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Edwards, Kasper; Nielsen, Anders Paarup

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# **Improving Healthcare through Lean Management: Experiences from the Danish healthcare system**

*Anders Paarup Nielsen*

*Department of Mechanical and Manufacturing Engineering*

*Aalborg University Copenhagen,*

*Lautrupvang 2B*

*2750 Ballerup*

*Denmark*

*E-mail: [ap@engsci.aau.dk](mailto:ap@engsci.aau.dk)*

*Phone: +45 2443 2085*

*Kasper Edwards,*

*Department of Management,*

*Technical University of Denmark,*

*Building 425, room 108*

*2800 Kgs. Lyngby*

*Denmark*

*E-mail: [kaed@man.dtu.dk](mailto:kaed@man.dtu.dk)*

*Phone: +45 2225 6320*

# **Improving Healthcare through Lean Management: Experiences from the Danish healthcare system**

## **Abstract**

The ideas and principles from lean management are now widely being adopted within the healthcare sector. The analysis in this paper shows that organizations within healthcare most often only implement a limited set of tools and methods from the lean tool-box. Departing from a theoretical analysis of the well-known and universal lean management principles in the context of the healthcare this paper will attempt to formulate and test four hypotheses about possible barriers to the successful implementation of lean management in healthcare. The first hypothesis states that lean management in healthcare still is in its infancy and it is just a matter of letting sufficient time pass in order to have a successful implementation of lean in all areas of healthcare. The second hypothesis states that a major barrier to lean management in healthcare simply is lacking understanding of the lean concepts leading to lacking absorptive capacity (Cohen & Levinthal, 1990) by the professionals within healthcare. The third hypothesis states that the nature of work and work processes in some areas of healthcare represents a significant barrier to successful implementation of lean management in healthcare. The fourth and final hypothesis states that different mind sets and different rationalities between different types of healthcare professionals act as a major barrier for lean management in healthcare. The hypotheses are tested and discussed through four case studies.

Using empirical research from four case studies the paper will continue by discussing these four hypotheses. The cases were followed over a period of one year and the researchers gathered a substantial amount of data concerning the lean implementation processes. Based on an analysis of the case data hypothesis one is rejected whereas hypotheses two, three, and four are supported. The paper concludes by discussing the implications of hypothesis two, three, and four for the successful application of lean management within healthcare. It is concluded that this requires a transformative and contingent approach to lean management where the universal

principles of the lean philosophy are respected, but the tools and concepts within the lean toolbox are adapted to the specific context of healthcare. Some concepts might even be considered inappropriate for healthcare. The key to harvest benefits from lean management lies in the ability to adopt lean in specific areas of healthcare organization where the prerequisites of lean can be satisfied. Finally, it is concluded that there are limits to lean management in healthcare as there are many situations and processes where lean is judged to be unsuited due to the reactive nature of the work.

**Keywords:** Healthcare; Lean implementation; Processes; Rationalities; Barriers; Denmark

## **Introduction**

The ideas and principles from lean management are now widely being adopted within the healthcare sector (de Souza, 2009). There is general agreement that there are huge opportunities for making improvements within healthcare (Spear, 2005). The interest in lean from healthcare managers and policy makers, however, appear to contrast the realized benefits. An analysis of cases reported in literature show that organizations within healthcare most often only implement a limited set of tools and methods from the lean tool-box such as value stream mapping and 5S. The implementations are thus fragmented and only creating small “islands” of lean. This kind of lean implementation leads to limited productivity gains in the healthcare organizations. Lean implementations tend to focus on peripheral activities in the healthcare organizations for example laboratory work and logistical issues (e.g. emergency room layout, billing processes, and logistics of consumables) (Edwards, Nielsen & Jacobsen, 2010; Nielsen & Edwards, 2010). Having participated in the Lean without Stress (LwS) research project we were puzzled by the apparent difficulties of adopting the lean tools and principles in the healthcare sector. The LwS project forms the empirical background and will be introduced in the methodology section below. This paper will focus on the contrast between the widespread interest in using lean in healthcare and the apparent lack of effect by answering the following research question “Why don’t we see a more pervasive application of lean in the healthcare sector”.

## **Literature review**

This literature review is based on a literature search focusing on journal papers reporting actual cases of lean implementations within healthcare organizations. Papers concerning conceptual and organizational issues have been omitted from the review. Focus has therefore been on papers reporting concrete applications of lean tools or the lean methodology within healthcare organizations – what (de Souza, 2009) describes as “*manufacturing-like case studies*” and “*patient flow case studies*”.

In order to systematize the review we introduce two dimensions: 1) Type of activity and 2) Approach to lean. There can be two types of activities: 1) core activities, i.e. treatment of and care for patients, and 2) support activities, i.e. laboratory analysis, administrative processes, and the management of consumables. The second dimension, approach to lean and is inspired by the prestigious Shingo Prize, which split an organizations' lean approach into three levels. The first level is "tool driven" which is characterized by an ad hoc use of a limited number of lean tools. The second level is "system driven" which is focused on a systematic use of a number of lean tools and principles. The third level is "principle driven" this approach is characterized by a widespread use of lean in the organization and an attempt to integrate lean principles into the organizational culture. This results in a matrix with 6 different lean implementation patterns in healthcare. In constructing the table a total of seventeen concrete case stories about lean projects in healthcare were identified and analyzed according to the dimensions in the matrix below.

*Table 1. Cases on lean implementation in healthcare (Nielsen & Edwards, 2010)*

		<b>Type of activity</b>	
		<i>Core</i>	<i>Support</i>
<b>Lean approach</b>	<i>Tool driven</i>	<b>0</b>	<b>11</b>
	<i>System driven</i>	<b>0</b>	<b>5</b>
	<i>Principle driven</i>	<b>0</b>	<b>1</b>

The case review in table 1 illustrate that most of the lean activities within healthcare are focused on support or peripheral activities in the different organizations. Four of the papers (King et al, 2006; Kelly et al, 2007; Ben-Tovin et al, 2007; Fairbanks, 2007) classified as tool driven support did have an indirect impact on the medical core activities. These four papers focused on improving the flow of patients through an emergency ward resulting in reduced waiting times leading to some positive effects on treatment.

Examples of system driven approaches to lean implementation can be found in (Tragardh & Lindberg, 2004; Lummus et al, 2006; Ng et al, 2010) here the lean implementation processes are characterized by a relatively systematic application of a number of lean tools and concepts, e.g., value stream mapping in combination with a deliberate focus on eliminating waste. However, the lean efforts are only focused on a relatively limited number of processes in the

hospital. Therefore we have classified these cases as system driven. Only one paper can be characterized as applying a principle driven approach to lean (Stuenkel & Faulkner, 2009). However, this case had a very strong focus on the management of consumables.

### **The lean principles and the nature of healthcare**

The key principles in lean are according to (Liker, 2003) and (Womack, Jones & Roos, 1991)

- Value: Focus on activities and processes that create value for the customer and eliminate activities and processes which do not.
- Flow: Creating flow concerning the value creating activities and processes.
- Variation: Eliminate variation by standardizing activities and processes as much as possible.
- Leveling: Leveling the load on the system in order to avoid load spikes in the production system.
- Pull: Manage production based on pull from the customer and not push.
- Excellence: Strive for operational excellence by continuous improvement and elimination of waste.

According to the advocates of lean these generic principles should be applicable to most activities in most organizations. With lean developed in an industrial context, it is important to have a basic understand of how a healthcare system works and what tasks it undertakes. Healthcare systems take many forms and for the purpose of this paper, it will be described from Danish public healthcare perspective. The Danish healthcare system resembles most European public healthcare systems.

A fundamental issue in public healthcare is that they must be able to treat all types of illnesses in the population and educate future healthcare professionals such as doctors and nurses. This is in contrast to private healthcare organizations, which has the option of specializing on specific diseases, procedures or treatments and don't have educate. This has implications for efficiency

as both a wider scope of treatment and education will decrease efficiency due to less specialization and treatment resources spent on education.

The nature of work in healthcare systems can further be divided into four types of processes: 1) disease prevention, 2) diagnostics, 3) treatment and 4) care. Disease prevention will typically entail counseling and educating patients about changes in life style, e.g. how to stop smoking or changing their diet. Disease prevention is normally carried out by a general practitioner and these activities will not be addressed in this paper. Diagnostic methods and activities must uncover the disease and formulate a treatment strategy. Diagnostic activities rely on the expertise of doctors and employ a broad array of tools such as image diagnostics, blood and tissue samples and exploration. A person with some sort of symptom always goes through an initial screening which is followed by one or more diagnostic activities if the initial screening cannot diagnose the problem. The sequence of these diagnostic activities cannot be planned in advance as it is not known what diagnostic activities are needed and because the result from one activity influence or determine the next diagnostic activity. A growing patient group exhibits multiple competing diagnosis, further complicating the process and making the development of standardized flows difficult if not impossible.

Once diagnosed, treatment/care may initially be planned as in the case of a cancer patient who is presented with a treatment regiment consisting of surgery followed by chemo therapy. While the general process can be planned, it is highly susceptible to changes in the patients' condition. If for instance, the patient does not respond positively to the chemo therapy or is weakened by the treatment to such a degree that it is not possible to continue the treatment. Treatment consists of a known sequence of activities to which resources can be allocated through planning. However, this planning will often be overturned if the patient doesn't respond as predicted and expected.

Patient care is about caring for the patients when not in treatment, this entails food, psychological support, mobilizing the patient, bath, toilet visits, medication etc. Care is characterized by consisting of a lot of different activities which unlike treatment are not interrelated. It does not matter in which sequence the tasks are performed. Naturally some micro

dependencies such as washing hands after toilet visit exist. In this sense care cannot be characterized as a process but as atomic tasks. Care is further characterized by being reactive as the care provider must respond to immediate patient needs. Acute pain cannot wait for the next medicine distribution and must be dealt with immediately. Same holds true for all tasks that are related to personal needs.

Another key characteristic of the typical healthcare organization is the existence of different rationalities or mindsets among the different groups of employees and stakeholders in the typical healthcare organization. According to (Mintzberg, 1997; Glouberman & Mintzberg, 2001; Mintzberg & Glouberman, 2001) the typical healthcare organization is characterized by four different mindsets with specific foci areas: Nurse, Doctor, Manager and Trustees. Nurses focus on *care* for the patients as well as orchestrating efficient flows that accommodate the actual need and well-being of the patient. The nurses' perception of value is related to well-being of the patient. Doctors focus on *cure* which entails curing whatever diseases the patient has. Doctors perceive value as related to the ability to cure the patient expressed in for example survival rates and the number of successful treatments. Managers focus on *control* over the operations of the hospital. However, managers are often outsiders to the medical professions and often managers will use their formal power over budgets and organizational structure to exert their control. The final group identified by (Glouberman & Mintzberg, 2001) are the trustees (or the politicians) governing the healthcare organization. The trustees focus on *community* which entails representing the surrounding community and naturally also seeking to influence the healthcare organization. In this paper focus will primarily focus on the relation between nurses and doctors.

The contrast between the original industrial context of lean and health care is strong and is illustrated by analyzing each of the lean principles from the perspective of the nature of healthcare. However, it is important to remember that the range of activities and treatments in the hospital vary from elective surgery characterized by a high degree of standardization and predictability to acute treatment of, e.g., accident victims, which require intensive and individualized treatment and care. The characteristics of elective surgery will to a large extent

resemble the characteristics of industrial production. However, the treatment of accident victims or elderly patients at a geriatric ward is highly reactive to the concrete needs of the patient in question. When analyzing the characteristics of healthcare focus is primarily on complex treatment procedures of for example accident victims or elderly patients.

*Value* is difficult to establish uniformly because of the different mindsets. Doctors assign value to fast and effective treatment although this may not be delivered with care and concern for the patient receiving the treatment. Nurses on the other hand assign great value to providing care and comfort for the patient. *Flow* can be established when the process is predictable, stable and in sufficient volume. The four types of care does not all lend themselves to flow. Prevention fit the criteria for flow, it can be planned, there is no urgency, the process is stable and it must be done in volume. Diagnostics is a sequence of activities which cannot be planned in advance and thus flow cannot be established. Some diagnostic activities may be serialized, however, when this happens there is a firm suspicion as to the diagnosis, which is quite a different matter. Treatment can be planned if the patient is not traumatized and in need of urgent attention. The procedure in question must also be stable in the sense that the planned time should be predictable allowing downstream activities to be planned ahead. But, for many types of treatment and patients this does not hold true. Care consists of mostly activities that are not interrelated and must be responsive to the needs of the patient and therefore not suitable for flow. *Variation* can only be minimized by screening the patients and remove those who does not fit profile. This cannot be done for a public healthcare system and certainly not for a healthcare system that must accept acute patients. This also implies that private hospitals may reduce variation substantially thereby maximizing profits. *Leveling* in public healthcare is not possible as the influx of patients cannot be controlled. Statistically the amount of patients any one day can be predicted and planned in advance. However, the patient mix is not known in advance and malignancies or accidents require attention of the particular medical specialty. *Pull* – the typical healthcare organization has elements of both pull and push in the different processes. Pull can be seen in the fact that some procedures, including care and treatment activities, only will be carried out when the patient has an actual need for the procedure. Elements of push also exist

due to the interdependencies between the different procedures, i.e., it does not make sense to start treatment before a diagnosis has been established. *Excellence* is all about improving the different processes in a continuous manner. There is little tradition in healthcare for systematically discussing and improving processes. There is excellence in the science of treating patients but this does not extend beyond the immediate doctor-patient treatment relationship.

### **Hypotheses**

Looking at the historical development of lean manufacturing in Toyota as described by (Holweg, 2007) it was obviously not developed over night. The Toyota Production System has been continuously developed and refined over the course of many years with principles tracing back to the Toyota automatic loom (Holweg, 2007, app. B).

Furthermore, industrial companies have been working with lean and concepts from the “lean tool-box” for many years also for example, scientific research on productivity development in manufacturing can at least be dated back to the works of Frederick W. Taylor – see for example (Taylor, 1911). As such, many of the different concepts, tools and ideas that we today associate with lean have been around in the discussions concerning productivity improvement in manufacturing for a long period of time and there has been developed a substantial amount of knowledge concerning the appropriate use of lean within the manufacturing sector. A recent review of the literature on lean implementations in healthcare suggest that it is only recently that we have experienced a sharp rise of academic and practitioner oriented research on lean in healthcare (de Souza, 2009). Based on this it can be argued that lean in healthcare still is in its infancy and it just a matter of time for lean to have a significant impact in healthcare. Time is necessary to develop a sufficient amount of knowledge and competence concerning the most appropriate ways to implement lean in the healthcare sector. Finally, most literature on lean acknowledges that creating a “lean culture or philosophy in an organization” is a cumbersome process that can take many years. This cultural change is a prerequisite for success with lean in the long run (Bhasin & Burcher, 2006) as lean needs to be institutionalized within the healthcare organizations. This leads to the formulation of hypothesis one (H1):

*H1: Lean is still immature in healthcare and this limits the application of lean*

Another theoretical observation is related to the nature of improvement processes within the medical profession itself. The medical profession is predominantly focused on improving treatment processes in order to cure the patient. Lean inspired concepts like flow, pull/push systems, and leveling all with their origins in industrial manufacturing are not easily communicated to and understood by members of the medical profession. These concepts are simply too far away from their frame-of-reference and there might be a lack of absorptive capacity concerning these unfamiliar concepts (Cohen & Levinthal, 1990; Zahra & George, 2002). Furthermore, there is a high level of specialization amongst personnel within the medical profession making it difficult to develop a thorough understanding of (the need for) cross-functional processes. As previously mentioned, the review by (de Souza, 2009) illustrates that there is an increasing level of interest in and focus on the application of lean in the health care sector. However, the concrete results on the productivity within the health care sector still need to manifest themselves (Burgess & Radnor, 2010). Furthermore, many lean projects and activities within the healthcare sector are fragmented with limited effects. This leads to hypothesis two (H2):

*H2: There is a general lack of knowledge about lean in the healthcare organizations in order to secure a successful implementation of lean.*

The previous analysis also highlights an apparent mismatch between the lean principles and the nature of work in the healthcare sector. The nature of the work and thereby the nature of the work processes within healthcare, i.e., care for patients, is difficult to standardize thus creating difficulties in creating a stable and predictable flow which is a key prerequisite for lean. In fact only one the six lean principles, pull, is completely fulfilled within the healthcare sector. Please note that the focus of this paper primarily is on public health care which, as mentioned, has an

obligation to treat all kinds of patients and diseases. Private hospitals can specialize on one type of treatment, e.g., elective knee surgery, which will help to reduce complexity and also enable the private hospital to establish a more predictable and level flow. Many processes concerning patient treatment and care in the public healthcare system are complex and unique depending on the actual condition of the patient and also involving many different professions. As such, it is difficult to see the public hospital as a “focused factory” (Skinner, 1978). Due to this inherent variability in dealing with patients no treatments sequence will be completely alike as many activities within healthcare are dependent on the professional judgment concerning the optimal treatment and care by, e.g., doctors and nurses. This mismatch leads to hypothesis three (H3):

*H3: The nature of the work processes in healthcare is a key barrier for the successful implementation of lean*

Hypothesis four is founded in a discussion of the concept of customer value. In lean customer value is seen as uniform concept and it is assumed that every employee within an organization share a common perception of customer value. However, within the work processes of healthcare many different professions have to participate in order to diagnose, treat, and care for a patient. Each of these professionals has a different focus area and therefore also a different understanding of customer value, i.e. what characterizes “good” patient care and treatment (Glouberman & Mintzberg, 2001). For example doctors emphasize and focus on successful treatment of whatever disease the patient has. Truth is established through scientific validity such as the double blind experiment. Nurses, on the other hand, focus on patient care and well-being of the patient. Compassion, psychology and human understanding are central drivers for nurses. Laboratory technicians (and other technicians as well) focus on maintaining a high level of productivity and accuracy in the different analyses being carried out. Secretaries will often focus on supporting doctors and nurses, by maintaining an efficient flow within the department. These different rationalities and logics create barriers for the successful

implementation of lean both the lean project and subsequent continuous improvement. These different rationalities lead to hypothesis four (H4)

*H4: The existence of different rationalities is a key barrier for successful implementation of lean within healthcare*

In the following sections the methodology is presented. This is followed by a description and analysis of the four cases. The case analysis will be used to test the four hypotheses outlined in the hypotheses section of the paper (Yin, 2009; Flyvbjerg, 2006).

## **Methodology**

The cases reported in this paper is a subset of cases from a larger research project called “Lean without Stress” (LwS) – see (Edwards, Bojesen & Nielsen, 2010). The LwS project focused primarily on the relation between implementation of lean and psychosocial work environment. Besides cases from the healthcare sector LwS also included cases from industrial manufacturing and administration.

In the LwS project the researchers follow and observe the lean implementation process. The LwS project uses a pre-determined script in the interaction with the participating organizations. The purpose of the script is to ensure that researchers follow the same process and methodology and collect data on the same issues. The case studies were carried out by at least two researchers in order to increase the reliability of the data. Furthermore, the data from each case were assembled in a case-report with a pre-determined structure, which then was reviewed by the entire group of researchers. The methodology used in LwS project draws on elements from action research (Coughlan & Coughlan, 2002) and a key element is a research design or script which makes interventions possible.

The LwS script perceives lean implementation projects as consisting of four phases: 1) Think, 2) Getting started, 3) Implement and 4) Move on. In between each of the phases a reflection seminar is held with the employees of the organization. The purpose of the reflection seminars

is to critically address the implementation process and discuss the how the employees feel about being part of a lean implementation. The reflection seminars were facilitated by the researchers who were careful to create a trustful relationship with the employees. Furthermore, the reflection seminars provided the researchers with the opportunity to make interventions in the lean implementation processes. The interventions were based on five questions which were developed for each reflection seminar. An example of a question from the reflection seminar to be held following the ‘Think’ phase: “How do you feel about the decision process? – is it the managers and consultants that make all the decisions?” The questions were presented to the whole group, followed by group discussions and a brief presentation and discussion of results from all groups. The reflection seminars were the most important forum getting in-depth knowledge about the key issues in the implementation process.

Besides the reflection seminars the LwS data collection includes a number of seminars, interviews, and questionnaires. The researchers held a “history workshop” with each of the case organizations before the lean implementation project commences. The purpose of this history workshop is to establish an understanding of the starting point for the lean project in the case organization, e.g., what experiences does the organization have with lean and what are the expectations among the employees to the forthcoming lean implementation? The data from seminars and interviews were analyzed using multiple investigators (Eisenhardt, 1989) to ensure complementary opinions and insights and to enhance confidence in the findings. Besides the qualitative data the project also collects quantitative data in the case organizations before the lean implementation commences as well as after the lean implementation is finalized. However, the questionnaire primarily focus on the psychosocial work environment and the purpose is to measure if there have been any changes in the psychosocial work environment as a result of the lean implementation. This data collection is based on a standardized questionnaire concerning the psychosocial work environment developed by the Danish National Research Centre for Working Environment (Pejtersen et al. 2009). In this paper we will primarily draw on the qualitative data from the case reports. Finally, in order to ensure reliability the data have been resented to representatives from the different case organizations in a series of meetings between

the researchers and all the case companies. These meetings have also served as a forum for discussion and reality check of the preliminary results of the project.

### **Case Descriptions**

The empirical evidence is based on four cases, three from hospital wards and one from a home care nursing unit in the city of Copenhagen. In the sections below the key findings from these different cases will be presented briefly.

#### *Case 1: Surgery ward: Picking low-hanging fruits in selected operating rooms*

The ward has about 200 employees, is open around the clock and covers both acute and elective patients. It has 10 operating rooms and 6 of the rooms are for orthopedic surgeries. The staffs were overburdened and often subject to overtime, which was a major point of complaint. Due to absenteeism and non-attendance from patients, the department was cancelling 6-7% of the planned surgeries. An analysis of the ward showed:

- Each of the 10 operating rooms showed more than 2 hours non-productive time a day
- Lack of procedures surrounding surgery leading to idiosyncrasies
- Every surgeon and anesthesia doctor had formed their own routines during operating procedures making cooperation difficult
- Clear sense of a lack of planning
- Rigid organizational structure
- Informal leaders especially among surgeons, leading nurses and anesthesia doctors.

A lean program was initiated to create more effective working procedures, and ensure a total continuity of care to the benefit of both staff and patients. The basic idea was to create operating rooms where surgeons do not have to leave the sterile area. In a similar manner teams were formed so that in-operating room team members did not have to leave the sterile area, thus

relying on team members in the non-sterile area. With the complete operating team present in the operating room no-one is waiting and procedures can be completed without waiting.

This resulted in the establishment of two so-called “Turbo rooms” that only performs elective surgery on less complicated patients. The turbo rooms do not perform any education and is manned by the senior staff i.e. the most skilled doctors and nurses. The turbo rooms have a fixed team structure which has allowed a deeper analysis of cooperation during the actual operating procedure. The result has been overwhelming. What was previously done in three operating rooms can now be done in two and the teams are finished within their shift. This has a significant effect on morale as the teams experience a sense of accomplishment – they make a difference. While the number of patients treated by the teams are 33% higher the activity level is reportedly not higher, but the waiting times have been eliminated and absenteeism has decreased by 33%. However, the turbo rooms require more support staff which must be ready to act when needed.

#### *Case 2: Regional hospital: Focus on non-core activities*

In general the hospital has very positive experiences with lean and has achieved significant positive results within, i.e., laboratory analysis and other non core activities. However, lean has primarily been implemented in support activities. The hospital now has an ambition to implement lean as part of the patient process. The lean process is to a large extent driven by internal lean expert who support lean projects in the different wards. One example of this is a lean project in an out-patient surgical unit which tried to capture the process from patient arrival to discharge. The staff did a value stream mapping of all the activities the staff thought was involved. In the early phase of the value stream mapping there was widespread agreement on content of the different activities as well as the prioritization of the tasks. However, in the later phases of the project when the lean staff at the hospital began to test the value stream in real life by making test runs through ward the value stream maps did not match the real world.

The proposed value stream had apparently become too simple and it did not take the many different needs of the seriously ill patients into account. The different groups involved in the

process also had very different interpretations concerning the value stream and actual content of the different activities. Differences arose over a number of issues, for example, over the necessary preparations for patients with different diagnoses, what equipment should be ready, and which specialists should be on call, where the patient should wait and how the patient should navigate. Interestingly, these different perceptions generally emerged between professions, i.e. doctors, nurses, secretaries etc.

The case study also revealed that the different professions involved in the treatment and care of the patient had different logics and work processes. This gave rise to (mis)interpretation of the activities performed by the other professions. An internal lean consultant at the hospital remarked: *“doctors and nurses focus on different values and metrics. Nurses tend to focus on the quality of the care they can offer whereas doctors focus on the success rate of the treatments”*.

### *Case 3: Oncology ward at a Danish university hospital: Maximizing capacity utilization.*

The ward is primarily focused on out-patient treatment of cancer patients, i.e. chemo therapy or radiation treatment. The lean activities of the cancer ward were part of a major lean initiative at the hospital. The lean activities were supported by a central lean task force and had significant top management support.

An element in the lean project in case 3 was the development of a standard operating procedure (SOP) concerning the booking of couches for chemo therapy patients. Besides initial technical problems this element of the lean project created resistance especially amongst the nurses who normally had the discretion to plan a series of sessions for the patients and book couches accordingly. Some nurses saw this new booking system as an attack on their professional judgment and discretion. They therefore resisted this standardization and argued that lean would limit their ability to provide the best possible treatment of and care of the patients.

Nurses, unlike doctors, perceive the complete patient experience such as booking, arriving, being comforted and assured etc. as part of the treatment. The booking system only focused on maximizing use couches, not treatment as perceived by the nurses. The booking system would

ensure the same amount of time for each patient. However, the nurses' previous discretion would allow them to spend less time on the less needing and more time with those who really needed it.

*Case 4: Domiciliary care center: Lean in an organization not ready for lean*

This case is a large domiciliary care centre in Copenhagen with 230 employees. The case focuses on a subset of 28 specialist community nurses which treat people in the municipality at home. The work is treatment of serious sores, administering prescription medicine, interfacing with the primary and secondary healthcare system, and other general nursing activities. The nurses work alone and must be able to cope with all situations that might arise.

Too much time was used for administration and talking to patients' relatives. Lean was selected by the administration as a tool to improve efficiency and provide more time for care. A consulting firm was hired to perform an analysis and implement lean.

A thorough analysis was done by the consultants and nurses who delivered data and participated in a value stream mapping event. 21 activities were selected ranging from transportation time to catheter insertion. The three main activities were: care 40%, documentation 19%, contact to relatives 10%, and administration 9%.

The analysis showed that the typical work consisted of many different activities which were discrete, as most of them could be done in different order or were not tightly coupled. The work was further highly reactive and nurses had to respond to immediate problems and needs. This made it impossible to use lean as a guiding principle for making nursing more efficient as levelling and stability is not possible.

### **Case Analysis**

The analysis focuses on four aspects. Firstly, the lean approach is assessed using the same principles as explained in the literature review. Secondly, the effects of the lean implementation projects are also assessed. This is based on a qualitative assessment by the two case researchers in the final case report. A key challenge here has been to untangle the causal relationships that

lead to productivity gains and thereby to determine how much lean has contributed to this. This challenge emerged as the lean implementation activities in the cases could not be de-contextualized from other improvement initiatives in the case organizations. Due to this problem it has been necessary to rely on the qualitative judgment of the case researchers. As the assessment is qualitative it has been decided not to assign a concrete scale to this assessment. Thirdly and fourthly, the cases are analyzed in order to evaluate if the cases support, partially support or reject the hypothesis outlined above.

In case 1 the lean approach is tool-driven as only the two turbo rooms are affected by the lean initiative and the project is to a large extent based on a common sense approach to flow and minimizing waiting time. However, the results are good for the turbo rooms, but the performance for the non-turbo rooms is unchanged. It is difficult to conclude on H1 in this case, as the surgery ward are novices within lean. H2 is supported as the approach to the lean project to a large extent where based on common sense and a very limited use of formal lean tools and methods. Employees in the ward simply lacked knowledge and experience with lean to go beyond common sense activities. H3 concerning the nature of work is supported because it has only been possible to implement lean in 2 of 10 operating rooms due to too much variation in remaining operating rooms. H4 is indirectly supported as the turbo-rooms are dominated by only one type of rationality: the rationality of the surgeons and there no barriers to lean.

In case 2 it is found that the lean approach is system driven as the use of lean is limited in the core functions of the hospital, such as treatment and care. However, the lean approach in a number of non-core functions such as laboratory work is almost principle driven. The case does not support H1 as the regional hospital have been able to achieve significant results from the lean activities in some (primarily non-core) functions despite only working with lean for a limited period of time. H2 is partially supported as some members of the staff clearly had difficulties in comprehending and using the lean tools even though there was strong support from the internal lean consultant at the hospital. Furthermore, both H3 and H4 are supported by the analysis of the case study.

In case 3 the lean approach is system driven as the oncology ward has applied a number of lean tools and concepts systematically in the ward, but it has proved difficult to maintain the lean activities over time as other projects have required attention. The lean activities in the oncology ward were primarily focused on the processes concerning the allocation of couches for chemo therapy and thereby on the flow of patients through the ward and the capacity utilization. A lesson from the case is that the lean project easily could be derailed by competing projects, i.e. the implementation of a new IT-system in ward. Furthermore, despite strong top-management backing and intense support from internal lean consultants it proved only possible to apply a few tools from the lean tool box. Case 3 does not offer support H1 as strong lean competences were available and support H2 as it proved difficult to move beyond the use of a few lean tools. Case 3 also provides partial support for H3 and support for H4.

Case 4 domiciliary care is an example of a lean project gone awry. Despite use of external consultants only very few lean activities were carried out and no significant improvements were achieved. The planned lean approach was tool driven with only use of VSM to analyze processes. In case 4 the key issue proved to be related to differences in the perceptions concerning the nature of work. Managers in the care center saw work as predictable and therefore able to plan in advance whereas the community nurses experienced the work as being reactive and focused on tending to the individual needs of the often elderly clients. The case does not offer support for H1 as very skilled external consultants were used. H2 is supported as it was difficult for the employees in the organization to make use of lean tools and concepts without intense support from the consultants. This case offers support for both H3 and H4.

*Table 3: The results of an analysis of the 4 cases*

	<b>Lean approach</b>	<b>Effect</b>	<b>H1</b>	<b>H2</b>	<b>H3</b>	<b>H4</b>
<b>Case 1: Surgical ward</b>	Tool driven	Limited for the overall ward, but good results for the turbo rooms	No conclusion	Supported	Supported	Indirectly supported
<b>Case 2: Regional hospital</b>	System / Principle driven	Limited, but good results in some	Rejected	Partial support	Supported	Supported

		support functions				
<b>Case 3: Oncology ward</b>	Tool driven	Improved patient flow in the ward	Rejected	Supported	Partial support	Supported
<b>Case 4: Domiciliary care center</b>	Tool driven	Almost none	Rejected	Supported	Supported	Supported

The four cases illustrate a pattern of limited lean implementations with limited overall effect which also can be found in literature. Lean can have positive effects in the healthcare sector, but it is typically within non core activities. Furthermore, core activities which resemble industrial production, e.g., elective surgery as discussed in case 2 may also be suitable for lean. The case analysis leads to the rejection of H1 and the case analysis offers support for hypothesis H2, H3 and H4 which all are supported by the findings in the case studies.

### **Discussion part 1: Barriers to lean in healthcare**

Hypothesis 1 which focused on the lack of overall knowledge development concerning lean in healthcare was rejected as it in three of the four cases was found that it in fact was possible to get access to lean knowledge from internal or external consultants. Based on the analysis in this paper it is therefore concluded that lack of lean knowledge in general is not a significant barrier to the implementation of lean in healthcare. The implementation of lean do indeed take time, but knowledge from external or internal consultants are available and the knowledge-base concerning lean in healthcare can no longer be characterized as immature.

Hypothesis 2, 3 are 4 are supported and they point to more fundamental difficulties in implementing lean in healthcare. The analysis shows that there are some significant barriers to lean within healthcare. The key barriers identified in this paper are all related to the difficulties of transferring the lean concepts and tool from one context to another – from industrial manufacturing to healthcare. Hypothesis 2 points to the observation that these a knowledge gap – not in the form that there is lacking knowledge about lean and healthcare, but rather that the people within the medical profession who, according to the basic ideas of lean, should play a

key role in the lean implementation process have difficulties in absorbing the tools, ideas and principles of lean. This difficulty may be linked to the two final hypotheses concerning the nature of work in healthcare and the competing rationalities among the different professions. Both the nature of work and the different rationalities may reinforce the difficulties in absorbing lean within some areas of healthcare. Future research should therefore focus on untangling these relationships in more detail aiming at providing a better understanding of the different barriers to lean in healthcare – and naturally also how these barriers can be overcome in order to improve the possibilities of implementing lean with more success in healthcare. However, it is questionable if lean can be implemented in all processes and activities within the healthcare organization. A more widespread implementation of lean will require a more transformative approach to lean.

### **Discussion part 2: A transformative approach to lean**

While there is no doubt that lean can be applied with success in some areas of healthcare the analysis presented above also illustrates that there are areas within healthcare where it is difficult to apply “of-the-shelf” standard lean tools and concepts. In this paper focus has been on the barriers to the successful implementation of lean emerging from the nature of work within healthcare as well as from the existence of different rationalities among the different professions within healthcare. The conclusion from the analysis is that there are significant barriers to lean within healthcare. Lean works well in some areas of healthcare, for example laboratory work and elective surgery. However, lean does not work well in an environment characterized by reactive work processes and the existence of different rationalities. As such, there is a clear mismatch between the nature of the production task within healthcare and the basic assumptions in lean.

Do these observations mean that the implementation of lean in within healthcare should be limited to the peripheral activities such as laboratory work and the management of consumables? The answer to this question is no – lean still provides opportunities for making significant

improvements within healthcare. However, it is necessary to adjust the lean tools and concepts if lean is going to have an effect within all types of activities in healthcare.

There is, therefore, a need for, what we might refer to as a, transformative approach to lean. The principles of lean are sound but it is necessary to adopt a more experimental approach to the implementation of lean. Within this experimental approach to lean the key task is to adopt lean to the special characteristics of healthcare. These special characteristics include first and foremost a high volume of complex and non-standard work flows and processes making it difficult to establish standardized work flows. Neither is the purpose to standardize these flows, which will have adverse effects. Secondly, many activities within treatment and care are by nature reactive making advance planning difficult. Thirdly, it is difficult to establish a coherent and consistent value stream due to the atomic nature of some activities within healthcare.

This transformative approach to lean should therefore be characterized by a strong emphasis on double loop learning (Argyris & Schon, 1996). Double loop learning is characterized by a high level of attention to the process of questioning and challenging the basic assumptions, norms and values of the different groups of healthcare professionals. This process of questioning should be two-fold. Firstly, it should concern the applicability of lean tools and concepts in order to transform the lean tools and concepts to the realities of healthcare. Secondly, it is also necessary to challenge healthcare professionals in order to check if it could be possible to make processes and activities more susceptible to lean. This transformative approach to lean is especially important if lean is going to be implemented in the core activities of healthcare organizations.

Finally, it could also be emphasized that lean in healthcare is still in its infancy and that success with lean will emerge as more time goes by. After all it took Toyota many years to become proficient in lean and to instill the lean principles in every aspect of their operations (Ohno, 1988; Holweg, 2007). However, this study also indicates that it is not without problems to apply lean outside industrial production. Radnor & Holweg (2010) states that lean aren't a "context-free methodology" and lean will therefore require adaptation in order to be successful within the healthcare sector.

## **Conclusion**

This paper has illustrated that if lean is going to be implemented with success in the healthcare it is necessary to adopt a transformative approach to lean and its implementation. Based on an analysis of existing research on lean implementation in healthcare it is concluded that most implementations of lean are focused on support activities. Furthermore, the majority of the lean implementations focus on using a number of tools from the lean tool box. Little emphasis is given to the idea of lean as a philosophy which should permeate the entire organization. As such, the level of lean penetration within healthcare is shallow and the effects on productivity of lean are limited.

In this paper it has been attempted to develop and test four possible explanations on this apparent problem concerning lean within healthcare. The analysis of the cases provides support for three of the four possible explanations. It is concluded that there is a lack of absorptive capacity within the medical profession, that the nature of work and that the different rationalities of healthcare professionals are significant barriers to the successful implementation of lean within healthcare. It is suggested the successful implementation of lean requires a transformative approach to lean where the basic assumptions within lean **and** within healthcare is challenged. There clearly is a strong need to go beyond the standard approach to lean known from industrial production.

This paper does not address how lean should be transformed in order to increase its applicability within healthcare. Future development and research should focus on finding the most efficient ways to implement lean in healthcare – respecting both the basics of lean as well as the special characteristics of healthcare.

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