the solution should be and why Lean caused so much trouble. I gave room for criticism and objections. Sometimes you need several conversations to understand peoples’ views. Many people think that the manager needs to solve everything. But when something is not working, that does not imply the failure of management. Moreover, it is an illusion to say that managers are the problem solvers.

It was unclear at VUmc who had responsibility for a certain problem, such as postoperative wound infections. As a manager I set frames and emphasize the fact that all employees have influence on the process and have to take responsibility. Employees do not have the free choice to work with Lean or not; I make them accountable. They cannot blame others, but instead must ask themselves what they can do to create a solution. Often it is a test of endurance and resistance but this should not be discouraging. I am glad to set the example. For instance, when an operation is cancelled I call the plan bureau to find out why. When someone feels insulted, I find out how we can cooperate in a better way. Perhaps the planners should join our meetings so that everyone will understand each other better. Such a conversation calls for diplomacy. It is not useful to say that something went wrong because that breaks contact. It is better to say you do not understand what exactly happened and you would like to hear the other side of the story. It is not useful to blame; you need to talk about the process. I trust that people naturally strive to do good. As a manager therefore I am open to input. It is not just my department that is going through a learning process: I must change as well.
This vignette addresses the importance of the relation between empowerment, trust and responsibility in Lean leadership. This was also stressed by study respondents. For example: “A lean leader trusts their staff and not only dares to delegate responsibility (...) to enhance their problem-solving abilities” (quote 1, Table 2). The vignette shows that responsibility can be assigned: people are made accountable by the Lean leader. Respondents spoke in similar terms, for example of “delegating responsibility”. This informs us about how, in healthcare Lean leadership, leaders use responsibility, passing it to others, to enhance care practice. While assigning responsibilities, a relationship of trust is fostered, which leaders expect to increase their employees’ problem-solving abilities (empowerment). The findings showed that leaders aimed to create space for employees to take part in the decision-making process (according to quote 1, Table 2). The findings showed that respondents value listening and taking others seriously to uncover problems before jumping to any conclusions. Managers are often the first to argue their own ideas and yet managers are usually furthest away from the *gemba*. Being open and responsive to employees’ perspectives and supporting them in the development of their abilities instills a sense of ownership of and responsibility for the work, and any problems relating to the work.

**Modesty and openness**

**First author’s auto-ethnography vignette**

*After working with Lean for 1 year I did not know how to continue. This impasse was broken by a visit from John Toussaint, an American who is prominent in the implementation of Lean in healthcare. He asked me questions while observing me. One was: ‘you have a capital-intensive department. Patients put their lives in your hands. How do you know for certain whether your process is safe?’ I answered that we had inspection reports and measurements, but he asked further, ‘How do you know that your measurement contributes to safety? How often does your measurement take place? And would you recommend your family to undergo surgery here?’ My gut feeling was ‘yes’ but I could not substantiate it.*
For 2 weeks I felt disconcerted because I could not answer that basic question. I was proud of our success: we had 50 improvement plans, a safety management system and our safety rounds. I was successful and my managers expressed their appreciation, but apparently I asked the wrong questions. I thought I had everything under control but suddenly I had a big problem. Not directly with patients, but in terms of knowledge. I realized that things needed to change, but how? The more I looked at it, the more frustrated I became.

I talked to my Lean coach: we needed to create focus. The important point was increasing patient safety. I realized that this should not be a project but something that employees kept in mind every day. The standards of inspection should not be directive; we needed to look at our measurements in a critical way rather than creating tension. We stopped measuring efficiency. The occupancy of the operating theatre and the start and end time of an operation do not add value for the patient. From a patient’s perspective, much more important are minimal waiting times, being able to drink and eat until the last possible moment before an operation and the reassurance that all staff is fully competent. Efficiency is not insignificant, but Lean entails doing only what is asked for and doing it right the first time. That is automatically efficient. It is meaningful to question whether efficiency should be measured."

The vignette illustrates that modesty is vital for listening and must be done from a position of openness and inquisitiveness rather than one of knowing. It is almost impossible to solve problems without a deep understanding of the current state of practice. It is key to recognize and halt any beliefs, prejudices, biases and archetypes when listening to employees for new opportunities and adjustments that need to be made. This study found that modesty is a key characteristic for successful Lean leadership and transformation of cultures. The ability to be able to express uncertainty may bring leaders closer to the workforce and it promotes others to show sincerity in return. The respondents report that by taking steps to reveal their vulnerabilities and showing modesty, leaders can create a culture where concerns are raised more readily and this also helps leaders to develop (the
Table 2. The importance of Lean leaders fostering empowerment and trust, and showing modesty.

**Interviewee quotations on modesty and trust**

[1] “A Lean leader trusts their staff and not only dares to delegate responsibility to the work floor but also considers it part of their own role to coach the people there to enhance their problem-solving abilities. They do that by going out onto the floor, where the work and the coaching actually take place, to see what is happening there. Lean leaders accept that they may not themselves possess the know-how needed to do the job in hand, but what they can do is help the person concerned to analyse the situation, to formulate solutions and to try them out in practice.”

[2] “A Lean leader knows exactly what the objective is, can focus upon it single-mindedly and can apply a keen sense of direction. Yet at the same time they also allow maximum flexibility. They trust in the ideas and contributions of everyone in the team, and they give their personnel an important say in the decision-making process.”

[3] “Lean leaders have to facilitate and support, they have to be modest and they have to acknowledge their own limitations. But they must also accept responsibility, give other people goals to work towards, be visible, make sure that their staff receive the praise they deserve and, above all, be brave enough to improve the current situation; day after day.”

**Interviewee quotations on empowerment**

[4] “In their words and actions, they display the kind of behaviour befitting an organization of stature. You can recognize a Lean leader from the people around them: they are developing all the time, and are always capable of recognizing and resolving those issues which are preventing the organization from achieving the goal it has set itself.”

[5] “They are familiar with the underlying work processes in their organization, and have a ‘nose’ for what is really important. And they can simplify complex problems by working with their team, and so find the best solution.”

[6] “Lean leaders manage processes, not numbers. What counts first and foremost is not the financial result, but the process yield. Rather than seizing instantly upon a solution or conclusion, the Lean leader tries to understand the situation fully. They are constantly asking ‘why?’.”

[7] “And not only are they good at teaching, they are inspiring coaches who are able to create an organization which is learning all the time.”
Discussion

A number of issues are raised by this ethnographic case study, which have a range of implications for leadership in healthcare practice. The findings highlight the importance of 1) going to the *gemba* to see and experience practice, instead of primarily focusing on measurement of outcome parameters, 2) processes of empowerment and trust and 3) modesty and openness, in successful Lean leadership. Our findings also show that there are a number of challenges to be overcome when implementing these tactics as part of a Lean management programme. Here we look at those barriers, in the context of these findings, and outline a framework for Lean leadership.

**Understanding barriers to Lean conversion**

In line with the findings of our study, the literature documents various issues that can hinder the sustainability of Lean implementation. For example, among staff who are under pressure to perform, and so need all their time to complete their “regular” work, it is often difficult to sustain enthusiasm for a new way of working. Such resistance to adopting change has been reported by others (Davis and Adams, 2012; Anand et al., 2012). It is therefore the case that leaders who intend to introduce Lean successfully should anticipate and prepare for challenges. There are four decisive factors in addressing these.

1. The openness of the workforce to change. Staff perceptions of the likely benefits of a change strongly influence its chance of success (Morrow et al.,
2012): they need to believe that an initiative will have a positive effect upon their own tasks and performance (Anand et al., 2012).

2. An understanding of the complexity of the change. Many factors can affect a change process, including user wishes, the organizational context and wider sociopolitical developments. It is therefore essential to understand the complexity of the processes involved and the decision-making surrounding them (Morrow et al., 2012).

3. Proof that the change will actually produce the desired effect. To convince those involved of the benefits, it is important to provide them with an insight into the expected costs and returns (Morrow et al., 2012).

4. How the change is anchored within the organization. For a change to take hold, old ways of working need to be replaced with new practices and with policy aligned to them (Morrow et al., 2012).

To be a successful transformational leader, it is important to understand these barriers and be equipped to deal with them (Aij et al., 2013).

**A framework for successful Lean leadership**

Becoming a successful Lean leader not just entails knowing how to implement changes and monitor key performance indicators; sustainability counts on there being a cultural change. This is not only true for work-floor employees, but also for leaders (Keiser, 2012; Mann, 2012). It is reported that most Lean initiatives are unsuccessful due to a failure to change leadership practices (Mann, 2009, 2012). However, despite the importance of Mann’s framework in directing a mechanistic approach for Lean management, this approach does not provide insight into how to take into account the contextual aspects of leadership and fails to capture the true essence of leadership as a fundamental pillar of any Lean management system. The present study reveals that leadership success can be achieved by appreciating the softer aspects of human relationships, as well as the value of gemba, being able to empower others and show modesty and openness. Effective transformational leadership requires connecting quantitative measures (for
example, key performance indicators) with qualitative workplace knowledge and understanding of human psychology (Vidal, 2007).

**Gemba**

For effective production, managers should focus on all the *gemba* events that give the real picture of the *gemba* rather than just the data obtained through reports. Managers should frequently visit the work floor, especially when problems arise. There are five *gemba* principles, as shown in Table 3.

**Table 3 The five principles of *gemba* (Womack and Jones, 2003)**

1. When problems arise, go to the *gemba*.
2. Check the *gimbetsu* (i.e. or equipment, tools, near misses and customer complaints).
3. Take temporary countermeasures on the spot.
4. Find the root cause of problems.
5. Standardize for prevention of recurrence.

According to Womack and Jones (2003), it is important that a *gemba* walk is done very publicly, so that managers are available to all employees to answer questions, share concerns or simply say hello. The employees also see that the manager truly cares about the metrics on the visual metric boards. The numbers therefore are not some abstract measure created by distant accountants; they are critical measures of how well the operation is being performed. Thus the manager is implicitly demonstrating that these results are important. In some organizations, *gemba* walk time is designated as “sacred”, with a designated time, so that “even the CEO will learn not to schedule meetings during this sacred time” (Toussaint and Berry, 2013). We found some objections to walking the *gemba* (Table 2), and many of these were because managers felt that other responsibilities took priority. By formally scheduling a regular time for the manager to be out on the floor there is a much better chance of getting away from the office.
**Empowerment**

It is often hard to get all the critical stakeholders together at the same time to review and discuss a problem. At VUmc we try to do this with regular staff meetings, but it has a few drawbacks. For one thing, the meetings happen when the information needed is not readily available. During a *gemba* walk, all the people are together, they all hear about the problem at the same time and see the same data, which gives them empowerment and lets them take responsibility. They are therefore all in a position to quickly decide on a course of action, and to initiate that action. This approach doesn’t always work for complex problems but it does work very well for the most common, nagging problems that are easily solved with a little ingenuity and some good follow-up. Empowerment of employees is associated with greater on-the-job satisfaction, and this has been shown to relate to cultural change and successful Lean transformation (multiple sources).

**How leaders can promote a culture that embraces change**

A culture that considers the identification and implementation of changes as a normal, everyday procedure is therefore regarded as a key factor in the successful introduction of Lean. Indeed, this particular point is emphasized by a number of authors (Simon and Canacari, 2012, Mann, 2009 and Anand et al., 2012). Simon and Canacari (2012), recommend that leadership “create a favourable environment in which problems are recognized as opportunities for improvement”. Mann (2009) writes that, “Successful sustained Lean conversions often involve changes in culture … where effective Lean leadership comes from the top as well as from lower in the organization”. Similarly, Anand et al. (2012), writes, “proactive employee commitment to continuous improvement is essential to gain any long-term traction and provide strategic organizational benefits”.

Knowing that organization culture is a very important factor for successful Lean transformation, the next question is: how can we address that, and what kind of leadership is required? According to Liker and Convis (2012), you need leaders who are prepared to make “… a deep, time-consuming and expensive investment
in everyone in the organization because they truly believe that their employees are their most precious resource. The role of the leader in this context is to 1) be open to the kind of self-development needed ...; 2) develop subordinates so that they grow and improve ...; 3) remove obstacles that prevent employees doing their work as expected; and 4) set challenges and goals so that teams at all levels of the organization can contribute to continuous improvement and attainment of its long-term goals." Weiner et al. (2006) assert that firm leadership from the top of the organization is a crucial precondition for the successful implementation of quality-improvement initiatives like Lean. Only senior leaders can make quality a first priority, forge a culture dedicated to it and provide the financial and human resources needed to develop a learning organization (Weiner et al., 2006).

Looking at healthcare in particular, Simon and Canacari (2012) describe a number of factors that contribute to successful Lean leadership. A leader, they say, must emphasize solutions to problems rather than assigning blame; ensure that a team has the appropriate multidisciplinary composition to involve all important stakeholders, thus generating mutual respect; be able to motivate and energize a team; and give employees the opportunity to express their ideas and suggestions in “an open, friendly and structured environment where their input is valued and acted upon”.

Creating an organization that is improving all the time requires a combination of commitment from senior management and a prevailing culture of continuous improvement. And that means changing the focus from each person’s own job to horizontal processes; that is, what adds value for the consumer and how it can be brought about (Liker and Convis, 2012). Mann (2009) also identifies four essential contributions from senior leaders: 1) developing and implementing structures and processes that anticipate and respond to the difficulties of a Lean initiative; 2) transforming commitments to change into actual change, supporting and sustaining new behaviours and practices; 3) establishing and maintaining new, process-focused, measures; and 4) creating conditions in which a sustainable Lean culture of continuous improvement can develop.
These characteristics of leadership apply to all layers in any organization. It is not enough for people only on one tier – management or lower down – to implement changes. It is only by enforcing these principles throughout an organization that Lean becomes second nature for everyone. However, that said, the emphasis certainly differs from one level to another. Within particular departments, for example, the focus will be on implementing Lean tools and keeping people motivated. Higher up there will be a greater emphasis on maintaining the culture of continuous improvement through permanent observation to identify where things can be done better as well as by challenging people to go in search of enhancements.

This study has a number of limitations that may restrict the generalizability of the findings. The study is an auto-ethnographic account of one person’s (the first author’s) learning experience in implementing Lean at a single centre, and thus may not reflect the experience of other leaders and other centres. However, combining and validating auto-ethno biographies with interview findings is a key strength of this work. Furthermore, the exploration of softer aspects of leadership and integration into a framework consisting of the three values of *gemba*, empowerment and modesty, offers advantages over other, less-specific, theoretical systems that have been suggested to date.

**Conclusion**

This research has provided a critical analysis of contemporary Lean leadership in the context of a healthcare practice. It has examined Lean leadership within an ethnographic framework and by doing so has added to the existing Lean leadership discourse from an inside perspective. In addition, the research has emphasized the extent to which leadership characteristics shape the context in which healthcare professionals operate. This study adds further insight to qualitative aspects of leadership, such as ethical values, respect for others, modesty, vision and inter-personal relationships. As to what makes a good leader, it can be said that a leader is a person who inspires those around them to join
them on a journey towards a challenging destination. A Lean leader is no exception in this respect. Creating value for the patient (in our case, or the customer in other organizations) is at the heart of this process. It requires the courage to question the status quo, and to keep doing so day after day. The Lean leader combines this with the discipline needed to work towards the set objective in a structured and consistent manner.

Leaders must be consistent, but at the same time flexible. By not being afraid of going to the work floor to study hypotheses in practice, by showing themselves to be part of the team and able to empower others, and by combining willpower with modesty, leaders will learn not just how to best implement Lean, but also how to become true leaders.
References


Chapter 8

General Discussion
Discussion

The aim of this thesis was to investigate whether and how healthcare organisations can benefit from Lean practice. How can we better understand the complex interactions and implications of Lean transformation in healthcare? What facilitators and barriers to the implementation of Lean healthcare can be identified and how may leaders use this knowledge to make the transformation process successful? What are the characteristics of Lean leadership in comparison with existing leadership models? Finally, what tools are useful and what can be learned from case studies on Lean implementation in healthcare?

This chapter first summarises the six studies and discusses their position in the Transition-to-Lean Roadmap. Next, barriers and facilitators of Lean implementation are considered individually, and related to the findings in the other studies. Finally, a synthesis of critical success factors for the implementation of Lean practice in healthcare is presented.

Overview of the studies

In this section, the results of the studies are described.

Study 1: Patient Safety in the Operating Theatre: How A3 Thinking Can Help Reduce Door Movement

The flow of personnel into and out of an operating theatre contributes to the development of surgical site infections, with an impact on patient safety, cost and quality of care. In this case study, a multidisciplinary team used an A3 intervention methodology with the intention of reducing door movements. After establishing the ‘current condition’ – scrub room door opening 24 times per hour during surgery – a fish-bone diagram analysis established the root causes of door opening. Three major root causes were identified: unclear policy regarding entering and leaving during surgery, problems communicating by telephone and an unclear warning sign about entry to the OR during surgery. Implementing countermeasures and use of a visual display resulted in a reduction of door opening by 78%, to 4 movements per hour.
This is a simple and clear example of the successful implementation of Lean. It also highlights the importance of learning on the job and dialogue while developing Lean practice.

**Study 2: A focus on throughput: Lean improvement of nurse scheduling in the operating theatre**

In the complex OR environment, nurse scheduling is challenging because staffing varies by surgical procedure, day of the week and for different shifts. Scheduling errors and the lack of a guarantee of appropriately trained staff being present during surgery can lead to increased workload and frustration. Using Makigami technique and a fishbone analysis, a multidisciplinary team identified ‘waste’, established a baseline of 35 errors in 7 days and reduced this to 2 errors in 7 days. Nurse scheduling was improved, ensuring the right nurse with the right qualifications was scheduled for the right surgical procedures.

Makigami clarifies people's responsibilities during scheduling, illustrating the importance of a multidisciplinary approach to process analysis, and diminishing resistance to change as employees experience both the analytic process and the resulting benefits.

**Study 3: Lean process-mapping techniques: improving the care process for patients with oesophageal cancer**

Most patients with oesophageal cancer are diagnosed relatively late in the course of the disease. Further, delays between diagnosis and surgical treatment result in higher rates of morbidity and mortality. Using VSM principles, a multidisciplinary team found the care pathway for these patients to be disorganised and vulnerable to medical error. After using this quality improvement tool, the number of steps required to commence treatment was reduced from 128 to 103, variability was reduced through standardisation and the delay to surgery was reduced by 3.5 weeks. Key messages include the importance of staff available to train and allocate appropriate resources, a multidisciplinary approach, and that VSM encourages consensus, which is an important enabler of Lean implementation.
Study 4: The role of leadership and workforce flexibility when implementing Lean healthcare

To determine factors influencing the ‘knowing-doing’ or ‘strategy-performance’ gap identified in the Introduction, a survey-based methodology was used to get access to the operating theatre staff perceptions of the extent of Lean implementation, transformational and team leadership and workforce flexibility after a Lean transformation process. This is a novel method, addressing the need for techniques that can be applied by employees in the assessment of Lean, as highlighted in the Introduction.

We showed a correlation between the degree of both transformational leadership and team leadership and the degree of implementation of Lean practice. Further, workforce flexibility, defined in terms of skill flexibility and behaviour flexibility, was strongly correlated with the degree of implementation of Lean healthcare.

Study 5: Experiences of leaders in the implementation of Lean in a teaching hospital

Using semi-structured, in-depth interviews with healthcare professionals directly involved in Lean implementation, we identified facilitators and barriers to the process.

The following factors were identified as having an important influence on lean implementation: training and education; senior management support (and involvement) alongside the provision of necessary resources; communication of strategy and purpose; resistance to change; multidisciplinary collaboration; and the overcoming of functional and professional silos.

Study 6: An ethnographic case-study perspective on Lean leadership

From in-depth interviews with representatives from all levels of the hierarchy involved with Lean implementation, leadership behaviours and qualities important to support Lean transformation emerge: going to the *gemba*, empowering employees and showing modesty.
Going to the *gemba* is a fundamental principle of Lean transformation and observations from this ethnographic study provide valuable insight into the challenges of Lean practice in healthcare. A *gemba* walk should be a public activity during which the manager shows interest and demonstrates care about metrics. Objections can arise to time devoted to a *gemba* walk because some feel other activities should take priority. Formally scheduling a *gemba* walk as a high priority encourages people to leave their office and helps to empower employees. When individuals meet as a multidisciplinary team for a *gemba* walk and consider problems and supporting data, many common problems are rapidly solved, which fosters an environment of responsibility and empowerment. In developing and showing modesty and listening to staff from a viewpoint of needing to learn rather than from a position of “knowing”, openness and transparency is encouraged, so contributing to the critical cultural change required in Lean transformation.

**Positioning the studies in the Transition-to-Lean Roadmap**

In the Introduction, we presented the Transition-to-Lean Roadmap, which provides a useful model to illustrate the stages involved as an organisation undergoes a Lean transformation process. Having now presented the six studies, these can be ‘mapped’ onto the Roadmap to provide practical examples and highlight areas for further discussion (Figure 1).

Chapters 2, 3 and 4 are examples of specific Lean improvement initiatives one would expect to find in the short term cycle of the Transition-to-Lean Roadmap. These are specific programmes, projects and activities executed over relatively short periods, once the organisation has been prepared for Lean implementation through creation of an appropriate environment.

While the first three studies focus specifically on Lean improvement initiatives, the challenges of implementing such initiatives are addressed in Chapter 6. This chapter illustrates a number of barriers to implementation and also exposes conflicts arising when moving from old to new ways of practice. As preparedness for Lean implementation occurs in the long term cycle, these barriers and conflicts
can be represented as tensions occurring at the interface between the long and short term cycles of the roadmap.

In Chapter 5, the process and success of Lean implementation were studied in relation to the strength of transformational leadership, team leadership and workforce flexibility. These factors relate to the “Energy” and “Focus” meta factors of the Elemental Change Model (Ten Have et al., 2011). Thus, transformational leadership and team leadership provide the “Energy” (preparedness and readiness for change amongst staff) for an organisation’s change capacity. Further, workforce flexibility would relate to the “Focus” meta factor, in enabling deeply embedded rigidity of traditional rules, and procedures, rituals, mindsets, structures and systems to be left behind – providing an adequate organisational framework for change. A flexible workforce is capable of
leaving behind traditional ways of working and deeply embedded attitudes to adapt to new ways of working essential to the new paradigm of Lean. We have modified the model to provide a visual representation of the variables of transformational/team leadership and workforce flexibility found in this study (Figure 2). These factors influence the change capacity of the organisation as it prepares to undergo a Lean transformation process, and therefore this study can inform us on the long term cycle.

Figure 2. Elemental change model: relationship of transformational and team leadership on ‘ENERGY’ and workforce flexibility on ‘FOCUS’, together increasing ‘CHANGE CAPACITY’. Adapted from Ten Have et al. (2011).

Finally, the reflections of a hospital leader in Chapter 7 provide insight into the direct implementation and troubleshooting of specific programmes – short term cycle activities exemplified by the practice of going to the *gemba*. This study also reflects on the cultural changes necessary in preparation for Lean implementation – the long-term cycle. Further, Chapter 7 illustrates learning from the whole Lean transformation process, which is an important component of the entry/re-entry cycle. Lessons learned will affect the strategic planning process as the organisation continues to move forwards.
Overcoming barriers to Lean implementation

The six studies have revealed a number of barriers to Lean implementation. They also provide information on how these barriers may be overcome. Here we present the barriers and the ways these may address in practice.

Training and education

Training and education were identified as important factors influencing the implementation of Lean in Study 5 (S5). Experienced team leaders (at middle management level) were enrolled in an LTP, which was delivered over four days with four hours of training provided each day in the evening after normal working hours. This is a familiar scenario in hectic and demanding healthcare settings, and it is perhaps not surprising that some participants experienced challenges concerning the timing of the LTP, given the low level of alertness after a day of work.

S5 also showed that being presented with theory during a short period might not be an ideal educational method, there being no coaching provided to help put the theory into practice after the course. In S3 not every workgroup member was able to participate in the introductory training and lack of knowledge and confidence was considered by some to be a barrier to the success of the initiative. Taking time out for training in hardworking hospital setting will always be a challenge and this therefore represents an important tension in the Lean implementation process: balancing Lean learning against other commitments in a context with limited time.

Simple Lean tools can be taught in the classroom but more advanced methodologies need to be learned 'on the job' with concomitant coaching: a 'hierarchical' delivery. The use of an A3 report in S1 encouraged dialogue, knowledge-sharing and collaboration between colleagues and can be seen as a valuable, practical process which complements learning about the theory of Lean in the classroom. Training on the job (or “learning by doing”) provides more opportunity for Lean principles to be adopted in a “shared learning process” during which team members discuss as they learn on the job. This “dialogical”
learning approach is recognised as valuable in delivering improvement programmes (Leon et al., 2012).

Involvement of senior management

In S5, middle managers attempted to implement Lean while senior managers were not necessarily intimately involved with Lean practice initiatives. Commitment of senior management in the Lean implementation process was characterised by involvement in implementation, supervision of the process, provision of necessary resources (particularly time), motivation of employees and, critically, the importance of senior managers acting as role models.

Senior manager support is therefore important, but should be available alongside senior manager involvement, with leaders acting as role models and spending time in the workplace. However, the traditional and long-standing practice of senior managers in healthcare is to remain distant from the “shop floor” (Dombrowski and Mielke, 2013). It can only be through education and personal development that traditional senior managers can come to appreciate the advantages of becoming more involved.

Multidisciplinary cooperation

Physicians and operating staff are highly trained professionals who traditionally act with autonomy. However, Lean culture requires multidisciplinary collaboration – communication between individuals with different skills, working in teams towards a common goal and understanding each other’s roles. Professionals must accept working on a level with colleagues from other disciplines, and here lies a tension.

Studies S2 and S3 provide examples of successful multidisciplinary practice, with the benefits of using Lean tools extending beyond quantitative improvement. Using Makigami in S2 provided team members with a better understanding of who was responsible for doing what work in the scheduling process and thus illustrate the value of a multidisciplinary approach. In S3, a multidisciplinary team was involved, whose team members (should have) had all the skills necessary to
address factors important in the implementation of Lean practice described in S5. Particularly important were: members available to train and coach, a care professional with responsibility to allocate appropriate resources, and representatives from the multiple departments involved in the care of patients with oesophageal cancer. The detailed observational techniques of VSM provided new insight into the care process, which empowered staff at every level to seek “solutions rather than workarounds” to improve patient care. The multidisciplinary team also enjoyed consensus, and we believe this “buy-in” is a key factor enabling the implementation of process improvements. Teichgräber and de Bucourt (2012) also consider such insights to be the most significant benefit of using techniques such as VSM: “mapping does not only lead to better processes, but it also leads to a consensus that enables and enhances implementation”.

Transcending functional silos

In a similar fashion to senior managers traditionally spending much of their time in their offices, hospital departments have long maintained separate identities. This is partly due to the differing training and expertise of personnel between departments, but also because of independent management structures and budgetary allocation. Interdepartmental cooperation challenges “boundaries” of expertise and the organisation of management and finance. These functional and professional departments (silos) can foster improvement in specific skills, but they are a barrier to the flow of patients, goods and information.

There is a need for separate hospital departments to work together across silos. To foster cooperation, participants in S5 advocated improvement in personal connections, establishment of common goals and support of people who strive to cross these traditional “departmental boundaries”. It is an important function of senior management to encourage such cooperation, to encourage and empower individuals introduce better communication between departments.
In a similar way to acceptance of multidisciplinary working, therefore, a tension is illustrated here: a need for separate hospital departments to work together across silos – to think ‘out-of-the-box’.

**Overcoming resistance to change**

Resistance to change represents a critical barrier to Lean transformation. The need for promoting a culture that embraces change is recognised by many workers (Simon and Canacari, 2012; Anand et al., 2012; Dombrowski and Mielke, 2013). Overcoming resistance can be achieved through empowering and motivating employees and developing a nurturing environment, which provides adequate resources (particularly protected time) for training and education. Employees should be encouraged to provide suggestions for improvement and importantly their suggestions should be seen to be valued, discussed and used. In S2, it was shown that in experiencing both the analytic process and the final benefits of a Lean initiative, staff were more willing to leave behind long-standing habits in favour of new ways of working – a cultural change so important in the implementation of Lean.

**Align different perspectives and issues of stakeholders**

In S2, we noted “the incentives of various stakeholders were not always aligned, making it a challenge to involve the different stakeholders in the process.” Our studies emphasise the need for a shared understanding of incentives, direction and goals (S2 and S5), inevitably difficult to achieve in the busy and complex hospital setting, in which the traditional management approach is ‘top-down’. This therefore constitutes an important barrier in the Lean transformation process.

Dombrowski and Mielke (2013) suggested what may contribute to failure of implementation. From an international survey in 2012 in which 91 manufacturing enterprises took part, the extent to which these authors’ five Lean principles were practised was quantified. While enterprises generally understand the importance of Lean leadership, applying the principles of Lean leadership can be problematic. A culture of continuous improvement involving empowerment of employees
(‘Qualification’) was commonly encountered but the fostering of a shared understanding of the direction of the organisation (hoshin kanri) was only present in 29%. A lack of alignment of goals in many organisations may account for Womack’s amazement at little or no connection between Lean projects and overall business purpose (Womack, 2006).

In S2, additional training was recommended to help overcome this lack of alignment of incentives between individuals. The need to communicate strategy and purpose, hoshin kanri, is an important component of the style of a good Lean leader, highlighted in Table 1.

The Entry/Re-entry cycle of the Transition-to-Lean Roadmap helps to identify how to align incentives between disparate groups of stakeholders. Thus, such a process requires strategic planning and a Lean vision. Prevailing culture, relationships with all stakeholders (and patients), practices, processes, assumptions, resources and business processes must be re-evaluated. One can therefore argue that leaders must: identify achievable common goals, communicate these goals to all stakeholders, and inspire a belief that achieving such goals will be to the benefit of patients and indeed employees. Such alignment requires leaders to be prepared (and educated) for such a challenge and to be excellent communicators.

Adequate manager attitude and practice

We found a need for managers to express modesty and show an attitude of humility (S6). This may be both a difficult quality to acquire (through self-development) and a source of tension when trying to leave behind a traditionally ‘officious’ attitude for more open-minded ways of working. Dombrowski and Mielke (2013) demonstrated that self-development of managers was only present in 42% of Lean organisations. A pertinent differentiation between implementation of “specific Lean tools (input) and short-term outcomes (output)” and “in-depth understanding of the sociotechnical factors that enhance the complete change process (throughput)” is made by Mann (2009): “Implementing tools represents at most 20 percent of the effort in Lean transformations. The other 80 percent of the effort is expended on changing leaders' practices and behaviours, and
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<td>Lean</td>
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<td>Vision and inspiration</td>
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<td>Leader qualities</td>
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<td>Go to gemba</td>
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Table 1. Comparison of Lean leadership and other leadership styles.
ultimately their mind-set”. Such change requires time and education: critical in overcoming many of the barriers to Lean implementation.

As managers change the way they work (traditionally working from their office ‘remotely’) and spend much longer periods with employees (going to the gemba), we found that some object to having to devote this extra time, which they perceive as unnecessary. Employees could also perceive going to the gemba as means by which managers control their employees. This was clearly a source of tension in S6.

However, S6 also highlighted the benefits of going to the gemba. These included: identification and understanding of problems, the immediate availability of colleagues with whom to discuss the problem and identify solutions, demonstration of commitment and interest in workplace activities and metrics, and availability to answer questions or share concerns.

**Workforce flexibility**

We found a relationship between workforce flexibility and the degree of implementation of Lean healthcare (S4). Workforce flexibility *together with* transformational leadership was also found to be a critical issue in four Emergency Departments implementing Lean (Dickson et al., 2009). Successful Lean transformation was associated with good transformational leadership *alongside an equivalent degree of workforce* flexibility – one without the other being likely to reduce the chance of success.

Consequently, the question arises as to how the problem of an ‘inflexible’ workforce can be addressed. Dickson et al. (2009) noted inflexibility as a cultural barrier to Lean implementation and this therefore represents an inevitable source of tension. Acquisition of appropriate Lean leadership qualities and the encouragement of team working may be achievable through preparation and education. However, improving ‘workforce flexibility’ when this is not forthcoming may be a challenge, requiring additional and more prolonged change activities.
We can surmise that flexibility would be improved by Lean leaders addressing the barriers of functional silos and hierarchical staff structures and providing good training and education. In moving away from such traditional structures and systems with their associated rules and procedures, a more flexible and now empowered workforce could work more freely – across traditional silos – in a truly multidisciplinary fashion.

**Combining short term and long term improvements**

Perspectives of time differ at different hierarchical levels of the organisation. At a departmental level, the focus is on the short term challenges, short term cycle of the implementation of Lean tools. However, implementation of Lean also requires maintaining a long term culture of continuous improvement.

Emiliani (2008) suggests “fake” Lean occurs when an organisation only uses tools, with an emphasis on short-term improvement. “Real” Lean is associated with a long-term commitment to continuous improvement alongside developing respect for people and changed leadership behaviour. Similarly, Radnor and Boaden (2008) described ‘rapid improvement events’ (also described as a kaizen blitz) used to achieve short-term improvement in UK public services, but true Lean can only be achieved through more time-consuming cultural change. Radnor and Boaden advise on being realistic about timescales in public services, a finding echoed by Morrow (2012) in evaluating the UK-based process of “the Productive Ward: Releasing Time to Care”. In this analysis of a large-scale quality improvement programme, and aligned with our observations, there was notable variation in perceived timescales of implementation by different hierarchical levels within the healthcare system. This should be heeded when establishing benchmarks for the achievement of goals in extensive quality improvement programmes. We can reflect again on Toyota’s success, which relies upon its capacity to *continue* to be a learning organisation, supported by good leadership, teamwork and a Lean culture.
Lean leadership style compared with other transformational leadership styles

Some argue that Lean leadership style is a distinct entity and separate from other theories of leadership (Poksinska et al., 2013). However, there appears to be much common ground between Lean leadership and transformational and servant leadership, and leadership in self-managed teams. Our studies concord with such overlap and the importance of both transformational and team leadership styles in Lean implementation was demonstrated in S4.

The transformational leader has many of the competencies required to implement Lean practices. Common to both is the ability to provide a vision supported by shared goals and to facilitate a change in culture through inspiration, motivation and respect for individuals. Transformational leaders motivate followers to achieve improved performance, analogous to employees’ drive for continuous improvement in Lean organisations.

A useful comparison of leadership traits arises from considering managerial ‘focus’. Poksinska et al. (2013) noted that during a Lean transformation process experienced by a manufacturing company and healthcare providers, managers’ focus evolved from managing operations (traditional management) to managing people (the focus of transitional and Lean leadership).

A major component of transformational and Lean leadership is senior leadership commitment to drive the process forwards (a ‘top-down’ approach), as illustrated by earlier studies of the implementation of Lean practice in healthcare (Dickson et al., 2009). Poksinska et al. (2013) found that the earlier stages of Lean transformation were characterised by managerial ‘push’ during which motivation of employees required strong transformational leadership skills. Later case studies (Dickson et al., 2009; Kruskal et al., 2012) in particular deliver some important messages about leadership and cultural change during Lean transformation. For success, it must be accepted that the process is gradual and continuous. Commitment from all levels of an organisation is important. Leaders should be committed to the ‘long haul’ (Kruskal et al., 2012) in a culture of transparency, honesty and respect for all staff members.
However, as employees adopt their new roles, the need for transformational leadership reduces, and managerial push is replaced by employee ‘pull’ (Poksinska et al., 2013). Top-down activity must be complemented by a ‘bottom-up’ approach to implementation in which employees are motivated, coached and committed to the process of continuous improvement (Dombrowski and Mielke, 2013). We found empowering staff to be a critical component of Lean leadership behaviour (identified in S6) and an important contributor to overcoming resistance to change. The bottom-up requirements show similarities with servant and self-managed team leadership. The former has a strong focus on the needs and development of employees, essential for empowerment of individuals in Lean organisations. Devolution of continuous improvement initiatives to multi-skilled teams is a central component of Lean transformation and such teams evolve and mature to manage themselves and achieve high performance.

The insights from our studies alongside other literature enable a more in depth comparison between traditional leadership styles and what emerges as Lean leadership style (Table 1).

To structure the comparison, the various individual characteristics demonstrated by transformational, servant and self-managed, and transactional leadership styles identified in the Introduction have been listed and grouped into themes. These themes and the individual characteristics form the titles of the rows in the table. Themes identified therefore include: vision and inspiration, leader qualities, shared goals versus employee needs focus, employee performance expectations, organisational culture, employee development and responsibility (‘qualification’), ‘push’ versus ‘pull’ management style, and people versus operation focus.

Leadership styles provide the titles for columns in the table. For transformational, servant and self-managed, and transactional leadership styles, the characteristics apparent for each individual style have been noted in the table. A similar process has then been performed for Lean leadership characteristics that have been identified in the thesis. This therefore enables a comparison to be made between
the characteristics of Lean leadership and the other well-documented leadership styles (Table 1).

It is clear that a good Lean leader should possess all the characteristics of a transformational leader. However, an important additional strength (perhaps not a major feature of a transformational leader) is the ability to encourage employee ‘pull’ (Poksinska et al., 2013), reminiscent of servant and self-managed team styles. Important differences between a Lean leader and other styles are a focus on managing people rather operations (more typical of transactional management style) and an expectation that employees will perform better than expected whilst transactional managers anticipate performance to be exactly as expected. Finally, while follower needs predominate in the servant and self-managed team styles, a Lean leader will adopt a balanced focus to ensure there is alignment of personal and follower needs and the overall objectives of the organisation.

**Methodological considerations**

In most studies in this thesis, a case study design was chosen. Although this can make generalization more difficult, the design was appropriate as the research questions focused on ‘how things work’ (Yin, 2003). Although we did not aim for external validity, the insights can be useful in other settings, and are therefore, transferable. Although all studies were performed in one academic hospital, the cases were not restricted to a single department or target group and are therefore relevant to hospital-wide processes. Findings may also be relevant to general hospitals, as many were not related to ‘academic’ hospital practice. Therefore, others are invited to see if the results are valuable to their institutions.

The studies were performed in natural settings with many unknown variables, making other designs such as a formal trial difficult to use and less relevant for answering the research questions of our thesis (Klazinga et al. 2007). Furthermore, using a case study in a natural setting enables scrutiny of the circumstances under which the Lean methods and tools were applied in practice in much greater detail.
The Lean methods and tools studied were not randomly selected or based on theoretical sampling. Hospital staff selected the methods to be used. Therefore, perhaps the optimum methods from a theoretical perspective were not employed. As an advantage, however, the research was guided by the perspectives of people who have a stake in lean and did not intervene or force practices on the healthcare professionals, making the setting more natural.

A potential complicating factor was that the first author of the articles in this thesis was also employed as Head of Anaesthesiology and Operating Care in the hospital, introducing a risk of bias. To resolve this, in most studies a thorough member check (Yin, 2014) was performed during different phases of data collection and data analysis. Also, all studies used data triangulation and interpreter triangulation (Yin, 2014). Furthermore, all chapters were peer-reviewed for publication in international academic journals. Moreover, the insider position of the first author had its advantages, such as enabling detailed data to be obtained and providing an insider’s perspective.

**Implications for practice and future research**

During the last decades, different quality management concepts, including Total Quality Management (TQM), six sigma, and Lean, have been applied by many different organisations. While the description of what quality management is differs, the aim of the different concepts seems to be similar and these concepts also have the same origin, the quality evolution in Japan after the World War II. However, activities such as developing a culture and empowering people for continuous improvement are often neglected (Radnor, et al., 2012). Our studies show the importance of this aspect of quality improvement and the way it can be fostered in Lean practice. The application of Lean methods in healthcare cannot be restricted to copying tools or methods, as it requires introducing a new way of thinking. Using automotive/industrial methods in healthcare is not transferring a model from one world to another, but rather adopting a philosophy. The process of learning from industrial methods and practices requires changing professional and organizational culture (Lewis et al. 2011; Rogers 2011). To adapt the
principles of Lean philosophy and practice, the role of the professional needs to change from that of a solitary, autonomous craftsperson to that of a team player. As highlighted in this thesis, professionals in healthcare seem to have a distinctive view of teamwork, rather different to that held by their colleagues in other industries.

In line with findings in the literature (Dombrowski and Mielke, 2013; Mann, 2009; Simon and Canacari, 2012; Liker and Convis, 2012; Dickson et al., 2009), our studies have identified critical success factors for Lean implementation in healthcare. In order to implement Lean in healthcare, a suitable environment must be created. Leaders must remove obstacles and provide necessary resources and an appropriate organisational structure to encourage workforce flexibility. Leaders should understand the importance of both self-development and employee development. Employees should be empowered and motivated so as to stimulate team working and good team leadership. It is essential that leaders support a culture of continuous improvement, and demonstrate this through going to the gemba regularly. Common goals should be communicated throughout the organisation and shared with all stakeholders. Finally, it is essential to promote multidisciplinary team working in an environment of understanding and respect.

While literature on leadership in lean is available, it mainly addresses the concept as a subtopic of hand-on guides on how to implement ‘lean’ in practice. The focus on leadership in such literature considers the steps that have to be taken, shedding little to no light on leadership attributes. Better understanding of the effectiveness of Lean would be provided by additional detailed studies focusing also on structure, systems and management control. In addition to more detailed analyses, future research should include stronger research designs to examine the relationship between Lean and quality improvements (Whetten, 2000). Without comparison groups, it is difficult to tell if clinical and process improvements were due to the Lean tools or other explanations.
We found limited literature on the failures of Lean. This may be because lean usually results in desired performance improvement. Alternatively, the absence of articles reporting no or negative findings may reflect a publication bias. If the latter is the case, the current literature may overstate the effectiveness of lean and therefore, may be misleading for health care managers considering implementing Lean tools in their organizations. Given the adage that we learn more from our failures than from our successes, studies on the failures of Lean to improve processes of care would serve as valuable teaching lessons.

Research should focus on further investigation into the impact of Lean practices. If possible, we recommend using multiple and objective outcome measures, including studies with a randomized cluster design, long-term follow-up measurements and validated measurement tools in different hospital settings. Such research may help to answer important questions. How can tools to measure the impact of lean implementation be validated? What is the relative importance of identified barriers in inhibiting professionals’ and managers’ lean improvement behaviour? What benefits are gained by overcoming these barriers?

**Conclusion**

Our studies have provided insights into the complex interactions and implications of Lean transformation in healthcare. We have shown that Lean is applicable as a process improvement approach in healthcare settings. We have demonstrated the importance of transformational and team leadership, and workforce flexibility in implementing lean practice. Our studies have revealed important leadership behaviours and qualities that support Lean transformation: going to the *gemba*, empowering employees and showing modesty. We have demonstrated the use of specific Lean tools to improve hospital processes and patient care: A3 intervention, Makigami and fishbone analysis, and value stream mapping. In comparison to other approaches in quality management, Lean transformation, by combining a focus on culture change with concrete tools for analysing problematic situations and developing solutions, is a promising approach for
improving healthcare practice and making it fit to patients’ needs. We recommend to implement Lean in healthcare because it crosses all departmental boundaries, addresses all organisational functions, and impacts the entire management system by engaging professionals in creating more value and improving work with less effort, capital and resources.
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Summary
Executive summary

This thesis aims to contribute to the knowledgebase of Lean practice and Lean leadership in healthcare and to provide a resource for those contemplating Lean transformation in this sector. The thesis comprises the following sections: Introduction (Chapter 1), Original studies (Chapters 2-7) and Discussion (Chapter 8).

Introduction (Chapter 1)

- This chapter describes the origins of Lean practice in the Japanese car manufacturer Toyota and the more recent introduction of Lean practice into healthcare. We present a ‘roadmap’ to successful Lean implementation, which predicts areas of tension and implementation challenges when applied to a hospital setting. Gaps in the Lean healthcare literature are identified, which include: how to measure the effectiveness of Lean transformation; what facilitates the implementation of Lean healthcare; a need for studies that examine the complex dynamics of Lean transformation; what factors contribute to overcoming the ‘knowing-doing gap’ in healthcare; and the characterisation of Lean leadership in relation to established leadership models.

- Our research questions were developed from this background. How can healthcare organisations benefit from Lean practice? How can we better understand the complex interactions and cultural implications of Lean transformation in healthcare? How can Lean leadership help to overcome organisational barriers and contribute to effective implementation of Lean practice? What facilitators and barriers to the implementation of Lean healthcare can be identified and how may leaders use knowledge of facilitators and barriers to make the transformation process successful? How can Lean leadership be defined and what are characteristics of effective Lean leadership in comparison with existing leadership models? Finally, what tools are useful and what can be learned from case studies on Lean implementation in healthcare?
Lean philosophy, Lean leadership and Lean tools are discussed in the context of the development of a theoretical framework, and the six original studies to be presented in subsequent chapters are summarised.

**Original studies (Chapters 2-7)**

- In Chapters 2-7, we present our original studies. In three case studies, examples of the implementation of Lean practice in healthcare are investigated. A further three studies focus on the complex dynamics of Lean transformation, factors influencing the implementation of Lean in healthcare and the characterisation of Lean leadership.

- In Chapter 2, A3 reporting and a fishbone analysis used by a multidisciplinary team to reduce operating department (OD) scrub room door movements are discussed. In Chapter 3, the use of Makigami alongside a fishbone analysis to reduce nurse scheduling errors in the OD is presented. Chapter 4 addresses Value Stream Mapping and shows it reduced the delay between diagnosis and surgical treatment for patients with oesophageal cancer.

- In Chapter 5, a survey-based methodology was employed to identify factors which influenced the transformation process after implementation of Lean practices in an operating theatre. These include the degrees of: transformational leadership, team leadership and workforce flexibility. Semi-structured, in-depth interviews with healthcare professionals who were directly involved with Lean implementation were analysed in Chapter 6 to identify barriers and facilitators to the implementation of Lean healthcare in hospitals. In Chapter 7, key Lean leadership behaviours and qualities were identified, including the empowerment of employees, going to the *gemba* and demonstrating humility by managers.

**Discussion (Chapter 8)**

- The discussion first summarises the main messages from the studies, and their relationship to the Transition-to-Lean Roadmap. Next, barriers and facilitators to successful Lean implementation are considered individually, and compared with findings in other studies. These include: training and
education; senior management support (and involvement) alongside the provision of necessary resources; communication of strategy and purpose; resistance to change; multidisciplinary collaboration; and the overcoming of functional and professional silos.

- As practical tools for the Lean implementer, tensions are identified: time for training and education vs. other commitments; the importance of senior and middle management involvement; single discipline autonomy vs. multidisciplinary approach; departmental autonomy (silo) vs. cross-departmental working; alignment of incentives between multiple stakeholders; employee resistance to change; and employees acceptance of managers when they go to the *gemba*.

- Lean leadership style is further characterised through comparison with traditional leadership styles reviewed earlier in the thesis.

- In conclusion, we summarize critical success factors for the implementation of Lean practice in healthcare, synthesised from the studies presented in combination with the literature.
Samenvatting

Het doel van dit proefschrift is het leveren van een bijdrage aan de kennisbasis van Lean werken (practice) en Lean leiderschap (leadership) in de gezondheidszorg. Daarnaast kan het als hulpmiddel dienen voor wie een overstap naar Lean binnen deze sector overweegt. Het proefschrift is als volgt opgebouwd: Inleiding (hoofdstuk 1), Oorspronkelijke onderzoeken (hoofdstuk 2-7) enDiscussie (hoofdstuk 8).

Inleiding (hoofdstuk 1)

- Dit hoofdstuk beschrijft de oorsprong van Lean werken bij de Japanse autofabrikant Toyota en de recentere introductie van Lean werken in de gezondheidszorg. We presenteren een ‘routeekaart’ voor een succesvolle Lean implementatie, die spanningsgebieden en knelpunten bij de invoering voorspelt bij toepassing binnen een ziekenhuisomgeving. Er worden hiaten in de literatuur over Lean in de zorg vastgesteld, zoals: hoe kan de doeltreffendheid van de Lean transformatie worden gemeten, wat bevordert de invoering van Lean gezondheidszorg, de behoefte aan onderzoeken die de complexe dynamiek van Lean transformatie bestuderen, welke factoren dragen bij aan het overbruggen van de ‘knowing-doing gap’ in de zorg, en een karakterisering van Lean leiderschap in relatie tot gevestigde leiderschapsmodellen.

- Tegen deze achtergrond hebben we onze onderzoeksvragen ontwikkeld. Hoe kunnen organisaties binnen de gezondheidszorg profiteren van Lean werken? Hoe krijgen we beter inzicht in de complexe interacties en culturele gevolgen van Lean transformatie in de gezondheidszorg? Hoe kan Lean leiderschap helpen om organisatorische barrières uit de weg te ruimen en bijdragen aan een effectieve implementatie van Lean werken? Welke bevorderende en belemmerende factoren (facilitators and barriers) voor de implementatie van Lean gezondheidszorg kunnen er worden vastgesteld en hoe kunnen leiders hun kennis van bevorderende en belemmerende factoren gebruiken om het transformatieproces te laten slagen? Hoe kan Lean leiderschap worden
gedefinieerd en wat zijn de kenmerken van effectief Lean leiderschap in vergelijking met bestaande leiderschapsmodellen? En ten slotte welke hulpmiddelen zijn nuttig en wat kunnen we leren van casestudies over Lean implementatie in de gezondheidszorg?

- De filosofie van Lean, Lean leiderschap en Lean hulpmiddelen worden besproken in de context van de ontwikkeling van een theoretisch kader, en er wordt een samenvatting gegeven van de zes oorspronkelijke onderzoeken die in de volgende hoofdstukken worden gepresenteerd.

Oorspronkelijke onderzoeken (hoofdstuk 2-7)

- In hoofdstuk 2 tot en met 7 presenteren we onze oorspronkelijke onderzoeken. In drie casestudies worden voorbeelden van de implementatie van Lean werken in de gezondheidszorg onderzocht. Drie andere studies richten zich op de complexe dynamiek van Lean transformatie, factoren die van invloed zijn op de implementatie van Lean in de gezondheidszorg en de karakteristieken van Lean leiderschap.

- In hoofdstuk 2 worden een A3-rapportage en een visgraatanalyse besproken, die door een multidisciplinair team gebruikt werden om de deurbewegingen van de wasruimte van de operatieafdeling (operating department, OD) te beperken. In hoofdstuk 3 wordt het gebruik van Makigami naast een visgraatanalyse gepresenteerd, om de roosterfouten van OD-verpleegkundigen te verminderen. Hoofdstuk 4 gaat in op Value Stream Mapping en toont aan dat dit de vertraging tussen diagnose en chirurgische behandeling verminderde voor patiënten met slokdarmkanker.

- In hoofdstuk 5 wordt een methodiek op basis van een enquête gebruikt om vast te stellen welke factoren van invloed waren op het transformatieproces na implementatie van Lean werken in een operatiekamer. Hiertoe behoren de mate van transformationeel leiderschap, teamleiderschap en flexibiliteit van het personeel. In hoofdstuk 6 worden semigestructureerde diepte-interviews met beroepsbeoefenaren in de gezondheidszorg geanalyseerd, die direct betrokken waren bij de Lean implementatie, om belemmerende en bevorderende factoren voor de implementatie van Lean gezondheidszorg in
ziekenhuizen vast te stellen. In Hoofdstuk 7 worden Lean leiderschapsgedrag en -kwaliteiten vastgesteld die belangrijk zijn, waaronder empowerment van werknemers, naar de *gemba* ('werkvloer') gaan en bescheidenheid van managers.

**Discussie (hoofdstuk 8)**

- Bij de discussie wordt eerst een samenvatting gegeven van de belangrijkste leerpunten uit de studies en hun relatie met de Transition-to-Lean-routekaart. Vervolgens worden belemmerende en bevorderende factoren voor een succesvolle Lean implementatie individueel onder de loep genomen en vergeleken met de bevindingen uit andere studies. Daarbij gaat het om training en onderwijs, ondersteuning (en betrokkenheid) van het senior management, naast het beschikbaar stellen van de benodigde middelen, communicatie van strategie en doel, weerstand tegen verandering, multidisciplinaire samenwerking en het overwinnen van functionele en professionele silo's.

- Als praktisch hulpmiddel voor degene die Lean implementeert, worden spanningen geïdentificeerd: tijd voor training en onderwijs vs. andere verplichtingen, het belang van betrokkenheid van senior en middenmanagement, autonomie van één discipline vs. multidisciplinaire benadering, afdelingsautonomie (silo) vs. afdelingsoverschrijdend samenwerken, stroomlijnen van incentives tussen diverse stakeholders, weerstand tegen verandering bij werknemers en acceptatie van managers door werknemers, wanneer deze naar de *gemba* gaan.

- Een Lean leiderschapsstijl wordt nader gekarakteriseerd door een vergelijking met traditionele leiderschapsstijlen die eerder in dit proefschrift zijn behandeld.

- Tot slot geven we een samenvatting van kritische succesfactoren voor de implementatie van Lean werken in de gezondheidszorg, samengesteld uit de gepresenteerde onderzoeken in combinatie met de literatuur.
Dankwoord
Dankwoord

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