The creation, organization and implementation of continuous improvement in healthcare

A study of how to provide Stråleterapien at Herlev Hospital a strategy to continuous improvement that is based on Lean.

Contents

Abstract

The purpose of this study was to provide Stråleterapien a strategy for creating continuous improvement in the department to help the department sustain their position as an excellent radio therapy service provider.

The study applied a single case study research design and primarily used observations and interviews to gather data for its analysis. The interviews and observations were conducted in several rounds in order to triangulate and gather new information that was discovered through an analysis of the previous round of data gathering. In order to conduct a thorough analysis of the entire department's context, the study used two units of analysis: 1) the overall department and 2) the palliative treatment process.

To find out how a strategy for continuous improvement could be created, the study used the Lean concept and contextualized/adapted it to Stråleterapien's respective context. The contextualization included a value definition, seven waste types and the value stream map. Furthermore, theory regarding implementation of Lean in healthcare was used to find a suitable way to implement the concept in Stråleterapien. The theory included a look at implementation barriers, change enablers and the typical implementation process for Lean in health care.

The result of the analysis was that while circumstances do not allow more profound changes in the department, because the department is doing relatively well and has several ongoing improvement initiatives, there are several places in which the department can improvement. The respective places that could be improved are communication, professional and functional silos and standardization (lack of an overall way to do things between the respective silos).

Since the department is already doing well and has several ongoing improvement initiatives, the proposition for implementing continuous improvement is that the implementation should happen through one of the department's current improvement initiatives - an initiative, which systemizes research in the department by dividing the research into diagnose-related group groups that is called SUMU-I.

Moreover, the continuous improvement initiative implemented through the existing improvement initiative should be employee-driven, which would match the employees' needs and the management's strategy of emphasizing problem solving and learning among the department's employees.

The integration of the continuous improvement initiative into the existing initiative requires an implementation approach that provides the employees who are will be involved in the continuous improvement initiative, an opportunity to take an education in Lean as well as research in Lean, because there is currently little knowledge about Lean in the department.

The study can be used by the department to implement an approach that can help them to continuously improve and emphasize value for the patient. However, while the specific places in which the department can improve were identified through Lean tools as an example of how they could be used, the specific places do not necessarily require Lean tools to be solved. Thus, the department can use the suggestions for improvement regardless of what it chooses to do.

The new temptation in these difficult times for healthcare is not to cling to the past. Instead it is to seek quick, painless miracle cures, and someone will always be offering these. But there are no miracles cures, not even “lean” ones, for poorly designed process, outmoded leadership styles, and unengaged employees. There are only continuous experiments, conducted honestly by leaders with courage, an open mind and a collaborative spirit, as the health care community commences a long journey in pursuit of lean healthcare

James P. Womack

Founder and Chairman

Lean Enterprise Institute

Cambridge, MA

June, 2010

Introduction

This study was conducted at Herlev Hospital's radio therapeutic department, Stråleterapien. The department specializes in treating cancer patients with radio therapy, which is one of several forms of cancer treatment. The department is a sub-department to the hospital's oncological department, but has recently made a name for itself by delivering excellent results based on its waiting list times. In 2010/11, the department was nominated as the best radio therapeutic department in Denmark by the medical trade journal 'Dagens Medicin' (Heissel, 2011).

In order to maintain its efficiency - and to continually improve - the department's management is constantly on the lookout for new initiatives that can help the department to sustain its top-of-the class status. This study can be considered as one of these initiatives.

The purpose of this thesis is to create a strategy that will help Stråleterapien to create continuous improvement in the department. In this sense, continuous improvement means the creation of a concept or a system that can contribute to incremental, systematic and sustainable improvement over time, which, if maintained can help the department to sustain its current position in terms of efficiency as well as work conditions.

To provide the department a strategy of continuous improvement, the study will use the concept of Lean and its perception of continuous improvement. Moreover, the thesis will attempt to do this from an employee-supportive angle, which literature has identified to be an important factor in a successful implementation and healthy of Lean in health care (Hasle et al, 2012; Poksinska, 2010; Ulhassan et al, 2013).

Lean in health care

Principles of Lean were introduced for the first time as the Toyota Production System (TPS), which was originally developed by the Japanese engineer Taiichi Ohno in the time period 1937-78. The Toyota Production System was initially designed for Toyota and the car manufacturing industry.

However, in 1994, the concept of Lean thinking was created by Womack and Jones (Shah & Ward, 2007). It elaborates on the original philosophy by making it more general and applicable in places other than production.

Lean has come a long way since then, and lately, the concept has become adopted in health care in Denmark. The concept has already been implemented at hospitals in Hillerød, Næstved, Ringsted, Odense and Slagelse (Bak-Bernth & Vinterberg, 2010).

Lately, Region Hovedstaden, the region in which Herlev hospital is located, has shown signs of wanting to implement the concept. As evidence of this, the region has established its own Lean academy, which specializes in educating health care staff in Lean application (Grønborg, 2011).

Thus, the concept of Lean is not as abstract and far away from the world and reality of health care as some people may think. Rather, it is becoming an integrated part of several hospitals' everyday operations with hospitals in Denmark already applying Lean tools such as Kaizen boards at Slagelse hospital to keep track of their weekly performance and to address root causes of the problems that may occur (Appendix C).

Based on the fact that the concept is already being adopted in Danish healthcare, this study will attempt to examine its potential for Stråleterpien and how to provide the department with a strategy for how they can implement continuous improvement through Lean.

Problem Statement

The goal of this thesis is as follows:

How to provide Stråleterapien with a strategy for continuous improvement?

In order to address the problem statement, the following research questions will be answered:

Research question #1

- Why does Stråleterapien need continuous improvement?

Research question #2

- How could continuous improvement be organized in Stråleterapien?

Research question #3

- How could continuous improvement be implemented in Stråleterapien?

Case introduction

Stråleterapien is a sub-department of Herlev Hospital's oncological department and has approximately 150 employees. The average age in the department is very high, and most of the employees are very experienced, having been employed in the department for a long time (Appendix N). Stråleterapien is a very well-functioning department, based on its short waiting lists and patient and employee satisfaction (Appendix B; Appendix N).

The department's employees enjoy their work, and they like their management's way of managing the department, which is focused on coaching and empowering employees (Appendix O, Appendix D).

Stråleterapien conducts around 56,000 beam treatments per year. These are divided between eight beam accelerators[1]. The beam accelerators are the department's main weapon against cancer, and the entire treatment process hinges on identifying the exact position of the cancer tumor, and radiating it on a 6-day-per-week basis for approximately three weeks. Sometimes, the patients are treated twice in one day and are permitted to stay in to rest between the treatments, which are usually six hours apart. In these cases, the patients are provided nutrition and a place to rest, or they can go to "Patient hotellet", a 'hotel' for patients that is located just next to Stråleterapien.

Stråleterapien provides treatment to patients with many types of cancer in several different stages, including palliative treatment. The palliative treatment process can be acute or non-acute. The difference between the acute and non-acute treatment process is the potentially large difference in lead time. An acute patient can be referred to the department just hours before his or her arrival, and the patient's treatment journal must be ready by then. The short lead time that is required for acute treatments requires the best of the department's employees. Moreover, the requirement of a short lead time also necessitates a well-designed process that enables the department's employees to work efficiently.

The palliative treatment process is discussed in depth in the analysis section C.f. "Case: Palliative treatment "

[1] A beam accelerator is slightly larger than a MR/CT scanner and needs to be used in a radiation-isolated room, because the treatment that is provides is radioactive, millimeter precise beaming of the cancer cells. The machine can rotate and provide beam therapy 360' around the patient to avoid critical organs that may surround the tumor, thus do the most damage to the cancerous cells while doing the least to the healthy surround tissues.

Treatment process

While deviations in the treatment process occur, the process functions as described below.

The process starts with a diagnosis and a doctor's referral, after which it proceeds like this.

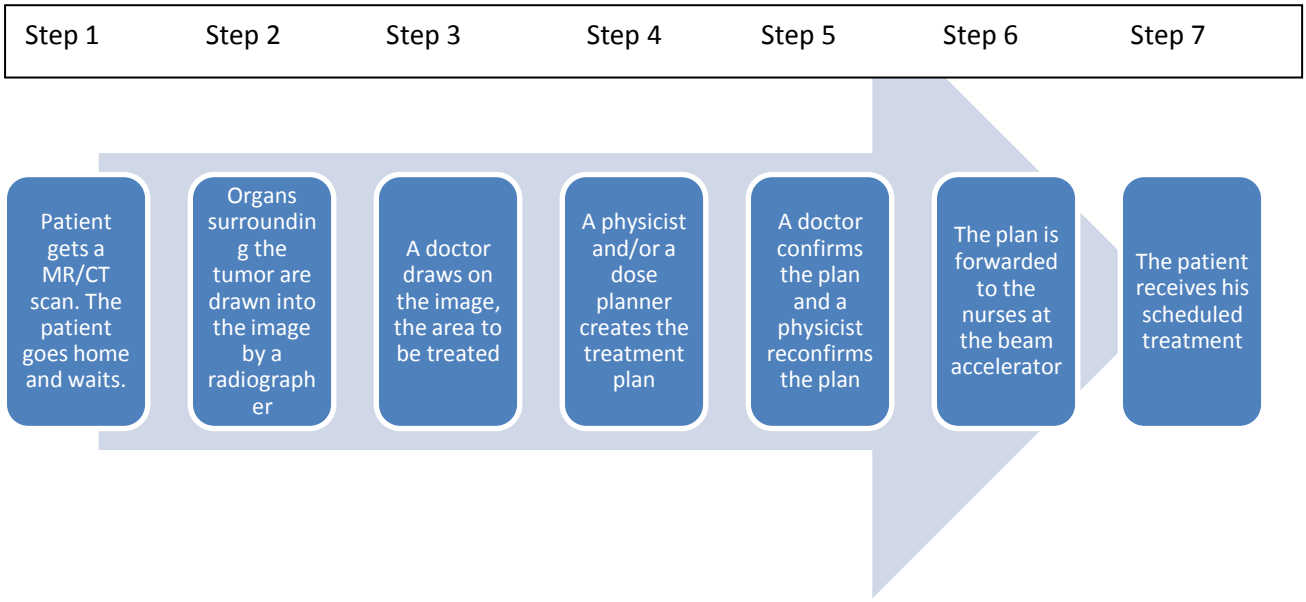

Figure 1. Treatment process

Step 1: When a patient has been referred to Stråleterapien, the treatment process begins with a CT/MR scan that is taken by the team of radiographers, who are responsible for taking pictures with the CT/MR image modalities, which later in the process will be used by doctors and physicists to encircle the area to be treated and calculate the doses, respectively.

Step 2: A radiographer draws the vital organs on the image. The purpose of doing this is to make the image ready for the doctors, who draw in the area that is going to be treated.

Step 3: The doctors in the department are responsible for defining the area that needs treatment. They do this by free-hand drawing on approximately 20" large digital drawing boards[2]. The doctors are divided into junior doctors and senior doctors, who besides drawing the anatomy to be treated, also have the job of helping the junior doctors. The junior doctors only work in Stråleterapien for a period of 1 month, after which they rotate elsewhere in the oncological department. Thus, the efficiency of one doctor can vary a lot, depending on whether he or she is a senior or in the beginning, middle or end of his or her rotation. Moreover, the senior doctors also spend a lot of time training the junior doctors.

Step 4: A physicist or a dose planner calculates and programs the patient's treatment by looking at what angles the treatment must be given at (the beam cannons rotate 360 degrees and can provide treatment in the angles which inflict the least harm on healthy tissue and the most harm on cancer cells).

[2] The MR/CT is uploaded onto a server, through which the doctors can access the MR/CT images on their drawing boards, which use a Windows interface.

Step 5: A doctor confirms the treatment plan that has been calculated and designed by the physicists and/or doses planner in order to secure that the right treatment is provided from a clinical point of view.

The confirmation process of the treatment plan can be quite complex, because all patients are different. What is more, respective doctors can have different opinions with regard to treatment plan specifications C.f. report section “Case: Palliative treatment“.

Step 6: When the plan has been confirmed, it is sent digitally to the treatment facilities.

Step 7: The second time the patients visit Stråleterapien (the first being to get an MR/CT taken) the patient receives his/her first dose of treatment. Typically, the patient will return to Stråleterapien six days for three weeks.

During the treatment period, the patient sees more or less the same nurses just about every time he/she comes, because the department only runs one daily shift, and the nurses work in teams with an approximately half yearly rotation. The department only runs one shift per day because of the fact that there is no demand for extended opening hours. According to the department themselves, cancer patients want quality time with their closest relatives and friends during the evenings rather than go to the hospital.

The department uses a physical paper journal that follows the sub-process of creating a treatment plan. The journal is complementary to the digital one, and is present for two reasons: to keep track of where the respective patient’s plan is in the planning process and due to the lack of a similar digital priority system.

Physical department layout

The entire process illustrated in fig. 1 takes place in the department, and is stretched over two stories: ground floor and first floor.

The radiographers, doctors, physicists and nurses work almost exclusively with people from their own profession.

The radiographers and doctors work closely together on the ground floor, which makes the daily contact easy. On the other hand, the physicists’ offices are located on the first floor, and it takes a few minutes to walk to them.

The nurses operate similarly to the radiographers and doctors on the ground floor, but in an area of the building which is specifically designed to house the beam accelerators, which demand special, lead isolated rooms and a location close to the patient entrance in order to reduce the walking distance for the patients.

The fact that the department is spread over a relatively large area makes it necessary for the employees to do a lot of walking. Consequently, formal contact between the respective groups is reduced to dialogue through the phone. Informal conversations occur only if the employees decide to go to the common room during lunch.

Formal organization

Stråleterapien has three vertical levels in the organization: management, operations managers and operational staff, which includes clinical specialists and other functions (fig. 2).

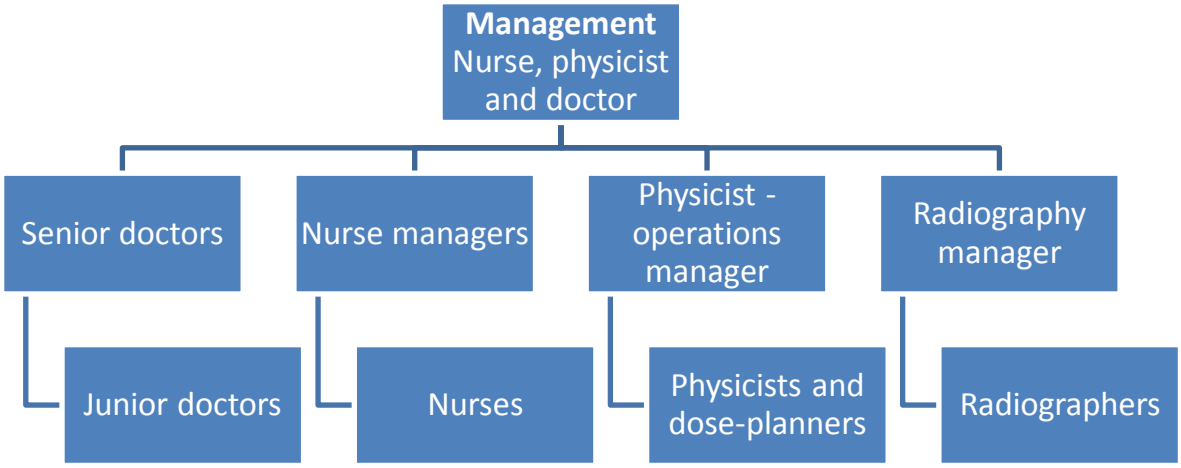

Figure 2. Organizational diagram

The management consists of a consultant doctor, a physicist and a nurse. The reason that the management consists of one person from each respective occupational group is to assure that everyone in the department is represented when decisions are made.

The task of Stråleterapien's management is to steer the department the right way on a strategic level. They are the ones to launch initiatives aimed at optimization, or research and development initiatives. Similarly to the majority of the department's staff, the department's managers are allowed to take higher educational courses if they want to. Consequently, the majority of the managers have attended several higher education courses over the years, and many of the employees have done the same, as well.

The responsibility of the department's second-layer managers is to make sure that daily operation goes as planned. The managers often communicate with the management and attend their meetings on a weekly basis.

The operational level of the organization consists of nurses, radiographers, doctors and physicists. Their responsibilities are as described above and illustrated in fig. 1. The operational level is also by far the biggest in the organization. Furthermore, it is important to note that the operational level in this organization is atypical, and unlike typical floor workers, it performs highly autonomous routine tasks such as calculating radiation dosages, creating anatomical drawings and operating multi-million dollar radio therapeutic machines.

Management initiatives

In order to keep up with the newest technological progress and clinical research, the management continuously launches initiatives. However, the management's strategy is mainly retrospective (Appendix N), but thus far it has worked based on benchmarks and employee satisfaction.

Described below are some of the major initiatives that have already been launched in order to continually improve the department's treatment efficiency.

Firstly, the department has its own research unit of at least three physicist PhD students and a head of research that is in charge of the unit's daily operations. The PhD students are trying to find new ways of using beam therapy to cure cancer, thus improving the department's treatment methods. The research unit also has brand value for the department, as it is a generally accepted notion that knowledge workers, such as physicists, want to explore new areas of their field and conduct tasks slightly more unusual than those founded in routine and daily operations.

Secondly, people from the entire department participate in educational programs that have the purpose of developing their expertise and producing better treatment for the patients.

Thirdly, the physicist operations manager has created an organization-wide program called SUMU-I, which tries to put the department's research into a system by dividing the research into seven diagnose-related groups. The SUMU-I abbreviation stands for "Samarbejde, Udvikling, Mødeaktivitet, Uddannelse og Information".

In the SUMU-I program, each diagnose group's research team consists of employees from all of the department's respective occupational groups, which means that every occupational group is involved in the research program. The purpose of involving everyone in the program is to create a synergy effect within the occupational groups by pooling their knowledge. Additionally, it gets the occupational groups closer to each other, thus promoting collaboration and teamwork between them. The SUMU-I program also reflects this vision of employee involvement and teamwork, which the management attempts to encourage.

Finally, it is the management's strategy to create a workforce that is able to solve problems through cooperation with each other, without relying on their superiors. To promote this behavior, the management acts as guides and coaches towards the employees, rather than enforcing a top-down approach in which the management's words are always final.

Contemporary history

In order to understand the department's "way of doing things", it can be useful to understand its history.

Prior to 2007, the department had a waiting list of eight to ten weeks, and Stråleterapien's efficiency was low due to old technology as well as an inefficient working culture i.e. the focus was much more removed from the patients than it is now (Holmgård et al, 2013).

Prior to 2007, the department was treating patients five days per week, whereas now, the department provides treatment to the patients six days per week, since high intensity of radiation is needed for the treatment to work properly.

Starting from around 2007, the department's change for the better included a large budget for new technology as well as an extra working day (Saturday). Consequently, some of the employees who had been in the department for a long time or who were of high age found it difficult to adapt, which resulted in lay-offs.

The lay-offs were performed to increase efficiency and had a symbolic effect of demonstrating that patients were the number one priority, and that it was about time to adapt to the needs of their treatment.

Today, the department boasts of its efficiency, which is largely credited to hard work and a slightly competitive environment that resulted from the lay-offs and a "no one is safe if they do not perform" culture, which is also the result of a change in legislation concerning "Frit sygehusvalg" (Free choice of hospital policy), which is a law that gives patients the right to decide which hospital they want to be treated in (Danske regioner, 2014).

Since many of the department's employees have worked in the department for many years, they remember the crisis as well as the positive changes that the department went through a half decade ago.

It is the researcher's perception (based on informal conversations with the employees) that the process has created a mentality in the department that is open to constant change, which consequently has put the department into a positive, progressive mode of development. In a way, it has also given rise to this study, because the department constantly wants to develop and improve its current organization and way of doing things.

Design and method

The purpose of this chapter is to explain the research design and research philosophy, which contributes to answering the problem statement. Furthermore, this chapter also includes validity, reliability and the delimitation.

Investigation structure

The investigation's research questions are answered in the following order:

Research question #1:
Why does Stråleterapien need continuous improvement?

Research question #2:
How could continuous improvement be organized in Stråleterapien?

Research question #3
How could continuous improvement be implemented in Stråleterapien?

Conclusion
The sum of the three research questions will be used to answer the conclusion/goal of this investigation.

Confidentiality

By request of some of the interview participants, names of people who are employed in Stråleterapien are not mentioned in this report, only their respective occupational groups are.

Research philosophy

The best suited research philosophies that match the problem statement are pragmatism and critical realism. Found below is an explanation of the choices.

Applying both philosophies to the investigation provides the best possible chances of addressing the problem statement with the right methods and theories (pragmatism) while at the same time maintaining a thorough approach by acknowledging the aspect of the investigation which permits interpretation (critical realism).

Pragmatism argues that the most important determinant of the epistemology, ontology and axiology you adopt is the research question – one may be more appropriate than the other for answering particular questions (Saunders et al, 2009:109). Thus, pragmatism allows focusing on the problem statement as the most important determinant for the epistemological view, which in this case allows for the most optimal problem solving relative to the problem statement.

Critical realists argue that what we see are sensations, the images of the things in the real world, not the things directly (Saunders et al, 2009:115). Thus, critical realism helps to answer the problem statement in that it provides an opportunity to question the factuality of data, thus allowing for interpretation of what is being said and done. Remenyi et al (1998:35) also argue that it is important to study *the details of the situation to understand the reality or perhaps a reality working behind them.* Since the study is conducted in a social environment, in which there are several levels of context, namely the organization, the occupational group(s) and the individual, it is necessary to understand the social constructions within these contexts in order provide a complete answer to the problem statement.

Research design

The problem statement is researched abductively through an exploratory single case study design with a qualitative multi-method research approach.

The research is abductive because it begins with an exploratory examination that is based on a theory of the unit of analysis – the radio therapeutic department - through the use of multiple methods, and subsequently generalizes these data to appropriate theories delineated below in the theory section. Finally, the research once again turns practical, by applying the relevant theories to the case in an appropriate way relative to the context, culture, and history etc. of the department and the implementation of continuous improvement.

The purpose of conducting the case study in an exploratory fashion is to identify *'what is happening; to seek new insights; to ask questions and to assess phenomena in a new light'* (Robson 2002:59). More specifically, questions regard the formal and informal organizational structures, culture and the ramifications of these for an implementation of continuous improvement through Lean.

According to Yin, a case study is a useful method when "examining contemporary events, but when the relevant behaviors cannot be manipulated" (Yin, 2014:12). Yin's argument for the use of a case study

matches the situation of this study, in which there will be no time to create an intervention to trigger continuous improvement. Instead, it is the purpose of this case study to provide Stråleterapien with a plan to sustain continuous improvement based on a cross-sectional analysis of the department.

As regards the definition of what a case study is, Yin offers a twofold definition of a case study (Yin, 2014:16). divided into scope and features of a case study, respectively:

"A case study is an empirical inquiry that

- investigates a contemporary phenomenon (the "case") in depth and within its real-world context, especially when:
- the boundaries between the phenomenon and context may not be clearly evident

A case study inquiry

- copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result
- relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result
- benefits from the prior development of theoretical propositions to guide data collection and analysis"

The definition of a case study provided by Yin offers a thorough description of what will be analyzed in the following chapters.

In this thesis, the phenomenon under investigation is Stråleterapien's context with regard to creating a strategy for continuous improvement in the department. Within the context of Stråleterapien, there are several units of analysis (Yin, 2014).

One of these units of analysis is 'Palliative treatment'. The unit of palliative treatment will be used to illustrate two propositions:

- The unit of palliative treatment is used to find out if there is room for improvement in the department.
- It is used for exemplifying how respective theoretical tools can be used in the department's context.

In regard to the overall case as well as the palliative treatment process example, a multi-method approach is applied, which includes several rounds of interviews and observations.

Multi-method approach

Primary data

Primary data is gathered through semi-structured interviews and direct observations.

As mentioned in the case study definition provided by Yin, the purpose of using several methods of data collection is "to converge data in a triangulating fashion" (Yin, 2014:16), to create a logical chain of evidence that provides extra depth and nuance through synergy, which would otherwise not have been obtained if only one data collection method was applied. Besides creating triangulation, using several methods of data collection also provides an opportunity to cross-examine the factuality of data, and test whether the opinions of different respondents in the organization are the same or not.

For example, semi-structured interviews may provide the researcher with an opportunity to ask probing questions of particular interest, whereas direct observations help to provide coherence and sense of what has been said during the interviews as well as observe cultural artifacts, everyday jargon and behavior. Thus, a combined approach provides a better understanding of what is actually being said during the interviews.

Found below is a detailed description of how the mentioned data collection methods will be used in this investigation:

- Direct observations
- Semi-structured interviews

Direct observations

Observations were conducted throughout the entire department and during entire investigation period (Appendix C, J, K, L, M, N, O, P).

The reason why observations were conducted throughout the entire duration of the study rather than just at one point was to continually apply the knowledge acquired in one phase to the next in order to gain increasingly deeper understanding by asking follow-up questions concerning things that showed up in the analysis of the data

The observations were collected through interaction with the employees in the respective parts of the department for several hours/a working day, and watching how they work, noticing what they say and how they say it.

The observations include following the work flow, delays, management, conflicts, functional- and professional silos, stress, informal hierarchy, espoused values, job satisfaction, degree of freedom at work and cultural artifacts among other things that are related to "the way things are being done" (Kristensen et al, 2005; Deal & Kennedy, 1999; Schein, 2010).

Combined with the other data collection methods, all such information will help to provide a thorough understanding of what is going on in the department, and how the department could become even better.

During the study, the following observations were conducted:

- Observation at the treatment facilities together with nurses
- Observation at the CT/MR scanner together with radiographers
- Observation at the doctors' drawing office
- Observation at Slagelse hospital to see how Lean functions at a hospital

The data that was collected during the observations was divided into several categories in order provide a systematic description of events. The categories are primary observations and experiential observations. Primary observations are 'what I see' and experiential observations are 'what I feel' (Delbridge and Kirkpatrick, 1994:296).

There is a high ecological validity in the conducted observations, because the observations were conducted in the normal work environment of Stråleterapien, featuring 'normal' persons working on their every-day routine.

However, there is a high threat of a researcher bias in observations, which Delbridge and Kirkpatrick attribute to the fact that "because we are part of the social world we are studying we cannot detach ourselves from it, or for that matter avoid relying on our common sense knowledge and life experiences when we try to interpret it" (Delbridge and Kirkpatrick, 1994:43).

To prevent personal interpretations of events, Saunders (Saunders et al, 2009:298) provides two ways to reduce/eliminate investigator bias that will be employed during this investigation.

Firstly, during the observation, it is important to ask oneself what was *really* meant by the gesture of the person in question: read the body language, think of the department's typical use of language, jargon, culture etc. in relation to what is happening.

Secondly, if a gesture has the possibility of being incorrectly interpreted by the researcher, it is important to verify the interpretation with the person in question and make them rephrase and/or explain their intentions.

Overall, the data is considered as reliable though, because of the fact that the interviews have been planned out and what is more, the several types of bias are taken into considered when analyzing the data.

Semi-structured interviews

Saunders et al define a semi-structured interview as "(…) a list of themes and questions to be covered (…)" (Saunders et al, 2009: 320). Yin speaks of unstructured interviews in a similar fashion: "(a) to follow your own line of inquiry, as reflected by your case study protocol, and (b) to ask your actual (conversational) questions in an unbiased manner that also serves the needs of your line of inquiry (…)" (Yin, 2014:110).

Several rounds of semi-structured interviews were conducted throughout the study (Appendix I). The purpose of the semi-structured interviews is to explore in-depth "the way things are done", how the organization functions, how the employees "are" and other similar questions that can capture the department's spirit in a way that can support the creation of a strategy and its organization.

Similarly to the observations, the purpose of the interviews is to capture information regarding: work flow, delays, management, conflicts, functional- and professional silos, stress, informal hierarchy, espoused values, job satisfaction, degree of freedom at work and cultural artifacts among other things that are related to "the way things are being done" accordingly to the theory section.

The interviews were conducted as described by Saunders and Yin, by creating a list of themes and questions to be covered and asking the questions in a conversational and unbiased manner. The questions and themes were based on the theory that will be applied in this thesis, in order to investigate what is going on in the department within the respective subjects and theoretical fields (Appendix I).

Since several rounds of interviews were conducted and several occupational groups were involved, the interview themes and questions were differentiated between the respective occupational group (Appendix I).

The benefit of conducting several rounds of interviews is that triangulation is possible as well as following up on themes that for several reasons got more priority than in the previous round.

Besides questions from a list of themes, probing questions were asked throughout the interviews into subjects which at the time of the interview were deemed as important to dive into. In this case, subjects deemed as important were anything that could have relevance to the strategy and organization of continuous improvement C.f. theory section.

The interviews include all levels of the formal organization in order to create an overview of the entire organization. Moreover, people from outside the organization who were considered as knowledgeable about the problem at hand were also interviewed. The people who were interviewed are (Appendix A, B, D, E, F, G, H, P, Q):

- 2 radiographers
- 4 dose planners/physicists
- 2 nurses
- 2 managers
- 1 patient
- 1 external nurse manager (Slagelse hospital)
- 1 Herlev hospital Lean consultant

In the case of the external nurse manager (Appendix C), the interview was not recorded, as the circumstances did not allow it. Rather, the visit at Slagelse hospital at which the manager worked has been , and pictures of the hospital's Kaizen boards have been taken to illustrate the concept.

In the case of the Herlev hospital Lean consultant, the two meetings with the consultant functioned as counseling and knowledge sharing, with no resulting summaries of these meetings.

In regard to the selection of the interviewees, selection bias cannot be completely ruled out, as the management chooses the persons that will be available for interviews in each occupational group. According to the management, the persons were chosen based on their time schedule.

In regard to selection bias, little could be done besides being aware of the fact that the persons chosen by the management may or may not have been chosen with a hidden agenda.

In order to improve validity as well as reliability and remove interview bias, several interviewing "techniques" are applied. The methods can be seen below.

In regard to validity, the nature of semi-structured interviews allows the interviewer to ask clarifying questions, thus allowing for the minimization of bias (Saunders et al, 2009:327).

To address the reliability and validity of the interview-session itself, several techniques are used (Saunders et al, 2009:328-341):

- Triangulation by asking several respondents the same questions in order to confirm statements, facts, flow of events etc.
- Interviews are carefully prepared through the use of direct observations and questions that are derived on the background of these
- An appropriate location in which the interviewees feel "safe"
- An appropriate beginning of the interview, starting with an informal conversation to ensure trust
- Open, non-leading questions followed by probing questions
- Sensitive questions asked in the very end when a sufficient amount of trust has been established
- Interview posture must be open and the voice encouraging

Additionally, to dive into further detail, Becker (Becker, 1998:58-60) argues that "how" questions should be used rather than "why" questions. According to Becker, "why" questions can create defensiveness in the interviewee.

Secondary data

The secondary data was found through desk research, libraries and journals such as PubMed etc. The secondary data primarily consists of literature regarding Lean in health care and articles regarding the organization of health care in Denmark. Additionally, the author of this thesis once wrote a semester project related to change management in Stråleterapien, which may have relevance for this study with regard to the department's culture and history (Holmgård et al, 2013).

Data analysis

In order to conduct a study, collected data needs to be analyzed and reviewed. All the collected data was analyzed through the following process:

The analysis relies on a method developed by Bogdan and Biklin (Bogdan & Biklin, 1998) in which data is coded into several categories. The process has three steps.

The first step is to read and listen to the collected data and create a perspective of what has been said and what the prevailing themes in the dataset appear to be.

The second step is initial coding. The purpose of initial coding is to categorize all data that is relevant to the subject that is studied into different categories. The initial coding is seen in the respective interview appendices, where themes have been assigned to the respective quotations.

The third step is focused coding. Focus coding means assembling the many different categories that were formed during the initial coding into meaningful broad categories that are relevant for the subject that is studied (Appendix R).

Yin calls the matter of transcribing recorded interviews a personal preference (Yin, 2014:110). He further elaborates on the subject by acknowledging the increased accuracy provided by audio-recording, but at the same time he also acknowledges that the process consumes enormous amounts of time and energy.

In this study, the interviews were recorded in order to have the opportunity to listen to the data at later points in the analysis. Interviews from the entire department will be selectively transcribed in order to capture the exact way people from the respective occupational group speak.

If there were several interviews conducted in the same branch of the organization, the process of selecting which interviews to transcribe was based on how informative the respective interviewees were during the interview and what insights they provided for answering the problem statement. Thus, the decision of which interviews to transcribe was a subjective decision taken by the researcher. If several interviews within the same branch of the organization were considered informative and important for the investigation, all of the interviews were transcribed in order not to miss important information.

Since the interviews occurred in an exclusively Danish context, they are transcribed in Danish, in order to not lose any meaning or value from the transcription. Therefore, the quotations used in the following parts of this study will also be in Danish.

Validity

In order to ensure internal validity, multiple sources of evidence are used in a triangulating fashion supplemented with clarifying questions and cross-examination of data. In this way, the perceptions of respective respondents' will also be clarified, namely, by cross-checking with other sources of data. Moreover, transparency achieved by describing all steps of the research will ensure that a logical chain of evidence is maintained.

In regard to external validity, theories and different methods are applied in the study with the intention of making its findings generalizable. Yin calls this type of generalizability "analytic generalization" as opposed to "statistical generalization" (Yin, 2014:20).

It is a common belief that for various reasons one cannot generalize from a single case study. However, Flyvbjerg concludes that "One can often generalize on the basis of a single case, and the case study may be central to scientific development via generalization as supplement or alternative to other methods" (Flyvbjerg, 2006). Therefore, it can be assumed that the findings of this case study can be applied in other contexts.

Reliability

Because of the chosen research design, a qualitative single-case study, it can be difficult to replicate the findings in other contexts. Saunders et al argue that the results of non-standardized research methods are not necessarily meant to be repeatable, because of the dynamic and complicated context in which in the interview is taking place (Saunders et al, 2009:327).

However, in order to ensure reliability in the research approach, procedures were documented and any findings were written down in order to make the research process transparent. Consequently, the transparency will make the study easier to repeat. The fact that the data collection methods are used in a specified sequence, instead of a random, also makes the research more repeatable.

Delimitation

The investigation is delimited to the department of Stråleterapien, and will only include external political, environmental, financial and organizational factors that lie within the theoretical scope (C.f. Theory section).

Detailed data concerning how many patients are treated on a daily and yearly basis, machine breakdowns and delays have been unavailable due to illness in the department, which increased workload for the remaining staff in the statistic department at Stråleterapien.

Related to treatment data are also benchmarks that compare the department's results to other radiotherapeutic departments in Denmark. Since data have not been available, the department's word that it is going well is relied on.

Theory

The purpose of the theory section is to discuss how a strategy for continuous improvement can be achieved and to identify tools that can help to achieve this.

Lean

In order to provide the department with a strategy to continuously improve, this study uses the Lean concept of continuous improvement. Described below is Lean and its fundamental principles. Furthermore, continuous improvement is defined and its further use in Stråleterapien's context is delineated.

While the Toyota Production System (TPS) was published in 1978 for the first time (Shah & Ward, 2007), the term 'Lean thinking' was originally used in 1994 by Womack and Jones in their book Lean Thinking (Shah & Ward, 2007). Womack and Jones' elaboration of the concept made it applicable on enterprise level, and started the popularity wave the concept has been riding ever since (Shah & Ward, 2007). Since then, Lean has transformed from being a production technique, exclusively used by the car industry, to a philosophy which can be applied in healthcare, administration and almost any other environment (Bojesen et al, 2010:20).

Lean as created by Womack and Jones (Womack & Jones, 2010) is based on five principles:

1. Define value from the perspective of the customer
2. Identify the value streams
3. Create flow in the processes
4. Create a demand 'pull' system
5. Strive after perfection by continually improving

Especially important when introducing lean to health care is to remember the fact that Lean's main focus on value from the perspective of the customer, or in this case the patient. Hines, Holweg and Rich (Hines, Holweg & Rich, 2010) define Lean into two categories:

1. Strategic level: To understand value
2. Operational level: Eliminate waste

Hines, Holweg and Rich (Hines, Holweg & Rich, 2010: 995) write the following about the relationship between value and cost in Lean:

"*A critical point in the lean thinking is the focus on value. Often however, value creation is seen as equal to cost reduction. This represents a common yet critical shortcoming of understanding lean*"

According to the authors, the understanding relates to how clearly Womack and Jones emphasized that value is the first step in Lean, as opposed to a common misconception that eliminating waste is the primary function of Lean.

The double nature of Lean will also feature in this thesis: on the one hand to emphasize value creation, but at the same time to look at how waste occurs, and examine if and how it can be reduced through the appliance of Lean tools.

The above means that everything that an organization does should in theory provide value to the customer in order to have an efficient organization. If the opposite is true, processes can be considered as a non-value adding activities, and are thus considered as waste. It is accepted that some processes do not add value for the customer or patient, but are necessary in order for the process to run. However, it is important to remain critical and identify where value is created in the organization and where it is not created (Bojesen et al, 2010: 31-32).

Thus, by looking at which processes add value, and which do not, Lean focuses on increasing value *and* eliminating waste at the same time.

In its classical form, Lean operates with seven types of waste specifically related to production (Womack & Jones, 2010).

However, in an adaptation of the concept, consultants at Hillerød hospital, (Bak-Bernth & Vinterberg, 2009: 52) modified the original seven types of waste into seven health-care specific types of waste, which will be used in this study:

1. Unclear communication
2. Over-treatment
3. Errors
4. Unnecessary movement and transport
5. Bottlenecks / Unnecessary waiting times
6. Searching / interruptions
7. Excess and unorganized inventory

The fact that changes in the original concept occur and redefine essential parts of the concepts indicates that how Lean should be defined and perceived depends greatly on its context and form of implementation (Holden, 2011).

Also, it shows that there is no normative way in which Lean can be implemented and sustained, which is why companies use Lean in ways which they find appropriate in their own particular situation (Bojesen et al, 2010: 36-43).

Therefore, it is also reasonable to think that in order to achieve a successful implementation of continuous improvement that is based on Lean, an analysis is needed in order to identify how the concept should be applied in the specific context of Stråleterapien.

Continuous improvement

Besides Lean, other production and management concepts are also using the term 'continuous improvement. Among those are Total Quality Management (Shah & Ward, 2007), Theory of Constraints (Goldratt, 2012) and Business Process Reengineering (Hammer, 1990).

However, this study proposes continuous improvement through Lean. Thus, continuous improvement is defined in the same way as it is in Lean literature. Found below is an elaboration of how it is defined.

Continuous improvement definition

Continuous improvement originates from the term 'Kaizen'. In Lean, there are two types of continuous improvement.

Firstly, continuous improvement in Lean can be incremental and it can occur slowly over time through the use of several Lean tools such as Value stream maps[3] or Kaizen boards[4] to measure performance, identify bottlenecks and eliminate them, thus gradually increasing performance.

The other type of continuous improvement that exists in Lean is 'Rapid Improvement Events' (RIE's), which are also referred to as a 'Kaizen blitz'. A Kaizen blitz is a short event lasting 3-5 days in which there is particular focus on improvement (Radnor et al, 2012).

The purpose of this thesis is to provide a strategy to create the incremental and slow type of continuous improvement that can help the department to systematically concentrate their improvement efforts around value creation and elimination of waste, and ensure that the department continuously improves with time.

Why apply continuous improvement conceptualized through Lean

This study will focus on the continuous improvement concept that is conceptualized through Lean for two reasons.

Firstly, the Lean concept is widely adopted in general in the health-care sector, and is currently receiving much positive attention (Ulhassan, 2014; de Souza & Pidd, 2011, Radnor et al., 2012; de Souza, 2009), with several examples of a successful Lean implementation in a health-care setting (AppendixC; Aherne & Whelton, 2010, Mazzocato et al, 2010, Nelson-Peterson & Leppa, 2007).

Secondly, hospitals in the close proximity of Stråleterapien, in Denmark and Sweden, are already applying the concept (Ulhassan, 2014; Kasper Bojesen et al, 2010, Appendix C). The fact that it is already applied in Denmark and Sweden increases the odds of making the concept succesfully applicable in Stråleterapien, because contextual factors are very likely similar to the other places in which it is already applied (in

[3] See page 28
[4] Appendix C and p. 60

Denmark and Sweden). Moreover, because Lean is already applied in a relatively close proximity of Stråleterapien, for example in Slagelse Hospital, empirical evidence relating to the best practice and implementation is relatively easy to acquire.

Finally, Herlev hospital also has their own Lean consultant, with whom a dialogue was maintained for the duration of this study in order to discuss the case and draw on the consultant's experience with Herlev hospital. Unfortunately, the consultant has not had any dialogue with Stråleterapien, which is why the results of the study will be just as interesting for him.

Lean health care

Since patients are not equal to cars, it is important to define value from the customers' perspective in a health-care setting.

There are several definitions of value in health care. In 1990, the Institute of Medicine proposed the definition:

"*The degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with the current professional knowledge*" (Institute of Medicine, 2001)

Since the definition is unclear, the Institute of Medicine proposed another definition based on seven measures which prescribe that healthcare must be: safe, effective, patient-centered, timely, efficient and equitable (Institute of Medicine, 2001).

In 2007, based on their research, Young and McClean (Young & McClean, 2008: 385) suggested a value proposal with three critical dimensions of value which include the Institute of Medicine's seven measures in a simplified way:

1. Clinical value, which equals best possible patient outcome
2. Operational value, efficiency of the treatment measured primarily in cost
3. Experiential value, the experience of the care for patients as well as care givers

The value dimensions as proposed by Young and McClean will be used in this thesis as the definition of value in health care because the dimensions include several of the value dimensions proposed by The Institute of Medicine such as care-receivers (patients) and are easy to grasp for Stråleterapien's employees when they need a value definition to rely on.

Thus, the value dimensions will be used both as a point of reference for the discussion of how to create a strategy for continuous improvement and for recommending a value definition in the strategy that will be devised for Stråleterapien.

Value stream map

The purpose of making a value stream map is to identify the organization's value streams. The value streams are used to analyze the respective processes in regard to value creation, waste and all that lies in between, including inventory, lead time and flow among others (Bak-Bernth & Vinterberg , 2009).

With regard to value stream mapping, the value definition is very important, as it is this definition that decides what value is and what waste is in a process. In this study, Young and McClean's value proposal with three critical dimensions of clinical-, operational- and experiential- value will be applied.

Value stream maps can be used to analyze where the value and waste is in a process. The purpose of doing this is to create a cross-sectional image of the department to capture any inefficiencies that might occur, and identify their root causes by investigating backwards through the sub-processes.

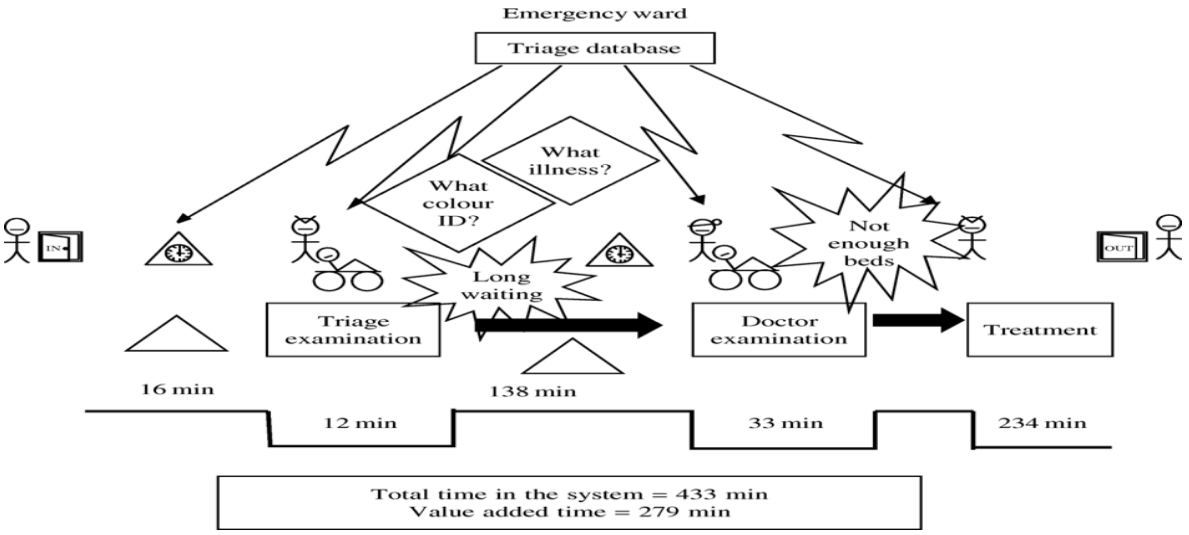

Figure 3. Setijono et al, 2010. An example of a value stream map

Implementation

The purpose of this section and its sub-sections is to find out how continuous improvement should be implemented in the department.

A literature review by Poksinska revealed that the implementations of Lean in health care often rely on three steps (Poksinska, 2010:323):

1. Conducting Lean training
2. Initiating pilot projects
3. Implementing the changes

Poksinska describes the first step as training days in which the employees learn what Lean is, how to use the tools as well as facilitate the widespread. Whom the training is for, employees, leaders or both, differs

greatly within the respective organizations, which again proves that there is no single ideal way to implement the concept. Instead, many organizations choose what they feel is appropriate for themselves in their own respective situation

The second step is Lean pilot projects that are initiated and that test what there is to gain by using the concept. Poksinska argues that the value stream map, which was discussed above, is often used in this situation as a go-to tool. The purpose of the pilot projects is also to engage employees in Lean, and train them to think Lean, in order to get the employees (and leaders) to incorporate this type of thinking into the daily operations, focusing on how to create value from the patients' point of view while eliminating waste.

The third and final step "*is about driving the change process with the full involvement of the employees*" (Poksinska, 2010: 324). Mentioned in this context are also specific Lean tools known are Rapid Process Improvement Workshops (Nelson-Peterson & Leppa, 2007) which contain a week's intensive process improvement work and a Lean focus on the treatment processes.

Moreover, in regard to implementation, Poksinska concludes that "*An appropriate implementation strategy is an adaptation-oriented approach with focus on finding ways that are consistent with the specific conditions and suit a health care culture. Health care units implementing Lean need to make a critical review of how the principles, methods and tools can be used in their own organization and adapt the concept to fit their context. The active choices concerning values, methods and tools can improve the chances of achieving long-term sustainable improvements*" (Poksinska, 2010: 324), which was also confirmed by other researchers (Fillingham, 2007; Bojesen et al, 2010; Hasle, 2014, Holden, 2011).

Because of the fact that it is important to adapt the concept to the specific context, this study will look at the specific context and analyze it with regard to how the department's managers and employees can use the concept themselves in order to improve the department's respective parameters, such as for example reduce lead time, reduce down time, increase efficiency as well as the apply the value dimensions that are mentioned above: clinical, operational and experiential value.

Moreover, since the above-mentioned three-step approach to implement Lean has been applied earlier with success, a similar method is very likely to be recommended for Stråleterapien.

Change enablers

In order to identify how the general implementation must proceed, it is important to look at the context and identify which factors are important for a successful implementation.

Poksinska (Poksinska, 2010:325) discusses the presence of three change enablers, which are important for a successful implementation. The change enablers are:

1. Commitment and participation
2. Developing people before implementation
3. Support from managers

Before the creation of the initiative it is important to find committed and enthusiastic employees that are perhaps handpicked by the management to start the initiative.

Radnor (Radnor et al, 2006) argues that the improvement team is often made up of those who want to get involved, rather than those who have to. Thus, it is important to have the *right* people to participate. In this case, the right people could be persons looked up to by others, so-called champions or heroes, as well as people from all of the department's occupational groups in order to get the entire department represented in the initiative.

The three change enablers all relate to empowering the work force, through insight and knowledge about the concept to be implemented. Potentially, a similar approach is recommended in Stråleterapien, if the context allows.

Other researchers in the field of how to implement Lean in health care have found employee support and empowerment to be important parts of a successful Lean implementation (Womack, 1996; Poksinska, 2010; Ulhassan et al, 2014) since it matches the strategy of what the management tries to achieve with the department, namely, to empower the employees and enable them to take initiative on their own without the help of their superiors. An employee supportive angle on the Lean implementation is hereby adopted.

Contextual factors

Research shows that adapting Lean to the context in which it is to be implemented increases the chances of a successful implementation

Holden (Holden, 2011) created the model in Fig. 4 that illustrates how contingency factors affect the success of Lean in an organization.

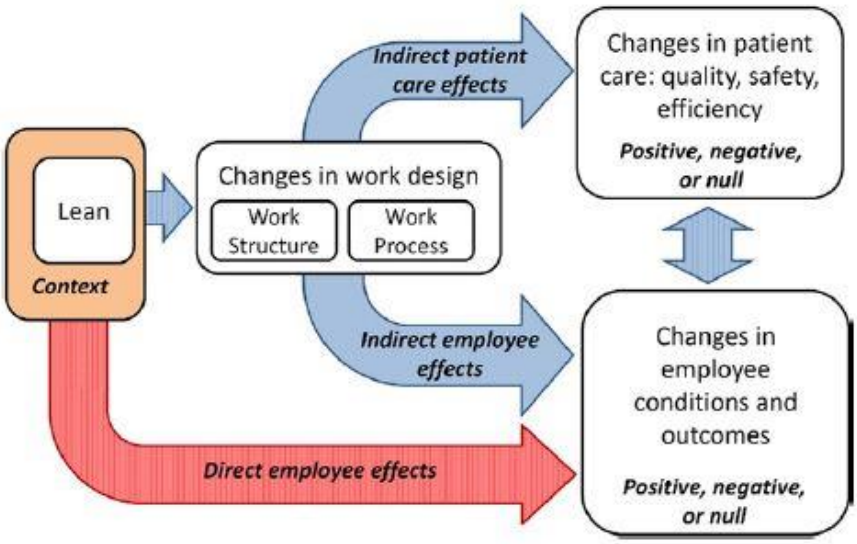

Figure 4 Holden, 2011. Contingency factors affecting the success of Lean

The model suggests that an implementation of Lean directly affects the employees, and that change in work structure and process indirectly affect the employees as well. Consequently, the patients are also affected by work structure and process changes, as well as by the employee mentality. In order to successfully implement Lean, there must be a contingency between the organization and Lean, which Holden describes through several contingency factors which are illustrated below.

The purpose of including the model is twofold. Firstly, the purpose of introducing the model in fig. 4 is to illustrate how a Lean implementation can affect the entire organization in Stråleterapien, and that it is important to be aware of not only direct but also indirect changes when implementing Lean into the context.

Secondly, and more importantly, the purpose of including the model is to examine all the proposed causalities in the model. The purpose of doing this is to identify the positive and negative implications which can be brought to the department through the implementation of continuous improvement that is conceptualized through Lean thinking.

Contingency factors

Holden also presents a list of contingency factors based on his review of literature that determines the success of a Lean implementation in health care (Holden, 2011:273), which can be is for the analysis. The list can be seen in fig. 5, and contains numerous contingency factors that have been identified as important to the success of Lean thinking efforts.

Prior to Lean

Readiness for change/acknowledgement of need for change[71,72,79]

Poor baseline conditions, allowing more profound improvements[75]

Management Involvement

Strong clinical leadership[71,79]

Leadership support of Lean[75]

Management defers to frontline staff's insight into their work and takes subordinate role in identifying problems and suggesting solutions[74]

Management undergoes a paradigm shift, refocusing on flow and quality[74]

Frontline Staff Involvement

Frontline staff participation in the design and implementation process[77,79,81,83]

Frontline staff engagement[75] and empowerment[73]

Frontline staff ownership of change process[78]

Frontline staff flexibility to change[75]

Frontline staff motivation to improve own work[74]

Lean Process

Easy to use, not requiring large time commitment[78]

Multidisciplinary project teams[69]

Open, iterative process[79,81]

Communication with staff[77]

Tracking and feedback of all worker suggestions for change[78]

Funding for data collection[69]

Greater focus on flow rather than on efficiency[74] or diagnosis[81]

Lean Change Initiatives

Multiple small process enhancements, not large breakthroughs[74]

Lean principles adapted to local working conditions and demographic environment[72,73]

Following Change

Skill of staff to carry out new work processes[77]

Standardize and sustain most efficient and effective way of work[71]

"Hold the gains" (ie, sustain initial improvements) and continuously improve[69,71]

Initial success encourages persistence[73]

*Factors suggested or inferred from reviewed studies.

Figure 5, Holden, 2011. Contingency factors

The contingency factors are be applied in the analysis by creating interview questions that are based on these factors, in order to see how ready the department is to implement continuous improvement if it is needed.

Analyzing the department's readiness for change (and other contingency factors) will help to diagnose the department's current state in regard to what the design of the continuous improvement intervention must look like to create the most positive effect on the department possible.

Barriers to implementation

De Souza & Pidd (de Souza & Pidd, 2011) identified in a literature review a series of barriers that potentially stand in the way for a successful Lean implementation. Fig. 6 illustrates the barriers relative to their specificity towards Lean.

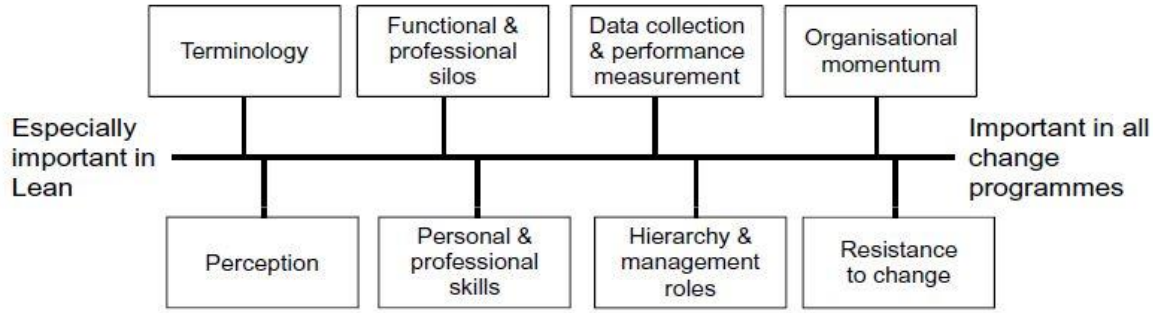

Figure 6. De Souza & Pidd, 2011. Implementation barriers.

The barriers are important for the study, because they help to predict what kind of challenges can be expected on the journey to creating a Lean organization. Found below is a short description of the barriers and their relevance.

Starting from the left, terminology relates to the lack of understanding of concept-specific jargon, which relates back to inadequate training and information regarding the concept. Terminology largely concerns Stråleterapien, because it is very likely that no one in the department has any knowledge of the concept not to mention its terminology.

Stråleterapien's employees may recognize Lean from the manufacturing industry, or perhaps they have heard that "Lean is mean" or other negative phrases used about the concept. Therefore, it is important to measure the perception of Lean among staff members before any sort of intervention can take place, in order to raise the odds of success.

A third challenge may be to change the problem-solving and fire-fighting mentality that is often found among health-care staff (Mintzberg & Glouberman, 1996). Stråleterapien's staff will need to acquire such skills through education and courses in order to enhance their personal and professional skills. According to

de Souza & Pidd (de Souza & Pidd, 2011), Lean requires a balance between qualitative and quantitative analytical skills, and they suggest that such skills can have a positive effect on health-care performance.

Diffusing the silos in and around Stråleterapien can have a positive effect on the health care, because employees will get to know what value their job provides to people outside of their own sub-departments. Therefore, they will potentially be able to focus on creating value where it is needed the most.

Related to the analytical skills that are required of the employee is data collection and performance measurement. The staff at Stråleterapien will have to be able to set up parameters, through which they can measure their performance and progress. Moreover, it must be emphasized that the employees participate in the measuring, since otherwise, they may feel that it is their own, individual performance that is being measured, rather than the process in question.

Stråleterapien's hierarchy and management will also determine how plausible it is to implement an employee-supportive Lean practice. If hierarchy proves to be high, which is not expected, it can mean that employees are not used to driving change themselves, but rely on hierarchy and their bosses to do it for them.

It is important that the management constantly shows support for the initiative by encouraging participation and involvement C.f. theory regarding employee-supportive Lean implementation. Managers must also let their employees be autonomous in regard to creating performance measurements and pilot testing new processes. Also, it is suggested by researchers (de Souza & Pidd, 2011) that a team of specialist Lean 'champions' be trained within the department. The team must remain outside the normal hierarchy in order not to be influenced by power.

Organizational momentum means that Stråleterapien must buy into the concept, and keep doing so, in order to avoid a belief that Lean is just another fad that will pass, which can be achieved through continuous management support and proper communication. Moreover, creating a Kaizen blitz or Lean workshops to create attention for the subject can also help.

The last barrier that must be overcome is resistance to change. De Souza & Pidd write: "In our case studies, the resistance encountered was not based on opposition to Lean ideas but on the simple fact that changes would be required – people are often worried about change" (de Souza & Pidd, 2011). Even though there appears to be a high level of social capital in Stråleterapien, and the employees are very much used to changes already (Appendix N), it is important that the management guides the intervention in a responsible way and ensures that it does not backfire at any point.

The definition of barriers and challenges presented above will be put into the context of Stråleterapien, and used in the analytical process. Moreover, clarifying questions relating to the barriers will be asked during the interviews. The purpose is to make sure that the barriers never become real barriers – but will be turned to advantages as a form of knowledge of what to expect and deal with the expectations in a proper way.

Operationalization

Research question #1

To answer the first research question, a value stream Stråleterapien's based in the palliative treatment process is analyzed through a value stream map with focus on efficiency and waste. The analysis includes looking at the seven waste types and evaluating how waste can be eliminated through the use of future-state value stream maps.

The purpose of illustrating the value stream through a value stream map is to see if the concept of Lean can be of any practical use to the department. The secondary purpose is also to illustrate to the department how value stream maps can be applied for future reference.

The overall purpose of this discussion is to see whether the department is efficient at the moment, and why and where the department needs to improve.

After the value stream analysis, an analysis and evaluation of the department's current improvement and research initiatives will be conducted to see how the department is currently improving.

Thus, based on the application of the value stream maps, seven waste types will be identified. Subsequently, an evaluation of the current improvement initiatives will be attempted, followed by a conclusion regarding whether and why the department needs continuous improvement.

An observation method as well as an interview method is used to collect the necessary data with regard to both the value stream analysis and current improvement and research initiatives.

Research question #2

To answer the second research question, the department's context will be analyzed through observations and interviews regarding the value dimensions, seven waste types and barriers to implementation. The purpose of the analysis is to get a clear understanding of the department's employees, their values and their organization with the purpose of suggesting how continuous improvement should be organized.

The purpose of including value dimensions is to identify the department's value perspective and emphasis, and examine whether a new value proposition can contribute to the overall value creation in the department.

The seven waste types will be used for the same purpose as the value dimensions, to identify whether the employees are overlooking waste in their processes in other places than in those identified in the first research questions.

Finally, the barriers to implementation will be considered to evaluate how ready the department is for Lean. The barriers are useful already in this research question and not only the third one, because they can help to evaluate how ready the department is for Lean, and thus, how continuous improvement and Lean should be organized.

Research question #3

Answering the third research question will involve application of theory regarding change enablers, contingency factors and Holden's model of contingency factors affecting Lean success. Data from the implementation barriers theory used in the previous research question will also be incorporated.

Change enablers theory will be used to discuss what criteria should be fulfilled to implement continuous improvement. Concrete and practical solutions to fulfilling these criteria will also be discussed.

Contingency factors and Holden's model of contingency factors affecting Lean success will be applied to evaluate the consequences of the implementation. The purpose of this is to discuss what the department should be prepared for during and after the implementation of continuous improvement through the proposed method.

Conclusion of the investigation

The problem statement will be addressed by combining the answers from the three respective research questions: namely, why does the department need continuous improvement, how could continuous improvement be organized and how continuous improvement could be implemented.

A synthesis of the three research questions will create a strategy for why and how the department could implement continuous improvement in the forthcoming years.

Analysis

The analysis is divided into three parts: a part for each of the three research questions and an answer to the problem statement in the final conclusion of the report.

Research question #1

Why does Stråleterapien need continuous improvement?

The research question is divided into three parts:

1. An analysis of the palliative treatment process
2. An analysis of the department's general context
3. A discussion of current improvement initiatives

Part 1: Palliative treatment process

Found below is an example of a work-process in Stråleterapien. The work-process in question traces what is going on when Stråleterapien receives a referral for acute palliative treatment (Appendix S).

The analysis below reveals that there are several types of waste involved, and provides suggestions for how the waste could be avoided.

Introduction

During an interview with the consultant doctor from the management, the consultant doctor mentioned that there had been issues with the acute and non-acute palliative treatment process. Moreover, a nurse commented on the subject and said that:

"*Jeg tror godt vi ved hvor hurdlerne er i afdelingen. Så er det spørgsmålet om faggrupperne kan klare det i deres arbejdsrutine. Mange gange har det været lægerne, andre gange fysikerne af forskellige årsager. Men jeg tror det er lægekapaciteten er den der er værst engang imellem, så flowet kan køre. Hvordan de har arbejdsfordelingen, de ved jeg ikke. Jeg kan bare se at det ikke helt fungerer*" (Appendix P: 4)

Later, observations and interviews confirmed that the consultant doctor and nurse were right, and that there were in fact issues with the palliative treatment process related to several types of waste, and consequently a sub-optimal treatment process.

One and a half year ago, the process of how to handle acute and non-acute palliative was changed for several reasons, which are described below. The process involves physical paper journals, which are transported between the respective staff who participate in the process. According to several people in the department, a new electronic system will be put into place within a year, although no one knows exactly when. A description of the entire new palliative treatment process can be found in Appendix S.

According to a physicist, one of the goals of the change was that:

"*Opgaven overgik fra én personalegruppe til en anden personalegruppe. Før var det radiograferne som sad og lavede dosisplanerne for de pallierende behandling. Og de er ikke særligt oplærte i dosis planlægning. Og så valgte vi at sige, at vi skulle skifte teknik til en mere moderne behandlingsteknik, og samtidig ville vi tage opgaven tilbage til fysikerne og dosisplanlæggerne, som laver de andre dosis planer. Og det medførte nogle ændringer i arbejdsgange og sådan noget. Ideen var sådan set at tage opgaven fra én gruppe til en anden*" (Appendix F: 1).

Besides more modern treatment techniques, a second reason for the change was that:

"*Der var meget med at lægen kom og sagde dét, så gik lægen igen og så gjorde radiografen, lavede den beregning, og så kom lægen ind og sagde den beregning var ok, måske ændre lidt i den. Og så skulle der komme en fysiker ind og godkende til sidst*" (Appendix F:1).

Thus, the second purpose of the change was to reduce minor disturbances in the doctor work flow.

As the physical location of the people involved in the process (radiographers and doctors) had changed to being relatively far from each other (physicists and doctors), the work flow relating to the acute and non-acute palliative treatment also had to change, because neither doctors nor physicists had the time to run back and forth between the ground floor and the first floor several times per day.

To reduce the running back and forth, it was agreed by the management, doctors and physicists that in the new procedure, the occupational groups would meet once per day at 13:40 just outside the doctors' office to confirm the treatment plans.

However, this procedure quickly proved to be impractical, because the physicists are inhibited from working while the doctor confirms the plans one by one, thus creating a bottleneck. Moreover, when the physicists arrive in the doctor's office, they have to re-open the journals that they were working on in their own office, which creates unnecessary waitings. Meanwhile, the fact that the physicists have to walk down to the doctor's office also creates unnecessary movement and transport.

The doctors have elaborated on the process for handling acute patients. The process involves one doctor per day who is responsible for all the acute cases. The responsibility rotates among the department's doctors to even out the acute workload among them.

However, in the doctor group, the senior doctors have their own diagnose-related group in which they are experts. Some doctors insist that only they themselves confirm dose plans that are related to their own specialty, which carries a risk of creating a bottleneck if they are busy in that particular moment when the plans need to be confirmed. Not all doctors have such requirements regarding the palliative treatment. However, because of the fact that some doctors believe that only they should treat a certain diagnose-related group, the process described above (electing one doctor daily who is responsible for all acute journals) falls to the ground in relation to acute treatment.

Moreover, if the respective doctors are working on an acute case at 13:40 when the dose-plan confirmation conference is scheduled, they may not have time to confirm their respective specialty/diagnose-group, thus forcing the physicists to come back to get the plans confirmed at a later time. They may also personally go up to the physicists at a later time, when the physicist who worked out that particular plan may be unavailable. When the dose-plans are not exactly what the doctors had in mind, they ask the physicists to change them, which means that the process has to be repeated all over again.

Whenever the physicist who created the dose-plan is not available, a doctor will ask the other physicists about the plan. Because the dose-plans are complex, the other physicists may not be able to satisfactorily answer all of the doctor's questions, and the plan has to be reworked, even though it may have been satisfactory provided the physicist who had created it answered all the doctor's questions.

Finally, the fact that the meeting between the physicists and doctors is held on the ground floor at the doctors' office also brings about computer-related difficulties for the physicists. When the physicists receive the paper journals, they rework them into digital dose-plans that are ready to be given to the patient in the treatment facilities. This means that the physicists have to log into a computer on the ground floor and import the plans on that specific computer, which also takes time. Once the dose-plans are on-screen, the doctors can confirm them one by one depending on whether they are relevant to their own diagnose-related group. Since only one doctor can confirm plans at any given time because there is only one monitor, the physicists who have created the other plans which are waiting to be confirmed are forced to wait. Thereby, their time is wasted on waiting rather than creating value for the patient.

Observation of the palliative work process

Normally, radiographers take a MR/CT of the patient in acute and non-acute palliative cases, but in this acute case the MR was already taken at Hillerød hospital, where the patient came from to get her treatment at Stråleterapien. Thus, the process after the doctor's referral started in the doctor's office with the drawing of the area to be treated.

According to one of the senior doctors, making either an acute or non-acute palliative "drawing" takes approximately one hour depending on the doctor's experience, which as mentioned previously can vary a lot.

However, during this observation of a senior doctor, several issues were observed that not only relate to seniority. Although the patient involved was particularly difficult, the purely organizational issues are still relevant.

First of all, the doctor complained about inadequate familiarity with the IT-programs, and was uncertain which one should be opened to retrieve the images which were needed.

Secondly, when the images were found, a second batch of images was still not available, because they had been imported form another hospital that uses a different imaging format and system. It is the task of

radiographers to import images and convert them to the right format. Therefore, the senior doctor had to wait for the radiographers in the room next to her to import the images.

The waiting and re-checking of whether the right images were available to the doctor, caused moments of confusion. Moreover, once the doctor realized that the right images were *not* there, the doctor moved to a second patient , where she stayed for a few minutes until the images had been imported by the radiographers.

During the whole process, the doctor wasted a lot of time, which in other conditions would have been spent creating value for the patient if the doctor had been able to import the images single-handedly without the help of radiographers. Also, the doctor went away from her work station several times, to identify the right people, and check whether the image import was in order, and whether other clinically related procedures had been set into motion.

Thirdly, once the images were there, an x-ray specialist had to be consulted regarding anatomical information. The specialist routinely comes to the department once a day, and was there during this specific incident. However, since there are several acute palliative cases daily, at other times the doctor would not be as lucky. The x-ray specialist has his office relatively far away from Stråleterapien. Thus, there would be a lot of logistical time spent if the specialist was to go to Stråleterapien again in order to give his opinion on the images. Such waste of time could be avoided if there was a process for sending the images to the specialist electronically, locating the specialist closer to the department or further educating the senior doctors in Stråleterapien about x-rays.

While the above-described acute palliative case was processed, a younger doctor, who sat next to the senior doctor, told a colleague that when she came to work in the morning, she opened up the journals of all the day's patients immediately, in order to avoid opening and closing them later on, when the radiographers came in to ask various questions related to the journals. The fact that the doctor used this practice – which was not shared by all the doctors – shows that current IT-systems are insufficient for the task. When confronted with this, she also added that the systems were very slow in general, which is why she had several documents open in the first place, to avoid the need to reopen them during the day, and waste her time waiting.

The incidents related to the palliative process described above reveal that there is room for improvement: time that could have been used to create value for the patient is instead used on miscommunication, unnecessary transport and unnecessary searching.

To top it off, the particular acute palliative treatment case which the senior doctor was working on during the observations had to be cancelled after the case was sent to the dose planners, because a doctor had spoken to the patient in question, and found out that the pains that the patient was experiencing were not coming from the anatomy which had been imaged by the radiographers at the other hospital. Thus, the entire process of drawing in the area to be treated by the senior doctor, the x-ray specialist's advice, the image import etc., had more or less been a waste of time and the discussion of whether the patient should have Stråleterapien's kind of treatment at all began.

Found in table 1 are the types of wastes that are discussed in this section.

Waste type	Example
Unclear communication	Physicists and doctors are waiting for each other to finish their respective tasks before meeting. Not everyone has time at 13:40 to meet, even though it is the agreed time. Roles regarding the retrieval of MR scans from Hillerød hospital were unclear.
Errors	The doctors/radiographers at Hillerød hospital committed critical errors due to inexperience, which wasted a lot of resources in Ståleterapien. Furthermore, most likely they will never get to know this nor find out what caused the errors (no root cause identification).
Unnecessary movement/transport	Physical paper journal has to be moved around several times between the doctors and physicists.
Bottlenecks/unnecessary waiting times	Physicists have to wait for the doctor to confirm the plans one by one. The plans are made digitally, and the physicists have to re-open them in the doctor's office one by one.
Searching/interruptions	During the observation, the senior doctor searched for the right images, was interrupted and had to change over to another journal until they were located by a radiographer.
Excess and unorganized inventory	The senior doctor had several journals lying on the table, although the doctors had a trolley system for prioritizing.

Table 1. Waste types and examples of waste in palliative treatment

Value Stream Mapping (VSM)

Illustrated on the following pages, is a value stream map analysis of the palliative treatment process that includes a current-state value stream map as well as two future-state value stream maps with suggested improvements.

Besides the waste that is illustrated in the value stream maps, there is a lot of waste (C.f. Table 1) within some of the respective processes shown in the value stream maps that is not shown in these value maps.

Illustrated in Figures 5, 6 and 7 are value stream maps of the current acute and non-acute palliative treatment process. The purpose of the value stream maps is to analyze whether there is room for reducing waste, and how waste reduction can be achieved.

VSM #1. The value stream map in fig. 5 shows a current-state value stream map. The radiation journal is transported manually (Yellow Inventory) between the respective stages in the process, such as between doctors and physicists. Also, delays occur while waiting at the respective meetings between the occupational groups (Red Inventory).

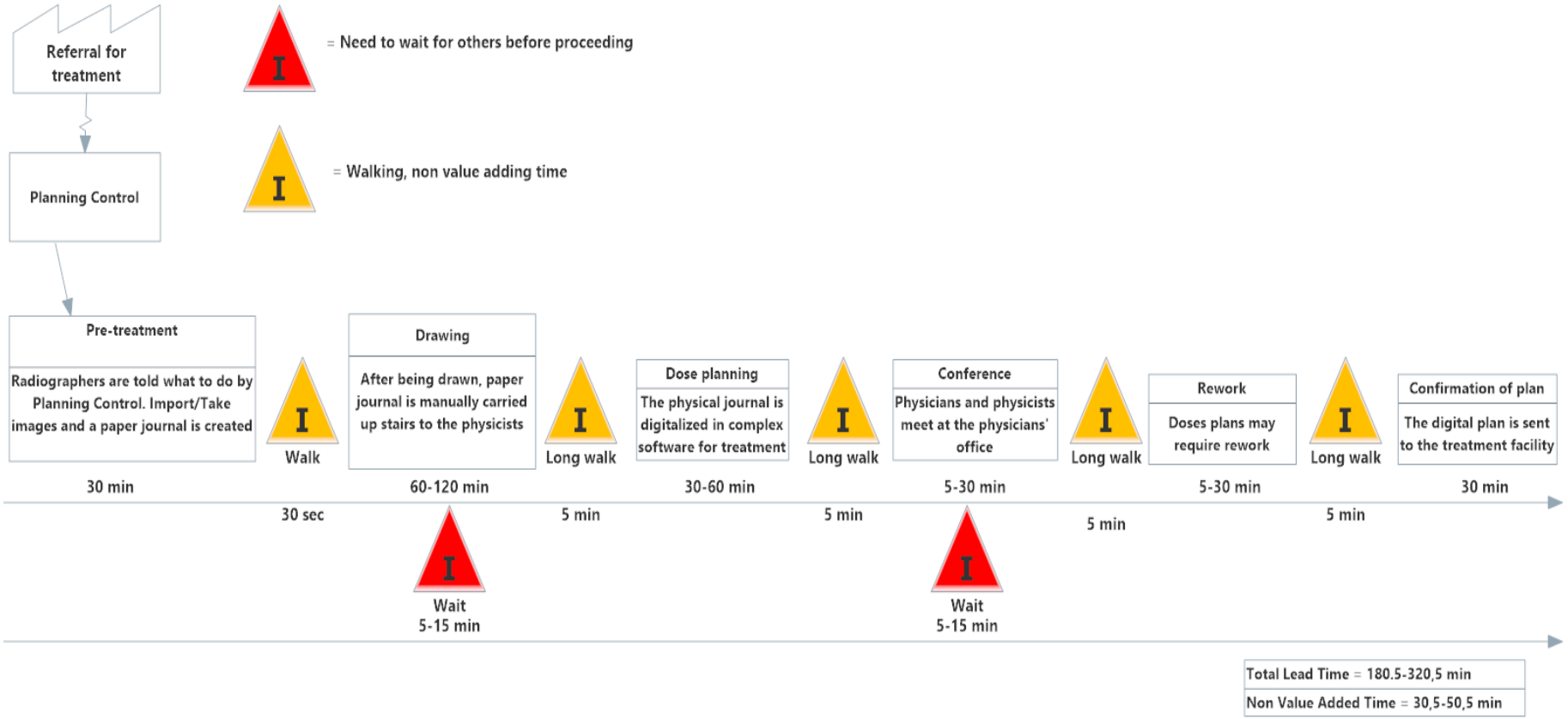

Figure 5. VSM #1: Palliative treatment current-state value stream map (above)

VSM #2. The value stream map in fig. 6 shows a future-state value stream map, with a proposed change to the process: to move the 13:40 meeting to the physicists' office. This reduces waiting because the physicists can now work while the doctor(s) confirm radiation journals and do not have to wait for their turn (they can just work while waiting!). Meanwhile, the doctors can go in rotation and confirm the respective treatment plans.

Moving the conference location to the physicist office eliminates the bottleneck for the physicists of waiting in line for confirmation of the plan by the respective doctor(s). The physicists are able to work while the doctor or doctors walk around between the physicists, confirm the respective plans or discuss what they think needs to be changed. This also provides the doctors with a chance to finish what they were doing at 13:40, before they confirm the treatment plans, as physicists no longer have to sit, wait and waste time while they wait for the doctors.

Figure 6. VSM #2: Palliative treatment future-state value stream map with manual transportation (above)

VSM #3. The value stream map in Fig. 7 shows a future-state value stream map which uses electronic journals rather than manual movement. By removing the back-and-forth walking, a lot of wasted time is saved.

By digitalizing the process, walking back and forth between work locations is reduced by sending the journals electronically, and all the waste related to the relay-race of passing on the palliative journal is eliminated. This not only eliminates non-value added time but also lowers the lead time of the entire process, as data is sent neigh instantaneously through the hospital's network.

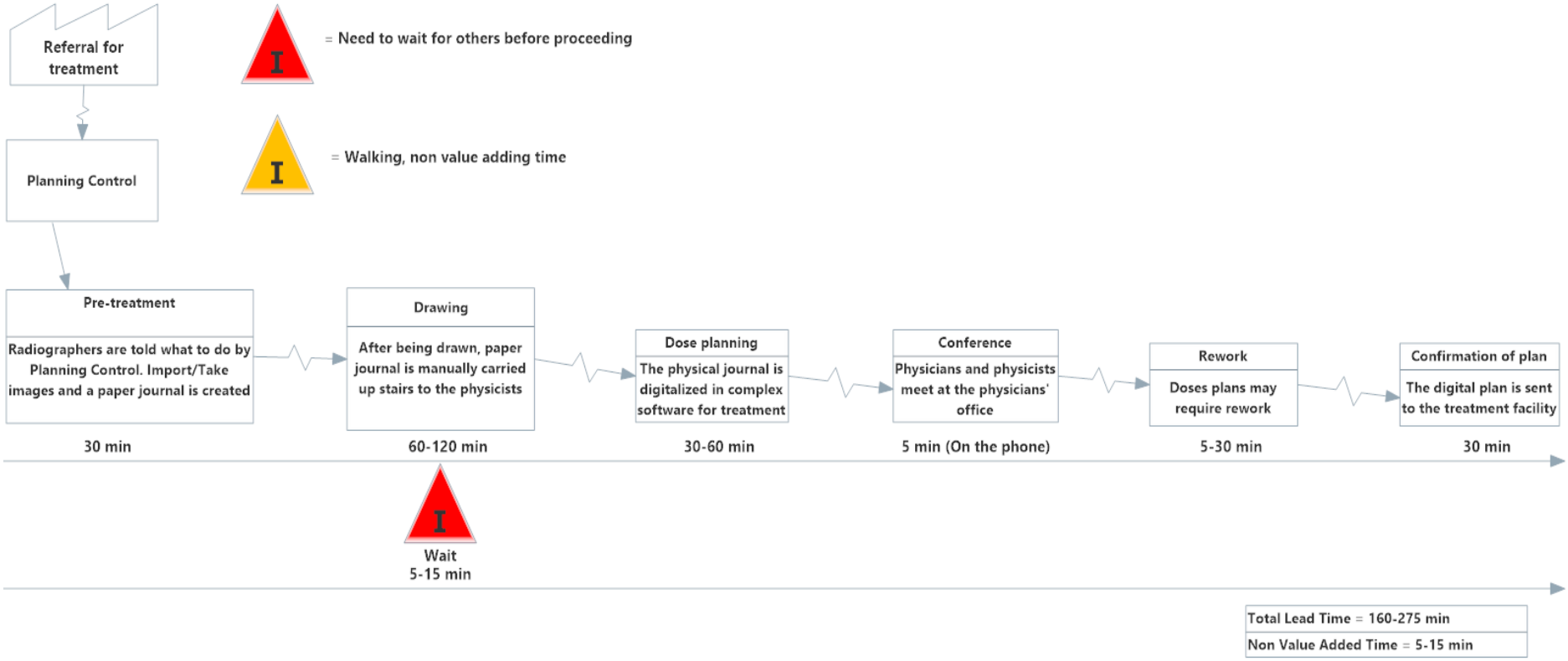

Figure 7. VSM #3: Palliative treatment future state value Stream map. Digital transport of information only (above).

What is more is if a priority-list of treatment can be created in the planning system, the process will move towards a one-piece flow, as every department in the process will know the journal-priority and work on the journals in the same order, thus reducing the lead time even further.

Such solution is also possible in a non-digital format, as long as the same standardized system is applied throughout the entire process. The doctors already have a very similar system with trolleys that work as priority-planners. However, in order to create a one-piece flow, the system must be followed strictly and applied in the entire process. During the observations it was noticed that the system was not always used, and a single doctor could have several radiation journals on his desk. Thus, it is recommended to the department that a system is worked out to include every participant in the process. One way of maintaining such system would be to have a 'champion' in each department, who made sure that everyone used the systems and followed the instructions of how to use it.

Part 2: Context analysis

Shown below is an analysis of Stråleterapien's context. The context includes all of the department's occupational groups and the management. The purpose of the analysis is to identify the department's values, organization, work conditions and room for improvement.

A patient's perspective

During the study, a patient was interviewed with the specific purpose of identifying his perception of the department, his treatment and his general experience with Stråleterapien.

According to the patient, there were no delays during his treatment process at Stråleterapien, whatsoever. This includes waiting and delays of treatment, which there were none of. Moreover, the patient also added that the nurses who were conducting his treatment in the treatment facilities were very friendly, and had energy to small-talk before and after the treatment process. On the days when he received two treatments the same day, he was assigned a place to rest, and nutrition was also provided.

Furthermore, he was taken care of by the same nurses almost each time, which meant that soon they became familiar faces, which made the treatment experience more pleasant.

The patient's narrative confirms the department's perception that they are doing well since there were no delays reported during the treatment, which had stretched over several months. What is more, the narrative also confirms that the service at Stråleterapien is patient-centered, and adds experiential value to the patient's treatment, by assigning the same nurses to the patient each time, thus enabling the patient to see familiar faces every time he returns to receive treatment.

Management strategy

The department's current strategy is retrospective, and the management plans what it sees fit (Appendix N). Thus, there is no specific strategy which has to be taken into consideration when suggesting how continuous improvement should be organized.

Management values

The department's management actively tries to coach the department's employees rather than rule them, which is a deliberate move from their side. During an interview, the chief physicist said:

"*Vi bruger meget krudt på uddannelse (the physicists, red). Vi har nogen der lige har været på europæisk kongres i Wien. Grunden til at de også er dernede på denne specielle kongres er, at de har dette (fra SUMU-I) de skal følge op på, så de har brillerne på at de er hoved- og hals fysiker osv. Næsten alle fysikere er afsted på engang om året på sådan et ugentligt internationalt kursus*" (Appendix D:2)

The quotation shows that employees are actively pursuing more education, which consequently also enriches the SUMU-I program, creating a situation which not only benefits the physicist himself, the physicist department but also the entire organization, as the physicist knowledge is formalized and shared through an organization-wide research program.

Employee values, work conditions and room for improvement

Found below is an analysis of employee values and general work conditions. The occupational groups are described in the same order as the planning and treatment process proceeds.

Radiographers

When asked about the psycho-social work environment, a radiographer answered:

"*Jeg syntes det er en rigtig dejlig arbejdsplads. Det er et superspændende speciale, og et fantastisk sted at være som radiograf fordi man har tiden til at tage sig af patienten, og det er patienten, som er i centrum*" (Appendix P: 1).

The quotation reveals that work is centered on the patient, and that the radiographer is satisfied with her work. It is important to notice that she replies that work is centered on the patient and not somewhere else. Thus, emphasis in the process is in the right place, namely, on creating value for the patient.

In regard to what she values the most about her work, another radiographer replies:

"*Jeg vil gerne have nogle gode kollegaer, det er vigtigt. At der er struktur. At man ved hvad man skal lave. En god struktur er rigtig vigtigt for mig. Og selvfølgelig også at dagene heller ikke er ens. Så meget struktur skal der heller ikke være*" (Appendix G: 1).

Thus, the radiographers want structure. However, they also want freedom to act accordingly to their own judgment.

Based on this, the radiographers could use tools for conducting improvement work as well as keeping track of their performance and improvements.

Doctors

While no doctors were interviewed besides the consultant doctor regarding the palliative treatment process (Appendix J), observations were conducted in the doctor's office.

As described in the research question one, the environment in the doctor's office was mildly chaotic due to complications with the IT-programs, missing CT images, waiting etc.

Subjectively, the doctors' focus seemed to be purely clinical, without assigning much operational value or experiential value of the experience.

A part of the doctor staff rotates each month, which arguably creates a work environment in which not everyone knows each other that well. Arguably, an office in which rotations occur frequently needs standardization and ways to learn things more than mature offices, in which there is already a routine.

Therefore, it argued that the doctor's office could possible use the Lean concept to organize and standardize. In this regard, it must be noted that the doctors must be able to see the clinical value that such tools can contribute, otherwise, it can be difficult to make the doctors acknowledge and use them.

Physicists and dose planners

During an interview, the chief physicist said:

"*Det er på et højt niveau. Vi bruger meget krudt på uddannelse (...) Næsten alle fysikere er afsted på engang om året på sådan et ugentligt internationalt kursus (...) En anden ting er, hvis man er uddannet hospitalsfysiker, så indgår man i sådan et CPD system, hvor vores løn er bygget op på. Man skal hvert år have et vist antal point, og dem får man ved at deltage ved kurser, man kan skal ca. På en uges kursus. Og man kan ikke optjene dem med mindre man er på en uges kursus. Så på den måde er det bundet op på det. Det bider sig selv i halen, så en fysiker har ret til at sige, at hvis han ikke kan få sine point, er det min pligt som leder at finde ud af hvordan de får deres point*" (Appendix D: 2)

Thus, there is a strong emphasis on education among the physicists, which indicates that research is also in the front seat among the physicists.

During another interview, when asked about standardization in the physicist- and dose planner department, the physicist operations manager said:

"*Vi er akademikere, så vi vil ikke rigtigt gøre som det bliver sagt det skal gøres. Vi har vores eget system og instrukser (...) Mange gange har vi heller ikke brug for noget på skrift. Og det bliver ikke læst. Men jeg opdager gang på gang at mange gange er det: Hvad var det vi aftalte? Hvad var vigtigt? Den instruks? Det syntes jeg vi er blevet bedre til.*" (Appendix E:2)

He also adds:

"*Jeg har forsøgt mange gange at ændre og etablere nyt møde. Det jeg gerne ville have, at det var medarbejdernes møde. Med egen dagsorden. Og at de selv førte referat. Nu er det meget afhængigt at mig eller en anden, og det syntes jeg er synd.*" (Appendix E:2)

The remarks show that the physicists and dose planners want to do things in their own way. However, the management tries to push them to be more structured throughout the work, as information is sometimes forgotten due to the fact that instructions etc. are not written down.

Finally, the above quotations indicate that the physicists and dose planners have a structure. Though, it is not necessarily the right one, nor is it a structure that is used in the entire department. Rather, it is their *own* structure.

The fact that there are no overall standards, which is also seen throughout the other occupational groups, points in the direction that there are professional silos in the organization that inhibit the process flow. Thus, there is a need for something that can support and unite the entire department rather than divide it into professional silos.

Nurses

The observations in the treatment facilities among the department's nurses revealed that the nurses are satisfied with their work, which could be observed through their relaxed work flow and espoused values such as the tone and flow of the conversation that was going on between the nurses (Appendix N). However, as illustrated below stress and frustration does occur among the nurses.

When asked what is important to her regarding her work, a specialist nurse answered that:

"*At der er en god stemning på arbejdet, og vi er tværfaglige, og jeg arbejder meget tværfagligt. Det syntes jeg er rigtig vigtigt. At man har en god dialog. Og samtidigt også at det giver mening det jeg laver. At det bærer frugt i den anden ende. At det har betydning for patienterne og kollegerne fordi jeg også arbejder med implementering af nye behandlingsformer. Så hvis det fungerer, har jeg det godt*" (Appendix P:1).

When asked to clarify her last remark, whether it "works", the nurse answered that:

"*Ja, størstedelen af det fungerer. Men det kan være frustrerende fordi en drift har førsteprioritet, behandling har førsteprioritet, og nogle gange kan det vælte, og være frustrerende at man ikke kan følge den plan man har lagt. Det er der så fin forståelse fra, fra ledelsen, så det er ikke noget man bliver punket for. Så man ved godt hvorfor det er gået som det er gået.*" (Appendix P:1).

Finally, when asked about communication throughout the department, the nurse answers:

"*Den kunne godt blive lidt forbedret. Også på egen regning. Vi forsøger, og det er blevet bedre end for 10 år siden. Men vi kunne godt blive endnu bedre til det. Nogen af mine kolleger, stråleterapeuterne, dem som behandler, føler måske nogle gange at de ikke bliver informeret om hvad der foregår i fysikergruppen med udvikling. Jeg vil så sige, at vores organisation prøver at fortælle det til vores morgenmøder og løbende*" (Appendix P:1).

It is difficult to evaluate the opinion of all the nurses based on two interviews. However, the quotations indicate that there is room for improvement in the treatment facilities where the nurses work in regards to communication and the organization of work to reduce stress.

During the interview, the nurse also said that she experiences stress once in a while during daily operations, because treatment plans occasionally do not arrive at the treatment facilities on time, and then it is the nurse's job to tell the patients that they have to wait. The nurse mentions delays of 15 to 30 minutes (Appendix P).

Thus, there appears to be room for improvement in the treatment facilities. Partly, at least according to the nurses, some of the improvement must come from previous units in the planning and treatment process: the physicists, dose planners and radiographers.

Unfortunately, there are no concrete measures in regard to lead time and bottlenecks which would be useful in such a situation in order to uncover where the congestions occur, and do something about them.

Related to the bottlenecks are also miscommunication and professional silos, which were also identified in the other units in the treatment and planning process.

Summary

The purpose of this analysis was to analyze the department's context and identify the department's values, organization, work conditions and room for improvement.

The analysis revealed that the department tries to create a balance between daily operations, research and education. In fact, at some point during the study members from all the respective occupational groups, except for the doctors, have at least implied that daily operations are necessary to keep the department on track (Appendix D; Appendix H; Appendix P).

Moreover, the analysis revealed that there are flaws in the organization in terms of professional silos that cause delays, miscommunication and lack of standards for the department as a whole unit.

Consequently, the delays, miscommunication and lack of standards lead to stress, at least among the nurses, and ultimately caused delays for the patients.

Table 2 summarizes the findings of the analysis and categorizes the findings for the respective occupational groups.

The findings reveal that work is generally conducted in silos, and that several employees believe that the communication could be improved. However, the findings also reveal a lot of positive aspects such as a patient-centered focus and emphasis on both operational (daily) and strategic focus, which can exist because the employees openly talk about the importance of daily operations and patient-centered treatment, but at the same time also want to conduct research, pursue education and go to congresses abroad.

Occupational group	Values	Room for improvement
Overall (general)	Patient centered Balance operations and research	Improve communication Increase cooperation
Radiographers	Treatment centered around the patient (Clinical/Experiential value) Structure, to an extent Challenges during work	Discuss performance Keep track of deviations
Doctors	Clinical value Clinical focus above all	Use several value dimensions Improve communication Standardize, sort, shine, set in place and sustain
Physicists	Want to do things their own way Research Education	Improve communication Formalize
Nurses	Experiential value Clinical value Structure and order Dialogue	Improve communication Discuss performance Identify root causes for delays

Table 2. Improvement initiatives

Part 3: Improvement initiatives

Presented below is a discussion of the department's current improvement initiatives.

The department has several improvement initiatives ongoing and several ended initiatives. Table 3 shows the department's improvement initiatives.

Improvement initiatives	**Occupational group**	**Description**	**Value type**
Ph.D. programs	External students	Clinical research	Clinical value
BOLUS, material for applying on the skin during treatment	Radiographers (and possibly others)	Process and clinical testing of how to apply the Bolus material on the skin of patients in order to improve the clinical outcome. **Ongoing**	Clinical value
Clinical research	Physicists & dose planners	Besides daily operations, physicists are conducting research on a frequent basis to sustain their knowledge regarding new treatment methods. **Ongoing** Conferences and traveling are included in this.	Clinical value
Process improvement	Radiographers	A team of radiographers were supposed to increase the efficiency of the pre-treatment process. Instead, the effort resulted in a gain in experiential value for the patient. **Ended**	Operational value (Failedl) Turned out to give experiential value
SUMU-I program	All occupational groups	A systematic approach to all diagnose-related groups which the department treats. All occupational groups are participating, sometimes together, but not always (room for improvement). **Ongoing**	Clinical value Operational value Experiential value
Lean consultants	External consultants	7-8 years ago a group of consultants came to help the department to improve, with a vague result. **Ended**	Operational value (Vague result)

Table 3. Values and room for improvement

All initiatives except for the SUMU-I program are local initiatives within the respective occupational groups in the department.

The initiatives are primarily focused on clinical and experiential value dimensions. Two initiatives focused on increasing operational value. However, according to the staff and a consultant doctor the efficiency gains were almost non-existent (Appendix G, Appendix J).

One initiative stands out by including arguably all value dimensions as well as all occupational groups. The SUMU-I initiative is a research initiative that includes all of Stråleterapien's seven diagnosis groups that the department treats on a daily basis (Head & neck, thorax, Mammography, pelvis, sarcoma, palliative treatment and surface). Each diagnose-related group requires teams that include all of the department's occupational groups. Each diagnose-related group team has several yearly meetings at which they meet and discuss the research that they have conducted before each meeting. Each diagnose-related group holds two department-wide meetings per year to share their research and knowledge.

Lately, as the head of the initiative has been on paternal leave, the initiative has been slightly neglected. Moreover, there were minor problems with popular attendance during the meetings (Appendix P).

However, several employees mention the initiative during interviews (Appendix D, Appendix P) and think that it is a positive contribution to the department. A nurse described the SUMU-I initiative as:

"*Jeg syntes det er positivt fordi man får talt både med fysikerne og lægeansvarlige. Specialister inden for området, hvor man kan få nogle gode faglige diskussioner. Lægerne kan have en ide hvad der er godt at lave. Så kan vi sige at det er godt nok, men at det tager lidt tid. Og så kan vi have en faglig diskussion om fornuften, og hvad vi får ud af at gøre det og veje det lidt op mod hinanden* (Appendix P:2).

Jeg syntes faktisk også at det giver en god respekt for hinandens arbejde. Det giver en god dialog og det er nemmere at tage telefonen og ringe, når man har dette her face to face møde engang imellem. Selv når vi sidder i en gruppe foregår det i et godt miljø. Så er det nemt lige at ringe og høre.. hvorfor er det nu lige sådan, eller kan vi ikke lige finde ud af et eller andet. Så det syntes jeg er et godt tiltag" (Appendix P:2).

As regards the efficiency improvements conducted by the radiographers, who did not identify any inefficiency, a radiographer replied that:

"*Jeg syntes det er rigtigt fint, at se om man kan forbedre nogle ting. Men selvfølgelig var man lidt skeptisk, fordi vi gør det jo så godt. Men jeg syntes det er rigtigt godt at man kigger på processerne og kigger hvad man kan gøre bedre, hvad man kan gøre anderledes. Det syntes jeg er rigtig fint.* (…) *Resultatet var, at der faktisk ikke blev lavet så meget om i vores arbejdsfordeling. Efterfølgende lavet vi så faktisk lidt om på det her for nylig (experiential value, red)."* (Appendix G:2).

The quotation implies that there is little incentive to improve, as efficiency is where it should be according to some employees, which is confirmed by another radiographer who replied in the following way when asked whether there were any delays in the pre-treatment where she worked:

"*Ikke så tit. Og tit hvad skal vi sige, er det lavet lidt som en middeltid. Og det kan være at den næste patient til gengæld går rigtigt hurtigt, fordi vedkommende sådan er forberedt det.. Nogle ting tager den tid der er afsat og som det tager. Andre ting kan man godt skynde sig med*." (Appendix H:2).

Sub-Conclusion

Part 1: Palliative treatment

The purpose of the analysis was to find out why Stråleterapien needs a continuous improvement in the department.

In order to identify why the department needs continuous improvement, an analysis of the palliative treatment process was conducted by applying Lean tools such as the value stream map and seven types of waste. Moreover, an analysis of the department's current improvement initiatives was also conducted.

The analysis revealed that there is room for improvement with regard to the palliative treatment process, especially in the doctor's offices, where there is a lot of time wasted through searching, communicating, transporting and waiting.

Whether the results are generalizable to diagnose-related groups is difficult to maintain with certainty, as the complexities of the diagnose-related groups relative to the palliative treatment remain unknown.

However, there are strong indications that for example the x-ray specialist help is also needed for other diagnose-related groups, because it was observed during the observations that the specialist was helping other doctors besides the doctor responsible for acute treatments that day.

Moreover, excess inventory and searching for the right image or journal is also likely to occur, as there is no overall priority system in the department for systemizing the physical paper journals that journey through the department.

Part 2: Context analysis

The context analysis revealed that there is room for improvement several places in Stråleterapien. Especially noticeable was the need for more communication among the occupational groups, and stress among the nurses was a consequences thereof.

Moreover, several professional and functional silos exist in the department, which are inhibiting communication and efficiency.

The overall conclusion of this section is that there is room for improvement in several places in the department. Thus, the answer to whether the department needs continuous improvement based on this section must be affirmative.

Part 3: Current improvement initiatives

Regarding improvement initiatives in the department, it was identified that there are several ongoing initiatives.

Interviews with radiographers revealed that while pre-treatment is timely and on schedule, the radiographers do not know how to make the process faster than it already is, which could indicate a shortage of tools for such work.

However, there is particularly one initiative that captures the interest of this study. The SUMU-I initiative systematically arranges research in the department, and has the general purpose of creating value and improvement in the long-term.

The fact that an initiative for strategy for creating continuous improvement already exists will affect the recommendations of this study for the organization of continuous improvement in the second research question.

Thus, the conclusion on this research question is that there is room for improvement, and that Lean tools such as the value stream map can be used to improve the department's process efficiency by looking at waste in the respectable processes. Moreover, while the department has initiatives that create value over time that very likely combines clinical-, operational- and experiential value, there is no clear value definition in the department.

Finally, regarding the next research question, the current improvement initiatives need to be considered in the proposal for how to organize continuous improvement in Stråleterapien, as the proposals are somewhat likely to cross each other's paths.

Research question #2

How could continuous improvement be organized in Stråleterapien?

The second research question is divided into two parts:

1. Barriers to implementation (and organization)
2. A suggestion for organizing continuous improvement

Part 1: Barriers to implementation and organization of continuous improvement

In order to identify how continuous improvement should be organized, it is also necessary to discuss which barriers there are in regard to organization and implementation of Lean based improvement. The purpose of taking this discussion now, and not in research question #3, is to evaluate how ready the department is for an implementation of Lean, thus revealing which type of organization/integration has the largest odds of success.

Found below is an analysis of barriers C.f. theory section that affect how Lean should be organized in the department.

Terminology

When asked whether she knew what Lean was, a radiographer said:

"*Jeg ved at det kommer fra Japan og at det er en måde at systematisere ting på. Og splitte processer op i enheder og kigge på hvordan man bedst muligt kan gøre det*" (Appendix H:1)

Similar remarks were made during observations and other interviews (Appendix G). They show that it does not seem that employees are familiar with Lean. The few who have heard about Lean still do not know the basic principles, only that its purpose is to make a lean organization (Appendix E).

Perception

A physicist in the department had the following perception of Lean:

"*Den er som regel positiv. Desværre er det svært at få Lean fuldt ud i den kliniske praksis. Men det er rimeligt nemt så længe du tager 1 proces i et enkelt afsnit, og så længe det ikke er et helt sygehus og tager ikke de praktiserende læger med* (Appendix E:1).

Det er mere eller mindre nødvendigt, vi må have det. Vi har nok et eller andet sted Lean, uden at vi kalder det for Lean – vi forsøger at minimere det der." (Appendix E:1)

The fact that they do not know how to apply Lean in a clinical setting can be related to their perception of the concept with regard to its value definition.

Lean was mostly related to operational value by the employees and associated with efficiency gains by analyzing process purely to minimize waste and cost. (Appendix K, Appendix N)

At the same time, no one thought about the fact that the concept can be applied to increase clinical and experiential value while reducing waste within the respective processes.

Thus, there is a need to educate the department about the concept. Moreover, participation in the improvement events based on Lean can help to change the staff's perception.

Functional & professional silos

As mentioned above, barriers exist within the current organization, and are arguably one of the factors that inhibit efficiency in the department the most, because not all employees know each other's work, or communicate sufficiently with each other, which creates friction and inefficient processes such as illustrated through the palliative treatment process in research question #1.

"*Nogen af mine kolleger, stråleterapeuterne, dem som behandler, føler måske nogle gange at de ikke bliver informeret om hvad der foregår i fysikergruppen med udvikling. Jeg vil så sige, at vores organisation prøver at fortælle det til vores morgenmøder og løbende. Men hvad de har informeret om der, kommer ikke ud løbende. Det kommer ud dér, men det kommer ikke andre steder*" (Appendix P:1).

Because silos inhibit knowledge-sharing, it is important to reduce the number of silos in the department, which can be accomplished through the use of several Lean tools. However, a prerequisite for applying such tools is education in the use of them. Thus, there is a need for employees to become more knowledgeable about the concept.

Personal & professional skills

While the employees have some of the competences that are important for an employee-supportive Lean practice owing to the fact that they are very independent, the fact that the employees do not know Lean terminology inhibits them from using Lean at any level other than the most basic. Thus, the employees do not have any professional skills related to Lean. Such skills must be developed before the implementation.

Data collection & performance measurement

The purpose of collecting data and measuring performance is to collect "Fakta i stedet for fornemmelser" (Bak-Bernth & Vinterberg, 2010:45).

The employees are not used to measuring their performance, and in order to truly identify what is the most efficient method, it is necessary to be able to measure the performance. Thus, employees need to learn how to measure their performance.

However, it is important that employees are taught how to conduct the measuring themselves. Otherwise, the consequence can be that the employees feel that they are being monitored, and that it is their individual performance that is being measured instead of the process.

Hierarchy & management roles

There is an obvious hierarchy in the doctor's office because of the large difference between experienced and inexperienced doctors. However, other occupational groups such as the nurses have a culture of saying things very bluntly to their managers.

"*Men vi har en høj gennemsnitsalder, som gør, at vi er selvstændige personer. Vi er ikke nervøse eller skal spørge om en hel masse. Vi får også lov til at have en masse selvstændighed i vores arbejde. Og dermed også respekten*" (Appendix Q: 1)

Thus, there are differences between the respective occupational groups.

Organizational momentum

Currently, the department has a relatively large positive momentum. The employees still remember the time in which the department's efficiency was relatively low. The department is sending their employees on courses, congresses and best-practice sharing sessions with other Danish beam therapeutic departments. Managers are trying to provide incentives for independence and self-reliant problem solving whenever issues come up.

However, the above-mentioned can be a reason why a full-scale Lean implementation is not possible in the department. Namely, because there does not appear to be a readiness for change, or poor baseline conditions that allow more profound improvements, C.f. Contingency factors in the theory section.

Resistance to change

In the course of the study, the radiographers were the only occupational group who reported conducting process-related optimization. Moreover, the majority of improvement work that is conducted in the department is related to clinical improvements. Therefore, there is a risk that the employees will not see the relevance of a continuous improvement intervention.

Moreover, it is natural that people who are busy disregard new tasks in order to keep on track with their already busy schedule, thus missing the chance for "future investments" can that help their efficiency in the long run.

Summary

There are several barriers to the implementation.

However, many of them can be eliminated through education concerning Lean and participation in continuous improvement strategy. Finally, the organizational momentum can be an inhibiting factor for organizing continuous improvement, as the department's satisfaction with its current situation may result in little willpower to create changes.

Found in Table 4 is an overview over the change barriers, their evaluation and a proposed solution to abolishing them.

Table 4 shows that the most frequent barriers are in the category of lack of education about Lean: terminology, perception, personal & professional skill, data collection & performance measurement and professional & functional silos.

Moreover, there are other barriers related to the lack of organizational momentum and resistance to change. In order to address these barriers, the organization of continuous improvement is proposed in the section.

Change barriers	**Evaluation**	**Possible solution**
Terminology	Employees are not familiar with the terminology	Educate employee regarding terminology
Perception	Neutral/Slightly positive	Education in regard to Lean / Participation in improvement events
Functional & Professional silos	Silos in the organization exist	Reduce silos through analysis
Personal & Professional skills	Employees have some personal skills. However, Lean competences are lacking	Courses in regard to professional skills
Data collection & Performance measurement	Employees are neither used to collecting data nor measuring performance. Employees may feel that *they* are being measured if not told otherwise.	Education, and more importantly, participation is suggested.
Hierarchy & Management Roles	Low hierarchy, which is generally positive in regard to implementation.	While management support is needed, the hierarchy should remain low.

Organizational Momentum	High organizational momentum can become a barrier for implementation.	Take advantage of the high momentum.
Resistance To Change	Extraordinary focus on clinical value can be inhibiting. Busy schedules as well.	Regard how value for the patient can be created through other value types than clinical.

Table 4. Change barriers

Part 2: Continuous improvement through SUMU-I

There is arguably little incentive to implement Lean on a full-scale in the department, which there is a valid reason to, as the department appears to be doing well without the concept. Thus, it is unrealistic to propose a full-scale Lean implementation in order to achieve continuous improvement.

Therefore, it is proposed that continuous improvement is integrated into one of the current improvement initiatives in order to take advantage of the organization's current momentum, and gradually increase the scale of the continuous improvement concept from this vantage point.

The particular initiative in mind is the SUMU-I research initiative, which consists of seven separate diagnose-related groups into which research is divided.

As mentioned earlier, the SUMU-I abbreviation stands for "Samarbejde, Udvikling, Mødeaktivitet, Uddannelse og Information". In the previous sections it was concluded that cooperation and communication is exactly what Stråleterapien needs in order to reduce its inhibiting professional silos that cause delays and miscommunication. Therefore, it is hereby proposed to integrate continuous improvement through the SUMU-I initiative.

Integrating continuous improvement into the SUMU-I initiative also appears to be a good option, because it will empower the staff to participate in the continuous improvement initiative through the nature of the SUMU-I program, which involves all occupational groups and encourages them to work together.

Furthermore, integration through SUMU-I which includes employee participation can be the key to a successful implementation in the context of Stråleterapien, because of the demanding and assertive nature of the department's employees. Particularly, one nurse said:

" (...) *vi har en høj gennemsnitsalder, som gør, at vi er selvstændige personer. Vi er ikke nervøse, eller skal spørge om en hel masse. Vi får også lov til at have en masse selvstændighed i vores arbejde, og dermed også respekten*" (Appendix Q:1).

The fact that continuous improvement will be integrated through the employee-powered initiative, SUMU-I, will give the mature staff an opportunity to express the freedom and independence that they desire by letting them drive the initiative forward themselves.

Finally, the integration through SUMU-I is also in accordance with the theory that argues that implementation success increases with employee-support C.f. theory section.

Structure

The SUMU-I initiative already includes seven diagnose-related groups which regularly meet, exchange know-how and inform the rest of the department about their findings.

Based on this knowledge, the proposal to structure continuous improvement is therefore through an eighth diagnose-related group, which reflects Lean, the concept's value perspective and how the concept can be used to improve communication throughout the department and increase the total amount of value that the department generates.

The eighth initiative in the department could be structured similarly to the other seven existing diagnose-related groups, with occupational groups from the entire department that work closely together to find out how the department can improve as regards the suggestions for improvements mentioned in Tables 1 and2, respectively, as well as other unidentified parameters.

An employee-driven initiative

Presented below is an elaboration of how the implementation of continuous improvement will be employee-supportive and match the management's strategy of having an independent workforce.

The well-being of the employees is secured through the fact that the implementation is organized through an existing research program that involves the employees, thus limiting the need for a large transformative intervention, since the implementation relies on a well-familiar research program.

Moreover, if employees are properly trained through Lean courses via the hospital's own Lean consultants, the outcome will be a Lean line of thinking that is learned in a hospital context and primarily related to creating value in a hospital context. In other words, the effect of Lean thinking will be positive, as the Lean thinking will be connected to health care and patient treatment.

Similarly, the context will be affected by the group of employees who are trained in Lean thinking and through the SUMU-I initiative, which will ensure a context that is ready, and a workforce that is enthusiastic towards implementing the concept in the department – to the extent in which it is needed.

Next, because of the way that the Lean thinking is grasped and adapted to the context, the implementation will most likely require little intervention, as employees themselves drive the implementation forward.

Consequently, the Lean practice will be employee-driven will little interference from management, which supports the management's strategy of having an independent workforce that is capable of solving problems on their own.

The purpose of the employee-driven practice is to reduce the negative impact on the working environment, which would go against one of the goals of the implementation, namely, to decrease stress among nurses and improve the department's communication.

Employee-driven Lean at Slagelse hospital

In order to illustrate how an employee driven Lean initiative can function, I have made a visit to Slagelse hospital. Slagelse hospital applies Lean in their entire organization, and is claiming to have achieved notable reductions in errors and mortality as well as have increased efficiency (Appendix C, Slagelse).

Kaizen boards

The purpose of Kaizen boards and Kaizen meetings is visualization and generating the discussions that would otherwise not be taken regarding performance and improvement in the daily operations.

The Kaizen boards at Slagelse hospital help to in systemize and monitor the performance as well as improvement efforts.

Potentially, Stråleterapien could use the boards in the same way, namely, to keep track of performance and performance problems in the respective sub-departments.

The purpose of the board meeting is to discuss any delays and problems that occur throughout the week. Such delays must be written down along with other issues in order to be briefly discussed. When it is apparent what problems there are, and which problems are the most frequent, the employees should attempt to solve these problems.

It is important to add that Kaizen boards should not be added as the first thing, because they require implementation and organizational readiness such as education and competences which currently are not present in Stråleterapien.

As mentioned before, the purpose of the board meeting would be to discuss the actual and *factual* performance of the department, which should be measured on a weekly basis and benchmarked towards a goal that is set by the employees themselves.

By writing down the reasons for the respective failures to reach the intended performance, statistical data will be created over time which will show a pattern in the reasons why the performance target was not reached. When the problems have been identified through this pattern, the root causes can be worked on and eventually solved through team efforts.

The entire Slagelse hospital is using Lean to control their performance among other things. The head nurse of Slagelse hospital's cardiology department, which houses critically ill heart patients, was happy to extend an invitation to the department to proudly showcase how the department functioned, and how a Kaizen board meeting was used to control the department's performance.

Illustrated in fig. 8, 9 and 10 is the Kaizen board that is used for weekly meetings. The board is primarily used on a weekly basis for discussing weekly targets for the respective diagnose group, and whether these were reached or not. Moreover, the board also features a Plan-Do-Study-Act[5] implementation planner, through which suggestions are implemented. The purpose of the meeting is to make sure that the department considers *facts* rather than hunches and gut feelings when addressing its performance.

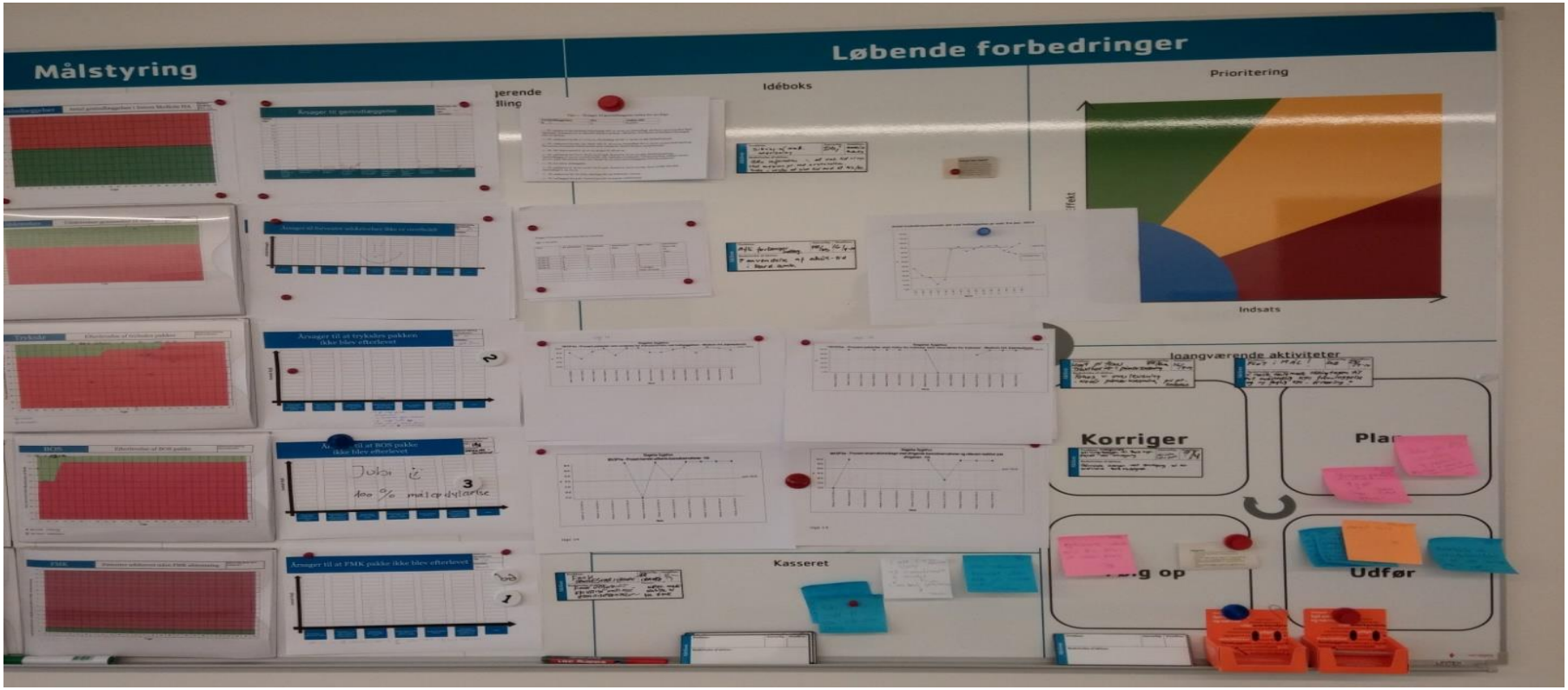

Figure 8. Kaizen board at Slagelse hospital. From the left: Weekly targets, Causes if target was not reached, Improvement charts (graphs) and a Plan-Do-Study-Act (PDSA) implementation plan (Lower right corner), Implementation prioritizer (Upper right corner)

[5] Plan-Do-Study-Act (PDSA) is a Lean tool for implementation; Plan what you want to do, Do what you planned that you wanted to do, Study what you did and if it is satisfactory and Act (Implement).

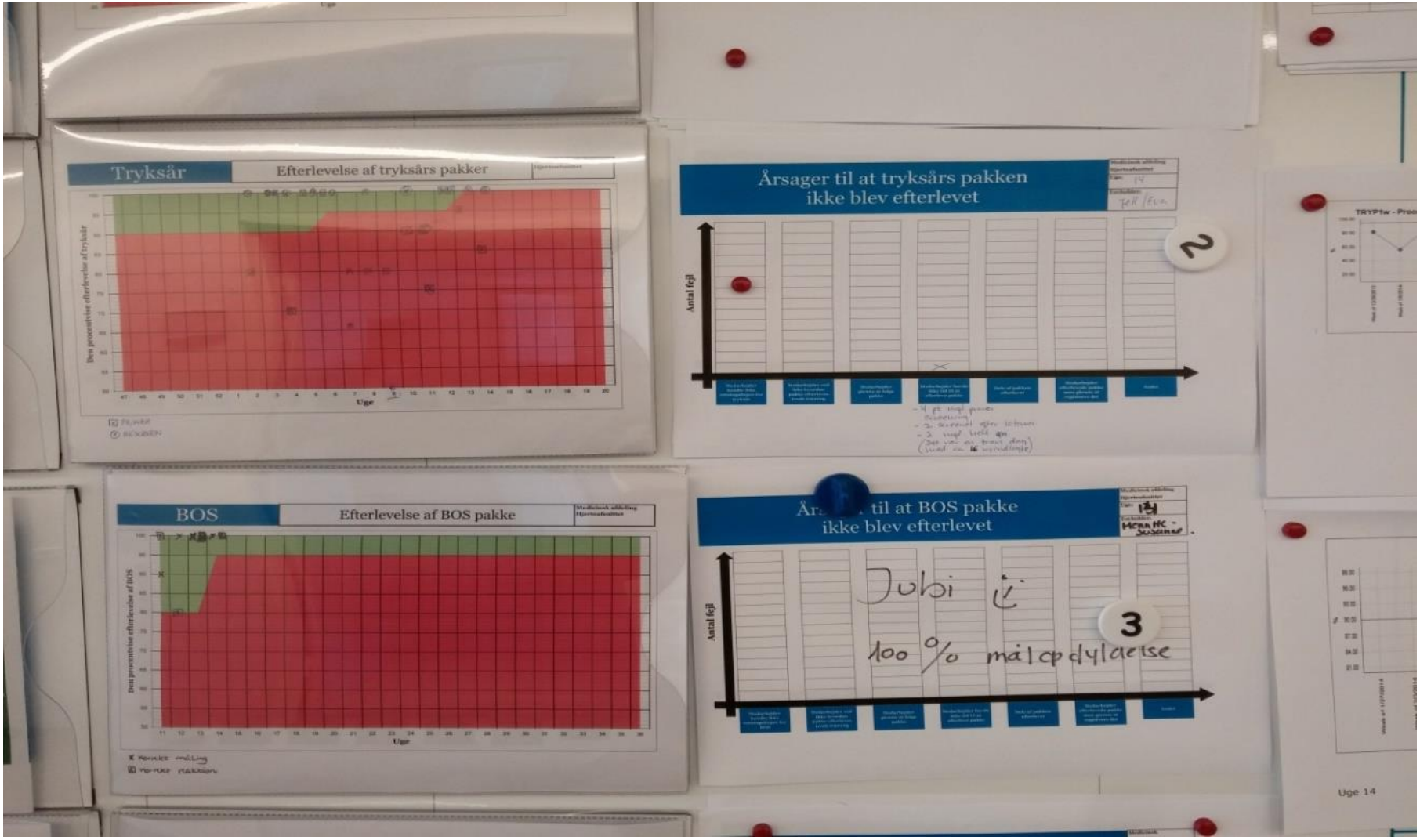

Figure 9. Top: Figure 10 Close-up on "Targets" and Causes/Reasons for not reaching the targets

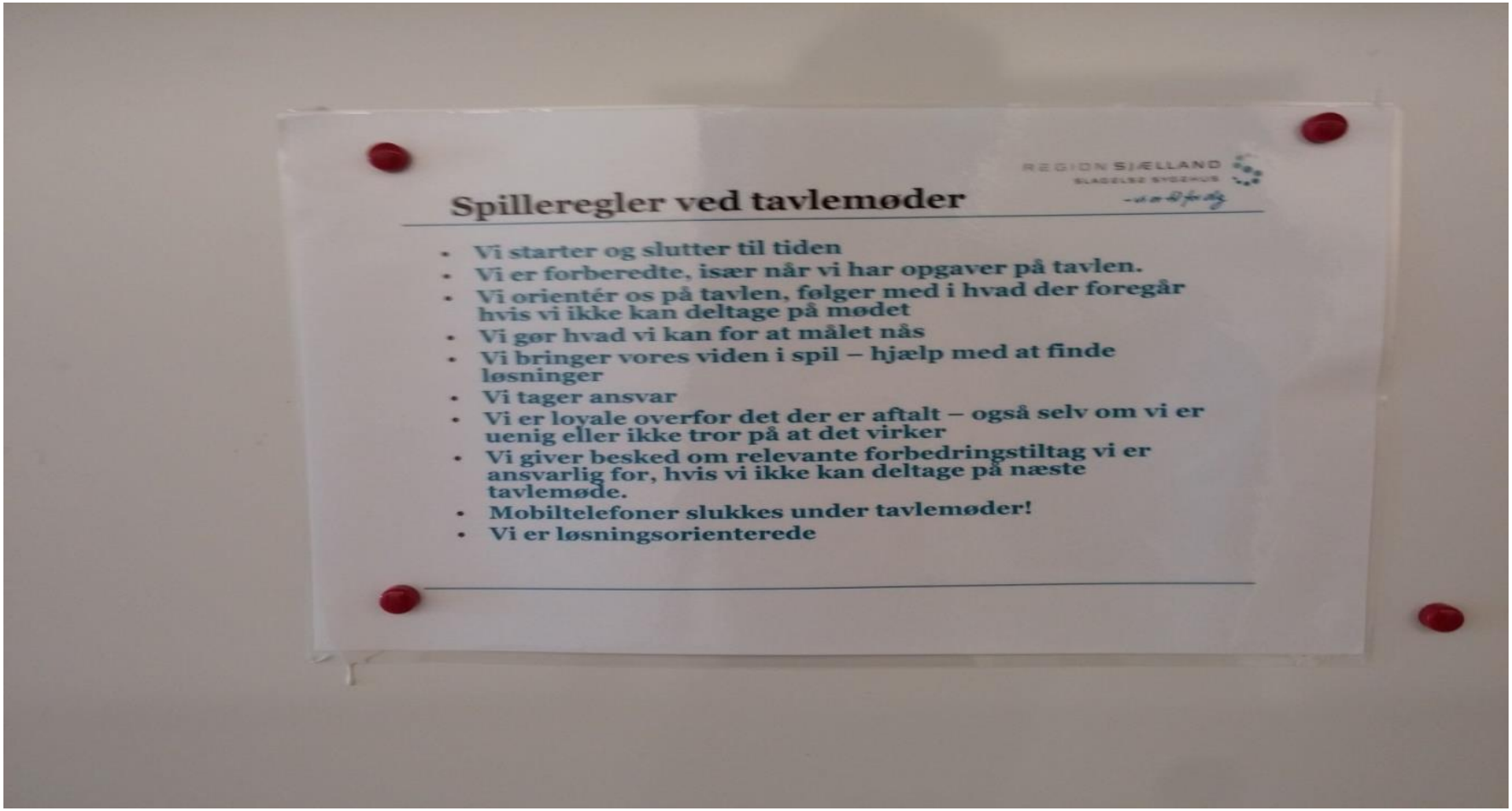

Figure 10. Kaizen meeting rules

Sub-conclusion

In the second research question barriers to implementation were analyzed and a plan for how to organize the continuous improvement initiative was proposed.

The conclusion from the analysis is that employees have little knowledge about the overall purpose of the concept, its terminology, professional skills required or understanding of performance measurement, all of which are deemed as needed to implement the concept of continuous improvement.

Based on the analysis of barriers as well as the previous research question which identified whether there was any need for continuous improvement in the department – and how it should be organized, it was proposed that continuous improvement was implemented through the existing research and improvement initiative, SUMU-I.

Through integration in the SUMU-I initiative, the continuous improvement concept becomes accessible to everybody in the department, including all the respective occupational groups as well as management. Moreover, the fact that the concept has a vantage point in the inclusive SUMU-I initiative remains in accordance with the ingrained in Lean thinking ideal of looking at the entire organization as well with the desire to address communication and professional and functional silos that currently exist in the department.

The initiative will not change the role of the management in any way. The management remains the guiding hand that assures that the department is thriving and that a positive outcome of the improvement initiative is possible. Thus, through the integration of continuous improvement in SUMU-I as the eighth “diagnose-related group”, an employee-supportive/driven angle on implementation is taken.

A look was also taken at Slagelse hospital’s implementation of employee-driven Lean. A visit to Slagelse hospital revealed that the hospital has fully implemented Lean, and according to a nurse manager, the concept had helped to reduce errors and mortality at the same time increasing overall efficiency.

Figures 8, 9 and 10 illustrate what the Kaizen boards at the hospital look like. The Kaizen boards are used to discuss performance, improvements and implementations.

Based on its use at Slagelse hospital, the Kaizen board initiative was suggested to Stråleterapien. The concept can be applied similarly to how it is used in Slagelse hospital, namely, to measure performance and discuss the performance.

Overall, an implementation through SUMU-I was suggested because of the fact that the department is currently doing relatively well and has an ongoing initiative in SUMU-I that focuses on improvement. Thus, it is not likely or needed to have a second initiative. Rather, if Lean’s value perception could be integrated into SUMU-I, and an eighth research group that is concerned with Lean is created, the department can integrate continuous improvement into their current organization without much effort.

Research question #3

- How could continuous improvement be implemented in Stråleterapien?

It was suggested in the second research question that continuous improvement should be organized with a vantage point in the SUMU-I initiative.

The purpose of this research question is to identify how to implement continuous improvement in the department through the SUMU-I initiative.

Implementation guide

C.f. theory section, implementation of Lean in health care often relies on three specific steps, which are illustrated below. The fact that implementation often *relies* on the three steps, does not make the steps the most optimal way to implementation. Therefore, the steps will be used in combination with theory regarding change enablers, which are also perceived as being relevant to this study.

Three steps to implementation	Three steps to enabling change
1. Commitment and participation 2. Developing people before implementation 3. Support from managers	1. Conducting Lean training 2. Initiating pilot projects 3. Implementing the changes

Table 5. Implementation

Commitment and participation are very likely needed to implement continuous improvement through the SUMU-I initiative since the initiative is employee-driven. What is more, creating commitment and participation can be important, because of the fact that there does not appear to be a readiness for change or a baseline that allows for more profound improvement in Stråleterapien.

Thus, Stråleterapien's management must find the right people to set the initiative in motion, people who are enthusiastic about the idea of continuous improvement through Lean, as well as people who sit in the 'right' places in the organization and have the personal ability of motivating others, thus working as improvement agents for the development of the concept.

Saying that the people who will be involved in the initiative must sit in the 'right' places, is means that the initiative must include personnel from the entire organization and all the respective occupational groups, in order to eliminate the functional and professional silos as well as to provide the team with an opportunity to make a thorough analysis later on in the process that is based on first-hand knowledge.

Based on the above, it is possible to propose the following first step in the implementation process:

1. Selection of employees for the initiative should be based on their commitment, qualifications and place in the organization/occupational group.

When the 'right' people have been selected or volunteered for the initiative, the participants must undergo further development which can be brought about through research as well as education.

Regarding research, the participants of the initiative could research Lean health-care literature or use the hospital's contacts to discuss best practice and Lean with other departments or hospitals in order to gain inspiration about continuous improvement.

To get a practical, context-specific training, it is recommended that the group members visit Region Hovedstaden's Lean academy. Here, the group members will receive instruction in Lean and improvement that is closely related to their own context. Thus, the knowledge they would acquire would most likely be relatively easily translated to the context of Stråleterapien.

Based on the above, the second step in the implementation can be argued to be:

2. Develop people and conduct context specific Lean training.

Next, when the SUMU-I continuous improvement team has received its Lean training, the team is ready to apply what it has learned to the context of their own department.

The continuous improvement team can now conduct analyses that are based on the expertise of the group's members, who come from different places in the entire organization. Thus, they can conduct detailed analyses that are based on information directly from people who work with the respective processes on a daily basis.

The fact that the employees conduct the analyses themselves is important for the next steps in the implementation process, as improvement suggestions from peers are less likely to be resisted than suggestions coming from management or subordinates.

Based on the above, the third step in the implementation can be recommended to be:

3. Conduct analyses with tools acquired through Lean training with information from first-hand sources (the employees who are included in the SUMU-I continuous improvement group and their colleagues)

The fourth step would be to put the analyses into action through pilot projects. Pilot projects can be conducted by applying the outcomes of the analyses to practice by making temporary changes to processes to test and measure how the changes affect performance.

Thus, based on the above, the fourth step in the implementation can be proposed:

4. Initiate pilot projects that are based on conclusions from the analyses.

The second last step is to implement the changes for good. Implementation can be done when it is confirmed that the proposed process exceeds the efficiency of the old one.

Therefore, based on the above, the fifth step in the implementation is:

5. Implement the changes that were identified through the analyses and tested in the pilot project.

The final step important for general outcome of the initiative is securing management support.

It is important that managers show their support for the initiative, and do it on a continual basis to let everyone in the department know that the continuous improvement initiatives as well as the SUMU-I program are supported by the management, and that the initiatives have come to stay.

Such support for the initiative can also inspire the personnel in the department to support it, as they realize that the initiative is there to stay, and that the initiative's effects can actually help the department to become more efficient.

There are several ways in which the management can show its support.

Firstly, the management can attend the initiative's meetings, thus showing that they are interested and willing to spend their own time on the initiative, which has signal value to the group members.

Secondly, the management can use their network to establish contact with other departments that work on similar projects. For example, Slagelse hospital is very far in their implementation process of Lean.

As already mentioned, it is important that the management sustains their level of support, thus showing the group that the initiative is important for the long-term sustainability of the department's efficiency.

Therefore, based on the above, the sixth step in the implementation can be argued to be:

6. Management must support the initiative on a regular basis.

A six step guide to implementation

Described in table 6, are the six steps identified in the analysis below that can support an implementation of continuous improvement in Stråleterapien through the SUMU-I initiative. The six steps provide a method for how to implement the initiative.

The six steps are based on Lean implementation theory, but have been adapted to Stråleterapien's context based on the analyses in the previous research question which were made using the data from Stråleterapien.

Step	Description
1	Selection of employees for the initiative should be based on their commitment, qualifications and place in the organization/occupational group.
2	Develop people and conduct context-specific Lean training.
3	Conduct analyses with tools acquired through Lean training with information from first-hand sources (the employees who are included in the SUMU-I continuous improvement group and their colleagues).
4	Initiate pilot projects that are based on suggestions obtained from the analyses.
5	Implement the changes that were identified through the analyses and tested in the pilot project.
6	The management must support the initiative on a regular basis.

Table 6. Six steps to implementing continuous improvement

Changes in patient care and employee conditions

The part below presents a discussion of the consequences that the introduction of Lean in the department can have for the employees and patients.

Direct effects

Initially, there will most likely be very few consequences of the implementation, as the initiative needs to build up momentum, and the involved employees need to learn how Lean works.

Thus, the education of the involved employees will be the only direct consequence to begin with. However, later in the process of integrating the initiative, another direct consequence can be resistance to the changes.

C.f. Table 2, the department's doctors were arguably primarily focusing on clinical value, which means that a broader focus on value for the patient could lead to resistance among the doctors.

C.f. Table 2, the physicists could potentially react the same way, because they enjoy "doing things in their own way".

In such cases, the management needs to diffuse the tensions that may arise and mitigate the negative impact the resistance can potentially have on the rest of the organization. Furthermore, it is required of the management to solve the pressing issues through negotiation with the employees who feel threatened in order to meet their concerns.

Indirect effects

The effects on employees and patients can also occur indirectly, through new work structure and work processes.

Work structure may change to include performance measurement of the respective processes. In such cases, it is necessary to let everybody in the department know that the measurement is used to measure the process, not the employee. Otherwise, employees may oppose the measuring, as they will believe that its purpose is to lay off people who do not perform well.

Another consequence can come as a consequence formalizing the work structure. Standardization is often a consequence of Lean, because there can only be one “best practice”, which is the most efficient and which should be used every time a process is conducted.

Such standardization can lead to stress, as employees will get bored during their new task, being limited to going through the same repetitive motions over and over.

To mitigate this, it is important to involve the employees in the optimization process, to launch pilot projects and to re-evaluate work conditions.

A positive consequence of the implementation can be the fact that employees will get better at understanding the entire treatment process, because they will have to engage in meetings about the process flow, which involves several occupational groups in the current matrix organization.

The purpose of gaining an understanding of the entire process is to get to know what steps in the process are needed, how they should be made and for what. When this is known, it is possible to eliminate waste and suggest improvements that are based on objective performance measures.

Changes in work process are difficult to forecast, because of the department’s complexity. For example, it is easy to argue that the x-ray specialists should have an office very close to the department’s doctors. However, there is a risk that such a change is close to impossible with the current physical configuration and physical layout of the hospital. Thus, there are physical (and most likely clinical) limits to what can be changed in reality.

Finally, while the initiative is employee-driven, negative consequences of changes to the work process should be monitored by the management. The role of the management during and after the implementation of the initiative can involve being a guiding hand that assures that the employees feel supported and that any negative feelings among the employees that may arise as a consequence of the initiative are heard and taken care of by the management.

In regard to the patient, the changes are hard to foresee, as the majority of the department’s processes are not directly visible to the patient. However, a consequence may be an alteration of the current treatment process due to positive findings in the experimental pilot projects regarding best practice of treatment. Thus, the patients may experiences changes in treatment, or feel the consequences through a reduction in the waiting lists.

Found in table 7 is an overview over the identified changes in patient and employee conditions.

Direct changes	**Consequences**
Perception of value	Could potentially give a clearer sense of what the patient needs
Perception of ideal flow	Could potentially improve efficiency in processes
Resistance to change from the physicists	Management needs to diffuse the tension in order not to jeopardize the improvement attempts.
Resistance to change from the doctors	Management needs to diffuse the tension in order not to jeopardize the improvement attempts.
Indirect effects	**Consequences**
Performance measurement	Employees need to be informed why. Resistance to change can occur if not handled correctly.
Standardization	Repetitive work. Pilot projects and re-evaluations are needed to secure employee work conditions.
Value stream analysis leads to better understanding of the department's work	Increased efficiency
Management needs to supervise changes to avoid negative consequences	Managers need to be aware of the changes underway. Management needs to guide the department and reduce negative consequences.

Table 7. Changes in patient and employee conditions

Sub-conclusion

Implementation guide

The analysis regarding implementation of continuous improvement in the department through the SUMU-I program led to a six-step implementation guide.

The guide is based on theory regarding Lean implementation in health care, but the respective steps are adapted to fit Stråleterapien's context.

The purpose of creating an implementation guide that is related to Stråleterapien's context is to ensure that chances of achieving a successful outcome are greater when context is taking into consideration.

Moreover, the proposed six steps have been developed on the basis of the previous research questions, which among other things conclude that education regarding Lean is needed in order to implement the concept.

While the six-step guide is arguably not bullet-proof, it provides the management with a rough estimate of how the initiative can be implemented through SUMU-I, and what has to be taken into consideration during and after the implementation.

Changes in patient and employee conditions

In this section, several potential negative as well as positive consequences of the implementation were identified.

The discussion shows that there are several positive consequences such as potentially increased efficiency and diffusion of the functional and professional silos in the department, which can be a consequence of the education regarding holistic analysis through value stream maps.

However, there can also be negative consequences such as resistance to change if the purpose of the concept is not explained correctly. Another negative outcome might be repetitive work which is a consequence of standardization.

Furthermore, the management needs to support the employees to prevent resistance towards change and mitigate any negative consequences that the change can bring.

Summary

In order to answer the problem statement, three research questions were posed. The research questions were as follows:

1. Why does Stråleterapien need continuous improvement?
2. How could continuous improvement be organized in Stråleterapien?
3. How could continuous improved be implemented in Stråleterapien?

The purpose of the research questions was to systematically build an analysis that combined could be used to answer the goal of this investigation:

How to provide Stråleterapien with a strategy for continuous improvement?

Research question #1

The first research question was divided into three parts: Palliative treatment analysis, context analysis and a current improvement initiative evaluation.

The first part used a value stream map analysis and the seven waste types to find out whether there was a need for improvement in the process. The result showed that there were several types of waste in the process as illustrated by table 1.

The second part used the seven waste types and the value dimensions in order to analyze the context of Stråleterapien. The result showed that there was a lot of waste in the department and that clinical value was prioritized.

The evaluation of the department's current improvement initiatives showed that the department had several sporadic improvement initiatives going on as well as one large, systematic initiative that was subdivided into the seven respective diagnose-related groups that the department is treating. The name of the initiative was SUMU-I (Samarbejde, Udvikling, Mødeaktivitet, Uddannelse og Information).

Based on these findings, it was concluded that there is a need for continuous improvement in the department, as there are many sub-processes in the palliative treatment process that are sub-optimal. However, there is a large improvement initiative already ongoing which should be further evaluated in the next research question to find out how continuous improvement in the department should be structured and organized.

Research question #2

The second research question was divided into two parts.

Firstly, In order to see if there were other barriers to organizing continuous improvement in the department, an analysis of implementation barriers was conducted.

The analysis revealed that employees knew very little about Lean, thus needed education in terminology, personal & professional skills, data collection and performance measuring.

Based on the analysis of barriers as well as an analysis of the employees' perception of themselves, the department and the SUMU-I initiative, the conclusion of the second research question was that continuous improvement should be organized through the SUMU-I initiative as an eighth research group.

This became the conclusion, as in that area the department appeared to be doing well already, which might potentially mean that the dangers of a full-scale Lean implementation would be too great. Moreover, the department had no compelling reason to fully transform, which is why there would be little will to conduct the changes. Based on this, an employee-driven gradual implementation through SUMU-I was proposed.

Finally, as a part of the suggestion for an employee-driven Lean practice, Kaizen boards as seen applied in Slagelse hopistal were suggested.

Research question #3

The purpose of the third research question was to establish how the employee-driven implementation of continuous improvement through SUMU-I can be achieved.

In order to do this, theory regarding Lean implementation in health care was applied, together with a discussion of change enablers and a model for evaluating changes in patient and employee conditions.

The discussion of Lean implementation in health care and change enablers resulted in a six-step guide for implementing the concept.

The guide was based on the respective theory regarding implementation and change, but was proposed based on the previous analyses of Stråleterapien's context. The proposal for implementation was based on the context involving the earlier identified problems of lack of Lean education and functional & professional silos that existed in the department.

After the guide for implementation was proposed, a brief evaluation of the potential direct and indirect effects of the implementation was conducted. The evaluation revealed that there can be negative consequences of standardization, performance measurement and too little education in Lean and its principles.

Based on research question one, two and three, it is now possible to answer the problem statement in the concluding section of this report.

Conclusion

To answer the goal of this investigation

> How to provide Stråleterapien with a strategy for continuous improvement?

Three research questions were posed, each with the purpose of contributing to the creation of a strategy for continuous improvement that is based on Lean. To answer the three research questions, Lean tools as well as theory regarding Lean implementation in health care were applied based on interview data and observations in the department.

Tools such as the value stream map, seven types of waste and the value dimensions all contributed to answering the problem statement.

By mapping the palliative treatment process through a value stream map and analyzing what type of waste there was in and between the respective processes, the analysis revealed that there is room for improvement in the department.

By using the value dimensions to discuss and evaluate what types of value were created, the analysis demonstrated that doctors primarily have a clinical focus, among other things. In other words, there is room for improvement in the doctor's office.

The doctors were not the only occupational group that needed improvement. There are several professional silos throughout the organization, which inhibit process flow and value creation due to miscommunication, interruptions and excess inventory. Through its tools such as the value stream map, Lean can be useful for diffusing such silos and solving the communication problems. Particularly, if the concept is employee-driven such as it was suggested in the second research question.

The analysis of implementation barriers in the second research question, combined with data from the first research question, revealed that very few people in the department are familiar with the Lean concept. Moreover, according to the management the department's baseline is pretty good, which entails that the conditions do not allow for more profound improvements or a full-scale introduction of Lean thinking in the department.

If the management were to try to forcefully implement a new concept in the department, it could have severe consequences for the department's employees and overall efficiency, as it would require the management to deviate from the current employee-supportive strategy, which could potentially lead to distrust between the employees and the management.

Moreover, Stråleterapien is seemingly doing well already, and the analysis revealed that conditions very likely do not allow for profound improvements/transformative changes, and indeed, there is no need for a transformative change in the department.

Thus, a conclusion from the second research question was that Stråleterapien starts an eighth research group in the SUMU-I program, with the purpose of creating an employee-driven Lean initiative that can

expand over time through research, learning and implementing continuous improvement in the department to the extent that it is needed.

The third research question analyzed how the initiative can be implemented based on theory regarding change enablers, implementation and direct and indirect consequences of Lean.

The analysis led to devising a six-step guide for implementing continuous improvement through SUMU-I that also included data from the previous research questions such as the implementation barriers, which revealed a lack of knowledge about Lean.

Moreover, in the evaluation of direct and indirect effects it was mentioned that doctors and physicists may resist to some of the changes, as especially the doctors may perceive Lean as a tool adding non-clinical value. Rather, they may perceive it as an optimization tool and a threat to their independence as a group.

Furthermore, as a consequence of the standardization that Lean can bring to the department, negative feelings may arise among the employees, especially due to performance measuring, because if not educated correctly, employees may begin to think that the purpose of the measuring is to measure individual performance, instead of the processes.

The proposed strategy was described above. An overall conclusion to the proposed strategy is that the department should include the employees in the initiative and let them drive it forward, since there does not appear to be a pressing need to conduct a transformative change at the moment.

When the employees are more informed on what Lean is, the initiative could be evaluated with the management, and if positive, the first pilot projects could be put into motion. Once again, patience and thoroughness are important in order to make sure that the details are in order and that no unexpected resistance is met.

If the management and the involved employees see a potential in the projects, it is important that the management are supportive and that the resistance is neutralized through first of all cooperative methods.

According to sources who are involved with Lean at Herlev hospital, the word goes that the hospital will try to push for implementing Lean in the hospital. If this becomes reality, Stråleterapien will have a head start in comparison to the other departments, and may have the capabilities and competences to lead the way, and inspire the other departments to make the journey as well.

At least, with the strategy provided for Stråleterapien in this study, the department has little to lose by trying it, as the elements for initiating the project are already present. The worst that can happen is that the employees who are working with the initiative become wiser on value perception, value streams, waste and a Lean thinking.

Discussion

Included in this section is a discussion of perspectives, approaches and fields that could be beneficial to investigate.

The study was conducted with the purpose of creating a strategy for how Stråleterapien could continually improve with a relatively limited knowledge of Lean and the principles of the concept.

In the first phases of the study, it became increasingly clear that Lean is not what I had thought that it was, and certainly it was not what everyone else in the department had thought. Thus, my perception of Lean changed throughout the study, from perceiving the concept as a process improvement tool to a philosophy which sees value from the perspective of the customer/patient.

From this point on, I realized that a definition of value would be important for the analysis, as value from the customer's perspective is a key element in Lean, an element which arguably should have a high priority for all companies and hospitals.

The fact that I only realized the importance of value after the initial round or two of interviews resulted in little detailed knowledge of Stråleterapien's value perception besides what the employees at Stråleterapien emphasized as the most important. Thus, the inquiry provided data about their perception of value, although in retrospect, more inquiries in regard to value and the perception of value should have been made during the interviews.

The initial misconception of value resulted in an overall lesser focus on value than there should have been to reach the best measure of value possible, and resulted in the fact that the term "value" had to be used comparatively to the perceptions of value in the respective occupational groups of the department rather than having a central role.

If value from the customer/patient's perspective had played a larger role, more misconceptions of value could have been revealed.

The case design could also have been designed differently though a comparative multi-case study of Stråleterapien and Slagelse rather than a single case study of Stråleterapien.

The investigation included a visit to Slagelse hospital, which has already implemented Lean, and has applied Lean in its entire organization. Moreover, employees in the hospital have grown accustomed to the concept, which could be observed through the way that Kaizen board meetings were conducted, in which every employee in the department was involved. Furthermore, secretaries and nurses had become Lean agents and were continually proposing incremental improvements to increase the department's performance, and generally thinking in Lean terms outside of the Kaizen board meeting times.

A comparative multi-case study would have had an emphasis on the context, how it differs and what best practices could be transferred from Slagelse hospital's context to Stråleterapien's. The analysis would have included an analysis of Lean tools similar to those applied in this investigation, only with a comparative element of whether the Lean tools that were used at Slagelse could be applied in Stråleterapien, thus providing Stråleterapienwith a strategy based on concrete Lean tools.

Such case design could have led to a lesser emphasis on employees, their values and what the current improvement initiatives at the moment are, because scarce resources such as time would have been distributed between Slagelse hospital and Stråleterapien, leading to less time spent at Stråleterapien, and a more shallow understanding of how the department functions than through the single case method. Consequently, it would have been difficult to prioritize time for the examination of palliative treatment process. Thus, the miscommunication and functional silos issues may not have been identified in the same degree as they were through the single case design.

As emphasized at the end of the conclusion, creating a continuous improvement initiative that is based on Lean is almost without costs for Stråleterapien for a very long time. Several hospitals in Denmark have already implemented Lean. One of them is Slagelse hospital, which according to the head nurse that I was speaking with, has had nothing but positive outcomes and a large efficiency boost, which is also confirmed in the Danish newspaper Berlingske (Pedersen, 2013).

Region Hovedstaden has also established a Lean academy, which educates health care staff in Lean, which Stråleterapien's staff can take advantage of in case they choose to implement Lean.

Also Herlev hospital has its own Lean consultant, with whom I had several conversations during the study. The consultant was very helpful and interested in my research, because Stråleterapien is a department that he was not very familiar with.

Thus, the cost of attempting to implement continuous improvement and Lean through an eighth 'diagnose-related group' in the SUMU-I program is almost free of charge except for the time that is invested in it by the management and the employees who participate.

Finally, if Lean really has come to the Danish health care system to stay, Stråleterapien still has time to slowly look into the concept and build up momentum over time before choosing whether the concept should be used or not.

References

Aherne, J., & Whelton, J. (2010). *Applying lean in healthcare: A collection of international case studies* CRC Press.

Bak-Bernth, T., & Vinterberg, J. (2010). Lean i praksis.

Bogdan, R. C., & Biklen, S. K. (1998). Foundations of qualitative research in education. *Qualitative Research in Education: An Introduction to Theory and Methods,* , 1-48.

Bojesen, A. (2010). In Bojesen K., Bojesen A. and Paarup-Nielsen A. (Eds.), *Lean og arbejdsmiljø - et dynamisk spændingsfelt* (1st ed.) L&R Business.

Danske Regioner, F. (2014). Frit sygehusvalg: http://sygehusvalg.dk/.

de Souza, L. B., & Pidd, M. (2011). Exploring the barriers to lean health care implementation. *Public Money & Management, 31*(1), 59-66. doi:10.1080/09540962.2011.545548

Deal, E., Terrence, & Kennedy, A., Allan. (1999). *The new corporate cultures* Basic Books.

Delbridge, R., & Kirkpatrick, I. (1994). Theory and practice of participant observation. *Principles and Practice in Management Research, Aldershot: Dartmouth,* , 35-62.

Fillingham, D. (2007). Can lean save lives? *Leadership in Health Services, 20*(4), 231. doi:http://dx.doi.org/10.1108/17511870710829346

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry, 12*(2), 219-245.

Glouberman, S., & Mintzberg, H. (2001). Managing the care of health and the cure of diseaseâ€"Part II: Integration. *Health Care Management Review, 26*(1), 70-84.

Goldratt, M., Eliyahu. (2012). *The goal* (25th Anniversy Ed ed.) North River.

Grønborg, C. (2011), Alle hospitaler skal bruge LEAN. *Region Hovedstaden.*

Hammer, M. (1990). Reengineering work: Don't automate, obliterate. *Hardvard Business Review,* (July-August), 104-112.

Hasle, P. (2014). Lean production - An evaluation of the possibilities for an employee supportive lean practice. *Human Factors and Ergonomics in Manufacturing & Service Industries, 24*(1), 40-53.

Hasle, P., Bojesen, A., Jensen, P. L., & Bramming, P. (2012). Lean and the working environment: A review of the literature. *International Journal of Operations & Production Management, 32*(7), 829-849.

Heissel, A. (2011). Herlev træder ud af skandalens skygge. *Dagens Medicin*

Holden, R. J. (2011). Lean thinking in emergency departments: A critical review. *Annals of Emergency Medicine, 57*(3), 265-278. doi:http://dx.doi.org/10.1016/j.annemergmed.2010.08.001

Homgård, H. C., Wagner, M., Lukasevic, A., Grynnerup, S., & Schlünssen, P. (2013). Change managment in the hospital sector - a case study research of a radiotherapy department seen retrospectively.

Institute of Medicine (US) Committee on Quality of Health Care,in America. (2001). *Crossing the quality chasm: A new health system for the 21st century* National Academies Press.

Kristensen, T. S., Borritz, M., Villadsen, E., & Christensen, K. B. (2005). The copenhagen burnout inventory: A new tool for the assessment of burnout. *Work & Stress, 19*(3), 192-207. doi:10.1080/02678370500297720

Kristensen, T. S., Hannerz, H., Hogh, A., & Borg, V. (2005). The copenhagen psychosocial questionnaire-a tool for the assessment and improvement of the psychosocial work environment. *Scandinavian Journal of Work Environment and Health, 31*(6), 438-449.

Mark, S., Philip, L., & Adrian, T. (2009). *Research methods for business students* (5th ed.) Pearson Education Ltd.

Mazzocato, P., Savage, C., Brommels, M., Aronsson, H., & Thor, J. (2010). Lean thinking in healthcare: A realist review of the literature. *Quality and Safety in Health Care, 19*(5), 376-382.

Nelson-Peterson, D., & Leppa, C. J. (2007). Creating an environment for caring using lean principles of the virginia mason production system. *Journal of Nursing Administration, 37*(6)

Pedersen, S., Flemming. (2013, Sådan blev udskælndt sygehus til danmarks hospitals-duks. *Berlingske,*

Poksinska, B. (2010). The current state of lean implementation in health care: Literature review. Retrieved 4, 19,

Radnor, Z. J., Holweg, M., & Waring, J. (2012). Lean in healthcare: The unfilled promise? *Social Science & Medicine; Part Special Issue: Organization Studies and the Analysis of Health Systems, 74*(3), 364-371. doi:http://dx.doi.org/10.1016/j.socscimed.2011.02.011

Radnor, Z., Walley, P., Stephens, A., & Bucci, G. (2006). *Evaluation of the lean approach to business management and its use in the public sector* Scottish Executive Edinburgh.

Remenyi, D., Williams, B., Money, A., & Swartz, E. (1998). *Doing research in business and management: An introduction to process and method* SAGE Publications Ltd.

Schein, H., Edgar. (2010). *Organizational culture and leadership* (4th ed.) Wiley.

Setijono, D. (2010). A conceptual framework for managing the performance of construction supply chain. *International Journal of Productivity and Quality Management, 5*(1), 1-20.

Shah, R., & Ward, P. T. (2007). Defining and developing measures of lean production. *Journal of Operations Management, 25*(4), 785-805. doi:http://dx.doi.org/10.1016/j.jom.2007.01.019

Ulhassan, W., Sandahl, C., Westerlund, H., Henriksson, P., Bennermo, M., von, T. S., & Thor, J. (2013). Antecedents and characteristics of lean thinking implementation in a swedish hospital: A case study. *Quality Management in Healthcare, 22*(1)

Womack, J. P., & Jones, D. T. (1996). Beyond toyota: How to root out waste and pursue perfection. *Harvard Business Review, 74*(5), 140-158.

Womack, J. P., & Jones, D. T. (2010). *Lean thinking: Banish waste and create wealth in your corporation* Simon and Schuster.

Yin, R. (2014). *Case study research* (5th ed.) SAGE Publications, Inc.

Young, T. P., & McClean, S. I. (2008). A critical look at lean thinking in healthcare. *Quality and Safety in Health Care, 17*(5), 382-386.

Bibliography

Birkinshaw, J., & Gibson, C. (2004). Building ambidexterity into an organization. *MIT Sloan Management Review, 45*, 47-55.

Burgess, N., & Radnor, Z. (2013). Evaluating lean in healthcare. *International Journal of Health Care Quality Assurance, 26*(3), 220-235.

De Souza, L. B. (2009). Trends and approaches in lean healthcare. *Leadership in Health Services, 22*(2), 121-139.

Fernandez, S., & Rainey, H. G. (2006). Managing successful organizational change in the public sector. *Public Administration Review, 66*(2), 168-176.

Gagliardi, P. (1986). The creation and change of organizational cultures: A conceptual framework. *Organization Studies, 7*(2), 117-134.

Hall, M., Kutsch, E., & Partington, D. (2012). Removing the cultural and managerial barriers in projectâ€toâ€project learning: A case from the uk public sector. *Public Administration, 90*(3), 664-684.

Kim, C. S., Spahlinger, D. A., Kin, J. M., & Billi, J. E. (2006). Lean health care: What can hospitals learn from a worldâ€class automaker? *Journal of Hospital Medicine, 1*(3), 191-199.

Koelling, C. P., Eitel, D., Mahapatra, S., Messner, K., & Grove, L. (2005). Value stream mapping the emergency department.

Kollberg, B., Dahlgaard, J. J., & Brehmer, P. (2006). Measuring lean initiatives in health care services: Issues and findings. *International Journal of Productivity and Performance Management, 56*(1), 7-24.

Lodge, A., & Bamford, D. (2008). New development: Using lean techniques to reduce radiology waiting times. *Public Money and Management, 28*(1), 49-52.

Lummus, R. R., Vokurka, R. J., & Rodeghiero, B. (2006). Improving quality through value stream mapping: A case study of a physician's clinic. *Total Quality Management, 17*(8), 1063-1075.

Manos, A., Sattler, M., & Alukal, G. (2006). Make healthcare lean. *Quality Progress, 39*(7), 24.

Nelson-Peterson, D., & Leppa, C. J. (2007). Creating an environment for caring using lean principles of the virginia mason production system. *Journal of Nursing Administration, 37*(6), 287-294.

Parker, S. K. (2003). Longitudinal effects of lean production on employee outcomes and the mediating role of work characteristics. *Journal of Applied Psychology, 88*(4), 620.

Portes, A. (2000). Social capital: Its origins and applications in modern sociology. *LESSER, Eric L.Knowledge and Social Capital.Boston: Butterworth-Heinemann,* , 43-67.

Schein, E. H. (1996). Three cultures of management: The key to organizational learning. *Sloan Management Review, 38*(1), 9-20.

Serrat, O. (2009). The five whys technique.

Singh Gill, P. (2012). Application of value stream mapping to eliminate waste in an emergency room. *Global Journal of Medical Research, 12*(6)

Spear, S. J. (2006). Fixing healthcare from the inside: Teaching residents to heal broken delivery processes as they heal sick patients. *Academic Medicine, 81*(10), S144-S149.

Appendices

The appendices to this investigation are found attached on a CD-ROM that is found on the back of the back side page of the study.