

STOCKHOLM SCHOOL OF ECONOMICS
DEPARTMENT OF MANAGEMENT AND ORGANIZATION
MASTER THESIS
EXAMINATION FOR A MSc IN BUSINESS AND ECONOMICS
ADVISOR: MATTIA BIANCHI

“LEANIFYING” HIGH-VARIABILITY OPERATIONS

Lessons from applying lean to oncology care.

Damiana Spadafora

December 9, 2013

Abstract - The increasing toll exerted by health care on society has called for the application of new management techniques that demand fewer resources. This demand has not gone unanswered and health care structures are starting to experiment with a set of tools borrowed from car manufacturing: Lean.

As a relatively new phenomenon a definitive assessment of the efforts in this respect has yet to be made, but so far the results seem to be positive. And while the examples of successful Lean applications in hospitals increase the question rises as to whether these outcomes can be applied to every branch of health care.

By taking the example of oncology care the author aims at showing what happens when variation in the operations is a desired quality, rather than a source of waste. By combining classical and newer perspectives on the application of Lean the author aims at providing a critical framework for defining the importance that should be given to variation in different scenarios. The cases studies, three oncology departments in Stockholm's main health structures, exemplify the dilemma between accommodating and reducing variation and how these choices affect the implementation of Lean. The result of this work is not to be seen only as proof of the versatility of Lean, but also as a moment of reflection as to what value is and being efficient is not always enough in delivering it.

Keywords: Lean Production, Lean Consumption, Health Care Management, Variation, Knowledge Sharing, Standardization

ACKNOWLEDGMENTS

There are several people I would like to thank as they have been an important part in the process of completing my work.

First I would like to thank all of my interview respondents who have given me their most precious resource: time, without their generosity this work could not have been possible. Second I would like to thank my supervisor for bringing me back to the right track when I was lost. Finally, I would like to thank my family and the friends who have provided me with the moral support and the strength I needed during all these months. I thank you all.

Stockholm, 9 December 2013

Damiana Spadafora

TABLE OF CONTENTS

1. Introduction.....	5
1.1. Background	5
1.1.1. Lean in contexts of high variability.....	5
1.1.2. Oncology as an example of a high variability context	6
1.2. Focus of the study	7
1.3. Expected Contribution and Purpose.....	8
1.4. Research Question.....	8
1.5. Clarification of Concepts	8
1.6. Disposition.....	9
2. Literature Review.....	11
2.1. Defining Lean.....	11
2.2. Defining variation	12
2.3. The necessity of taking away variation.....	13
2.4. The importance of keeping variation.....	14
2.5. Bringing together lean and variation.....	17
2.6. Compartmentalizing variability: an alternative approach.....	19
2.7. Distinguishing between good and bad variation	21
3. Methodology.....	22
3.1. Establishing a Research Design.....	22
3.1.1. Gathering perspectives through in-depth interviews	23
3.1.2. Case Study as the Research Design	24
3.2. Gathering data.....	25
3.2.1. Semi-structured Interviews	26
3.2.2. Selecting the respondents.....	27
3.3. Analyzing the data	29
3.4. Limitation and credibility of the study.....	30
3.5. Ethical Considerations	31
4. Empirics.....	33
4.1. An overview of oncology.....	33
4.2. Sources of variation in oncology.....	35
4.2.1. input variation: How patients' needs affect the delivery of cancer care	35
4.2.2. Process variation: How the chosen treatment affects the delivery of cancer care.....	36
4.2.3. How variation in information affects the delivery of cancer care	37
4.3. Reducing variation: the patient path at Capio St:Göran and södersjukhuset	39

4.4. Accommodating variation: the patient at Karolinska	41
4.5. Dealing with variation coming from the patients' needs.....	43
4.5.1. The role of the contact nurse	43
4.5.2. Scheduling	44
4.6. Different ways of treating cancer: from standardized practices to "gray areas"	46
4.6.1. The doctor and the nurse as project managers.....	46
4.7.2. Continuous checks in the performance	47
4.7. Dealing with variation in information.....	48
4.7.1. Formal sharing of knowledge.....	48
4.7.2. Training and informal sharing of knowledge	48
4.7.3. Checklists as a means of sharing information	50
4.8. Separating good and bad variation.....	50
4.9. Results from applying Lean to a high-variation context.....	51
5. Analysis	53
5.1. Establishing Value: Good Variation and Bad Variation	53
5.2. Managing variation: knowledge as an "andon" system.....	54
5.2.1. Striving towards making communication explicit.....	55
5.2.2. Sharing knowledge through redundancy	56
5.2.3. Sharing knowledge through training	56
5.2.4. Reducing input variation: the customer as andon system	58
5.3. A word of caution when it comes to knowledge sharing.....	59
5.4. Reducing variation: scheduling.....	60
5.5. Dealing with the choice of keeping variation	61
5.5.1. The doctor as a project manager.....	61
5.5.2. Have own set of kpi.....	62
5.6. A final note on choosing to accommodate or reduce variation	62
6. Final remarks	64
6.1. Conclusions.....	64
6.2. Theoretical Contribution	65
6.3. Limitations.....	65
6.4. Suggestions for further research.....	66
Bibliography.....	68
Appendix A – List of Conducted Interviews	74
Appendix B – Interview Guidelines	75
Guidelines for Interview – Medical Personnel.....	75
Characteristics of oncologic care.....	75

wastes in oncology wards	75
solutions implemented.....	75
Prototype for Interview – Patients.....	76
Appendix c – selected quotes from respondents	77

LIST OF FIGURES

FIGURE 1 - A NEGATIVE PERSPECTIVE ON LEAN	13
FIGURE 2 - THE EFFICIENCY PARADOX AND THE LAW OF VARIATION	14
FIGURE 3 - SCIENTIFIC AND ARTISTIC PROCESSES	16
FIGURE 4 - FROM LEAN PRODUCTION TO LEAN CONSUMPTION.....	17
FIGURE 5 - BRINGING TOGETHER STAATS AND NONAKA.....	18
FIGURE 6 - MANAGING DIFFERENT DEGREES OF VARIATION	19
FIGURE 7 - FREI'S ALTERNATIVE APPROACHES TO VARIATION.....	20
FIGURE 8 - CHOOSING THE RESEARCH DESIGN	22
FIGURE 9 - SELECTING THE RESPONDENTS	27
FIGURE 10 - DUBOIS' SYSTEMIC COMBINING	29
FIGURE 11 - PATIENT PATH AT CAPIO	39
FIGURE 12 - PATIENT PATH AT KAROLINSKA	41
FIGURE 13 - KNOWLEDGE SHARING.....	55

1. INTRODUCTION

1.1. BACKGROUND

1.1.1. LEAN IN CONTEXTS OF HIGH VARIABILITY

Out of all the existing literature on Lean, which seems to have touched every possible field (“This is Lean” by Modig and Åhlström counts 37 fields out of a quick research on Amazon) one field has remained untouched: what to do in cases of processes with in-built variation and uncertainty. The limitations of applying Lean in this context were pointed out already in the ‘90s with the critique that a Lean system might be too rigid (Cusumano, 1994) and therefore agile practices might be a better fit for such context (*inter alia*: van Hoek et al., 2001). Hines (2004) addresses these issues by providing a dynamic perspective of Lean in which this philosophy is presented as moving from focusing on cells and assembly lines to customer value. And indeed this shift can be seen in the existing literature about Lean which has moved from Lean Production (Womack and Jones, 1994) to Lean Consumption (Womack and Jones, 2005). This shift has been accompanied by an increased reach of Lean to different industries until the point previously raised. Nonetheless, regardless of the industry Lean touches, throughout the existing publications one recurring theme remains: the necessity to reduce variation in order to not only use the existing resources more efficiently, but also to achieve a better flow of the good which is being processed.

So, what happens when, in response to resource constraints a unit whose practices are characterized by a high level of variation decides to implement Lean? There is an existing study from Staats et al. (2011) which explores how Lean can be applied to knowledge work, software development in their case. As it will be discussed in the Literature review, their conclusions are relevant for this study, but as they point out, they are affected by three limitations: that the study could not be generalized to other contexts, given the specific features of providing services in the software industry; that the project was still ongoing at the time of the study and therefore no definitive results could be pointed out and finally the lack of definition for Lean in service development that could be used as a basis to decide whether the company was practicing Lean in the first place.

In conclusion, given the scarcity and the specificity of the existing literature on the subject, further research is required that explores what happens at the junction between Lean and high variability.

1.1.2. ONCOLOGY AS AN EXAMPLE OF A HIGH VARIABILITY CONTEXT

In order to overcome these limitations the author turned to the field of health care. First, as it will be pointed out while describing the case in the Empirics section the units studied have been working with Lean for several years now and have already seen positive results. Second, there is enough literature on bringing together health care and Lean that no question arises as to what Lean in health care is and whether a hospital is following its principles or not. Murray and Berwick (2003) showed how applying Lean practices can, among other results, reduce the variation in demand and in the options available to patients to access the care facility, reduces waiting times in a primary care setting without adding resources. Similarly an extensive study conducted in an English Primary Care Trust pointed out that a significant portion of the hospital's daily processes represented waste which could be reduced by eliminating the variation in the workflow and in the demand (Grove et al., 2010). Other publications demonstrate similar results in emergency care (Fillingham, 2007; Mazzocato et al., 2012) and make evident how these conclusions can be extended to several other departments inside hospitals (Cooper et al, 2008).

There is though, one particular department that has remained relatively untouched by studies on the implementation of Lean: oncology. There exists an editorial in which Montesarchio et al. (2012) stated the case for the need to apply Lean in oncologic care. At the same time a study from van Lent et al. (2008) conducted in a chemotherapy day unit showed the possibility of achieving positive results when applying Lean practices to oncology units. But in the first case the authors expressed their personal views as experienced doctors on the necessity of applying Lean to oncology care. In the second paper instead the discussion is limited to the exposition of the result of implementing a series of initiative in the unit and no inference is made which can be applied outside the case studied. What makes oncology interesting for trying and understanding the implementation of Lean in contexts of high variability is that this variation is embedded in the practice, which is a distinguishing feature in a world, the one of health care, which is heavily pushing towards standardization. Oncologists do not know from the start what effects the treatment might have on the patient and whether it will be beneficial at all. Patients with tumors which, from a clinical point of view, might be considered similar, respond differently to the same treatment. At the same time, while some patients are cured, others have relapses (Bast et al., 2004) which leaves doctors in the difficult position of having to make changes halfway through the patient's established path. Such a dynamic approach likens oncology to the oncology work described by Staats (2011).

This uncertainty affects negatively patients as well, who in turn put pressure on the caregiving unit for a timely delivery of care. In other words Murray and Berwick's initiative of reducing access options and variation in demand would have negative effects in oncology care. Cancer patients need in fact several contact points with the unit in order to reduce the uncertainty stemming from their condition (more about the peculiarities of Patients' needs will follow in the Empirics section).

While interesting at a theoretical level, there is also a practical rationale in looking at the implementation of lean in high variability contexts by taking the example oncology care. Cancer is in fact exacting an ever increasing toll on society. 12 million new cases of cancer are registered every year in developed countries alone and this figure is destined to increase to 27 million by 2030. At the same time, curing cancer is expensive. In Sweden, for example, the expenditure for cancer patient amounts to 7% of the total health care cost and the newest treatments cost much more than the ones that preceded them (Sullivan et al., 2011). And the shortage is not only in money, as the number of oncologists decreases (Erikson et al., 2007). The third constraint comes, in Sweden, from the Swedish government itself. In fact, in order to reduce cancer patients' waiting times, a fine has been imposed on all the hospitals which do not manage to see patients within established times.

In light of these limitations the choice made by the hospitals that are object of this study is not at all surprising. Capio St. Göran and the Karolinska Institute, in fact, started to work with the implementation of Lean practices in all of their departments several years ago. There is still some road to cover, but the results have been positive so far. Capio has been praised on the Economist (Schumpeter, 2013) for its successful application of Lean while Karolinska has introduced its own Lean agenda aimed at "improving patient security and quality, improving the work environment, improving availability and utilization of resources and creating long-term sustainable results" (Karolinska website). Interestingly, regardless of its peculiarities the oncology department was not left outside this improvement campaign. It therefore represents a good case to see first-hand what happens when Lean is applied to a context that seems to go outside one of its cornerstones: the imperative to systematically reduce variation.

1.2. FOCUS OF THE STUDY

Most of the existing theory about Lean and health care, hereby introduced as the case researched belongs to this industry, focused on how Lean was implemented in wards and hospitals and thus

devotes a section on stakeholder management and change management. Radnor and Boaden gave an extensive review of this issue (2010). But this leaves a void in literature as to whether and how Lean had to be changed in order to account for the peculiarities of the care provided. In the case under study, the debate whether Lean should or should not be used for managing the operations has already been conducted, all the relevant stakeholders seem to have been involved, there have been already changes in established practices, and Lean is now widely implemented. In accordance with this scenario, I decided to focus on the critical evaluation of the feasibility of Lean in a context which is highly sensitive to variation.

1.3. EXPECTED CONTRIBUTION AND PURPOSE

This paper makes contributions to the existing body of research of operations management and health care management. First, it adds to the existing body of literature about Lean to show how this philosophy can be applied in a context of high variation, which is a field that has been so far been researched by one author, to whose work this study aims at giving validation. Second a framework will be provided as to what Lean in oncology is and how it can be applied to other cancer units.

Given the background insofar provided, the purpose of this study is to:

-Propose an application of the Lean framework to a context with embedded high variation

1.4. RESEARCH QUESTION

Therefore, the research question can be formulated as:

-How does the variation inherent to the nature of certain processes affect the implementation of Lean?

The sub-questions can consequently be formulated as:

-How to differentiate for variation which needs to be reduced and variation which needs to be accommodated?

- How to include the variation that cannot be reduced in a successful Lean implementation?

1.5. CLARIFICATION OF CONCEPTS

Andon: Signaling system aimed at bringing attention on a problem that is affecting the flow. (Liker, 2004)

Flow: The progressive achievement of tasks along the value stream so that a product proceeds from design to launch, order to delivery, and raw materials into the hands of the customer with no stoppages, scrap or backflow (Womack and Jones, 2003)

Heijunka: leveling out the workload, or scheduling the production so that the production line gives out the same sequence of products throughout a given time period, with this sequence alternating between demanding and less demanding products (Hüttmeir et al., 2009).

Lean: coined by Krafcik (1988) this word is used as a synonym for the Toyota Production System, which is a set of principles originally thought for car manufacturing. It focuses on removing waste in the process, a “pull” rather than a “push” approach to inventory and improvement coming from the front lines.

Oncology Care: in this paper this term is used to indicate the all the medical care given to the patient affected by cancer, regardless of it being chemotherapy, radiotherapy or surgery. The different treatments will be pointed out when such distinction becomes relevant.

Process: A series of individual operations required to create a design, completed order, or product (Womack and Jones, 2003)

Shusa: In the Toyota Production System, the leader of the team in charge of designing the product. Per extension, the whole team centered design system.

Value: A capability provided to a customer at the right time at an appropriate price, as defined in each case by the customer (Womack and Jones, 2003)

1.6. DISPOSITION

After the introduction section, the work will proceed on to Section 2 which will guide the reader through the existing literature about the relationship between Lean and variation, analyzing and evaluating the different perspectives on the topic. In Section 3 the methodology approach chosen for the study will be explained. In this section information is also provided about the hospitals chosen as case study and limitations of the chosen approach. Section 4 will present the data gathered for this

study. First an overview of the observed sources of variation and their magnitude will be given, followed by an exposition of the practices implemented to deal with the different sources of variation while respecting the Lean mission. Section 5 will provide an analysis of the data gathered and provide a framework for how to distinguish between the variation that should be eliminated and the one that should be accommodated and how to reconcile the implementation of Lean and the presence of variation. Finally in section 6 conclusions will be drawn as to the results of the research, the limitations of such conclusions will be pointed out and suggestions for further research will be given.

2. LITERATURE REVIEW

The upcoming section will first provide a brief overview of the main components of Lean and the definitions of variation that will be used for this paper, and then the role of variation in Lean literature will be outlined together with the different perspectives on the subject. It will be first shown why it is crucial for some authors to reduce variation when implementing Lean, then the opposite perspective will be analyzed, how to keep variation in Lean. The final section about which stance to take will be followed by the formulation of hypotheses which will be tested in the empirics and analysis sections.

2.1. DEFINING LEAN

As described by Womack and Jones, (2007), “Lean” as a production system has its origins in the after-war Japanese car industry. Due to the severe resources constraints that severely hampered its production, Toyota created a new production system which would allow for a production that required fewer resources, hence Lean. It was not referred as Lean in Japan, where it is known as the Toyota Production System. Lean was the term under which it was taken to the Western as it would bring attention to the most immediate feature of this model: its lower requirements in terms of resources. This does not mean that Lean plants work with small capacity, but rather that they have found a way of taking away all the resources locked up in a state where they do not add value. These resources represent what is known in the Toyota Production System as *muda* or waste, and should therefore be removed. The “truly lean plant” achieves this removal in two ways: first, it transfers the highest possible amount of tasks and responsibilities to the frontline workers because they are the ones who are adding value to the product and therefore can identify right away which activities add value and which ones can be considered a waste. Second it has put in place a system to detect mistakes and trace them back to their cause, fast. This, in turn, requires well-functioning teamwork among frontline workers and a relatively uncomplicated information system that allows workers to check that everything is flowing smoothly and eventually run to have problems fixed. In the Japanese plants for example, all the information related to the production from targets to personnel shortages, is showed up on big electronic displays which are referred to as *andon*. This way whenever an issue requires attention, the person in charge of fixing it (having a clear role definition is a key component of Lean production) can quickly attend to it.

2.2. DEFINING VARIATION

As Modig and Åhlström (2012) stated “*there will always be variation in a process*” and, according to the authors, this variation has its source in three different factors: resources, flow units and external factors. In the first instance it is included not only the equipment used to perform a task but also the person behind the equipment. Flow units instead are defined as the units that are being processed, which can be an engine component but also a patient receiving a treatment. Finally the term external factors encompasses all the events that happen outside the unit of production, but whose consequences bring variation to the production, like an outbreak of flu which will increase the demand for doctors’ time and hospital beds. Further insight into how variation affects resources can be found in McLaughlin (1996), which proposed three more categories whose variation affects production: input, process and information. McLaughlin’s distinction is particularly useful in the service industry, where with the customer being at the same time the unit that is being processed and the final recipient of value Frei (2006) pointed out the importance of understanding where exactly variation is coming from in order to be able to manage it. According to Frei in fact, variation coming from the customer’s side, or using Modig’s terminology, from the flow unit, can present itself in five different ways: arrival variability, the customer might require processing at unexpected times; request variability, the customer might have requests that go beyond the standard offering; capability variability, the customer’s own skills and knowledge influence how much help should be provided to the customer in satisfying her needs; effort variability, customers differ in how much effort they are willing to make with each interaction with the business; subjective preference variability, the personal perception as to what constitutes a good service affect the customer’s view of the service provided.

2.3. THE NECESSITY OF TAKING AWAY VARIATION

There is no shortage of literature about Lean and the necessity to remove variation from the processes. The importance of standardizing tasks is heavily marked by Womack and Jones (2007) which oppose

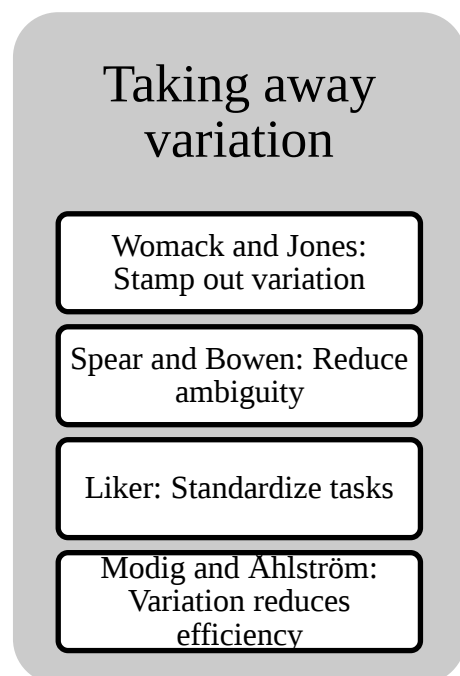


FIGURE 1 - A NEGATIVE PERSPECTIVE ON LEAN

Lean production to the concept of craftsmanship or those processes which not only refuse to be standardized, but dwell in their intrinsic variation. According to the authors there are two features which characterize craftsmanship: one is the requirement of highly skilled workers whose development proceeds through an apprenticeship system and the other is its very low production volume in terms of output. Their advice when it comes to craftsmanship is simple: “*stamp it out. Institute Lean production as quickly as possible and eliminate every need for craftsmanship at the source*”. It is easy to see why they would be so adamant in advising for the removal of craftsmanship, it is resource intensive and, according to the author, it might mask suboptimal processes

under the definition of crafts. Spear and Bowen (1999) provided insights in this direction as they describe how work is conducted at Toyota. Variation, they point out, brings about poorer quality and higher costs even when it occurs in something relatively straightforward as installing a passenger seat in a car. For this reason, they argued, the Toyota production system can be codified in four principles whose main purpose is to reduce ambiguity in the operations plant: content, sequence time and outcome or every task should be specified; there should be a direct customer-supplier relation and questions between these two channels should be answered in an unambiguous yes/no way; the unit should follow a direct path with a clear ending point and finally any improvement should be made by the workers on the frontlines but under the guidance of an expert and always with scientific rigor. These principles were further elaborated on by Liker (2004), who provided more detailed guidelines for companies which aim at introducing Lean in their plants. Throughout his fourteen principles emphasis is clearly placed on standardizing processes and eliminating variation in demand. The author clearly writes that “*Standardized tasks are the foundation for continuous improvement and employee empowerment*” and advocates for making the flow of goods clearly visible throughout the plant so that every variation from what has been specified

can be promptly identified and brought back to the desired condition. Liker also advised, whenever possible, to schedule activities so that variation in demand is hardly felt in the operations.

Modig and Åhlström (2012) have already been mentioned in their classification of variation. Their contribution to the relationship between Lean and variation continues as they pointed out how variation in demand and supply prevents organization from reaching the point at which they are both resource efficient and flow efficient. The concept of flow efficiency, as described in Modig and Åhlström, revolves around the single unit that is being manufactured in a factory. Specifically flow efficiency is the ratio of value adding activities to throughput time. All the activities that do not, directly or indirectly, add value to the patient decrease flow efficiency and together with high throughput time and bottlenecks, variation is the main cause of the generation of activities which do not add value to the flow of the unit.

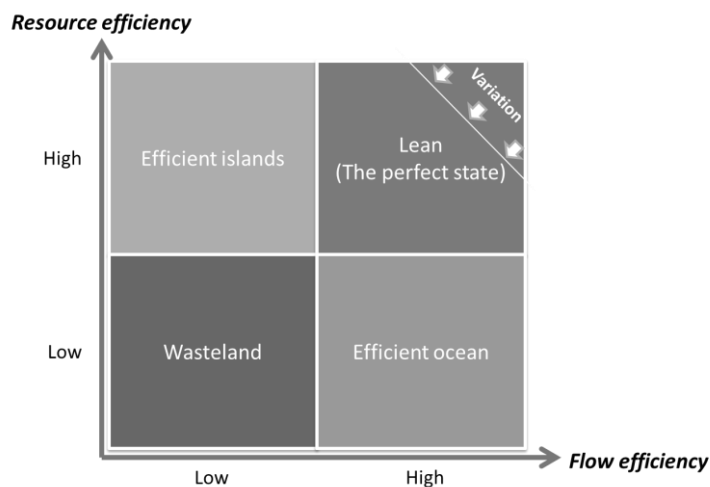


FIGURE 2 - THE EFFICIENCY PARADOX AND THE LAW OF VARIATION

This problem can be overcome only in the measure that it is possible to forecast what is demanded (and supplied), when it is demanded (and supplied) and how much of it is demanded (and supplied). As long as these factors cannot be estimated in advance variation creates an efficiency frontier which limits what operational states within the flow efficiency/resource efficiency matrix the organization can achieve.

2.4. THE IMPORTANCE OF KEEPING VARIATION

While compelling, the arguments for variation are not without shortcomings. The very idea of flow efficiency, defined by Modig and Åhlström as the ratio of value adding activities to throughput time is somewhat vague. While simple on the surface, this description raises questions as to what is really meant value adding activities and throughput time. Throughput time is per se not hard to define, it is in fact the time it takes for the unit to be fully processed. Yet, this raises the question of when the unit can be defined as fully processed. The starting and ending point of the process can be arbitrarily set and

they will affect the result when calculating flow efficiency. Picking up on the example of the cancer patient the authors use in their book and the processes she has to go through, a starting point that could be used is the moment the patient is admitted in the hospital while the ending point could be the moment she is discharged. But the starting point could just as easily be moved to the moment the patient receives her diagnosis or even earlier, the point where the patient goes through her first examination in order to determine whether she has cancer. Any of these two points would add to the flow efficiency calculation the time the patient spends waiting for the test results and the time between receiving the diagnosis and the start of the treatment. Both points would significantly decrease flow efficiency. When it comes to value adding activities instead, they are even harder to specifically pin down since, as pointed out again by Modig and Åhlström, value is defined by the receiver's needs and a universal way of capturing them is to date still lacking. Taking again the example of the cancer patient, it is argued that the quality adjusted life year (QALY) is a convenient way of quantifying value from the patient's point of view, yet this measure fails into taking into account the subjective way care is experienced (Young & McClean, 2008). The issue here is that a certain kind of variation might add value, rather than taking it away, like the caregiver doing something which is not strictly on the protocol, yet improves the patient's experience. The problem, Modig and Åhlström continue, is further worsened in the service industry, as *"people introduce an element of variation that is very hard, if not impossible, to avoid"* (2012). However the authors reckon that it remains possible to become better at managing variation regardless of the type of organization and of the demand that it faces.

The problem with applying Lean to a context of high variability is that this philosophy assumes that there is a single, clear path that the unit can follow in order to reach the desired state and that the Lean production system can be universally applied (Womack and Ross, 2007). By extension therefore there should always be a clear path in each production plant. But in high variability contexts there is an evident violation of this assumption. Within these processes there are many ways a unit can follow and the desired state might not even be the same as it was at the beginning. Hall and Johnson (2009) talk about exactly these processes, the ones where standardization is not only almost impossible to achieve, but it is not even desirable to do so. They call these processes "art" processes. As artistic processes they have two characteristics, one is the high variation in the inputs used for production and the other is that the variation in the product needs to be valued by the customer. The example they make is the piano manufacturer Steinway&Sons. There is variation in its input as no two pieces of wood are the same which make each of the Steinway pianos unique. At the same time, this

variation is highly appreciated by their customers, world renowned pianists who want unique instruments. What if, instead, the customers do not appreciate the variation? In that case the organization is either facing a broken or a nascent process. In the first case quick steps should be taken to bring the process towards standardization. In the second it is necessary to take a moment of reflection to understand if the process should be brought towards art or towards science (and therefore standardization).

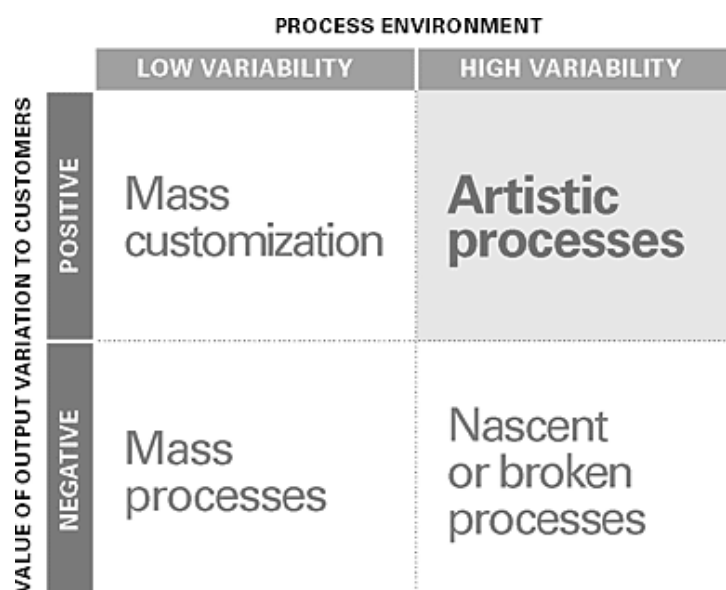


FIGURE 3 - SCIENTIFIC AND ARTISTIC PROCESSES

The obvious conclusion might be that Lean is therefore not applicable to contexts of high variation, yet examples exist which focus on stretching the model beyond the realm of processes which can be easily standardized. Several cases are present as to how Lean has been applied in health care. Progressive Health Care the setting up of the work according to Lean practices was entrusted to the employees at the facility right from the beginning with the authors acting only as facilitators in the meetings where processes were mapped and waste-reducing solutions proposed (Bushell et al., 2002). At Bolton Hospital instead a system of visual management aid was implemented so that it would be possible to see directly what caused an eventual problem without bothering the employees already at work (Fillingham, 2007). Even more interesting is the case of a French hospital where Lean was used first and foremost as a learning system aimed at empowering workers to see problems and wastes in their departments and implementing solutions to remove them. Stemming from Spear's assumption that problems in health care come from ambiguity and that reducing ambiguity implies a successful Lean implementation (Spear, 2005) the French team created a set of checklists for all the nursing practices which were then shared among the staff so that it was clear who had to do what and how. After establishing these rules and assigning a spot for everything in the ward, basic stability, the foundation of Lean, was achieved. Then, once this problem-solving mentality has kicked in, it becomes possible to tackle more advanced problems (Ballé et al., 2007).

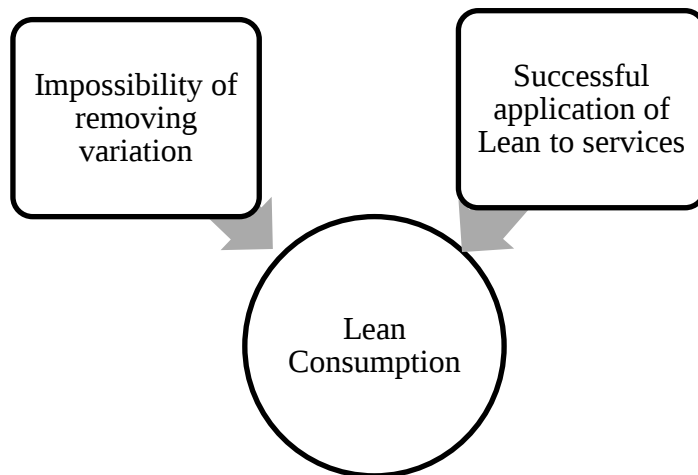


FIGURE 4 - FROM LEAN PRODUCTION TO LEAN CONSUMPTION

respect. These principles are surprisingly customer-centered; they in fact ask companies not to waste the customers' time and to provide what customers want, when and where they want it, without creating problems that might bring another visit from the customer. Furthermore rather than laying out the specifications under which companies should conduct their operations, they provide general advice which leaves to the company room for interpretation as to how this advice should be followed. Another response to this issue, which is the one this paper started with is the study from Staats and Upton (2011) which proved how Lean can be successfully applied in a context where individual judgment and expertise are needed as much as the following of standardized practices. Swank's (2003) research will be complemented to their study in the following section. Her research was applied in a field which is just as different from car manufacturing as software development: the providing of financial services.

2.5. BRINGING TOGETHER LEAN AND VARIATION

Staats and Upton (2011) proposed a way to keep a Lean profile while at the same time dealing with variation. Their model starts, like Hall and Johnson (2009), from the seeming incompatibility between the standardization of tasks required by the Lean philosophy and the reliance on judgment of knowledge work and, like Hall and Johnson, it reaches the conclusion that a portion of tasks which is considered knowledge work has very little to do with applying judgment. This work can therefore be progressively standardized by following two of the six pillars the authors laid out for their model: striving to make tacit knowledge explicit and specifying how workers should communicate. By

One response to the flourishing of Lean in fields very different than the ones it was theorized for comes from Womack and Jones (2005) themselves. In fact, after theorizing Lean Production, they went on to theorize Lean Consumption, or the way to bring the Toyota Production System to the service industry. For this purpose, they draft six principles

which, in order to be truly Lean, service providing companies should

following these two principles it is possible to control the part of variation that is related to information. The second conclusion they reach is instead in stark contrast with Hall and Johnson. While in fact Hall

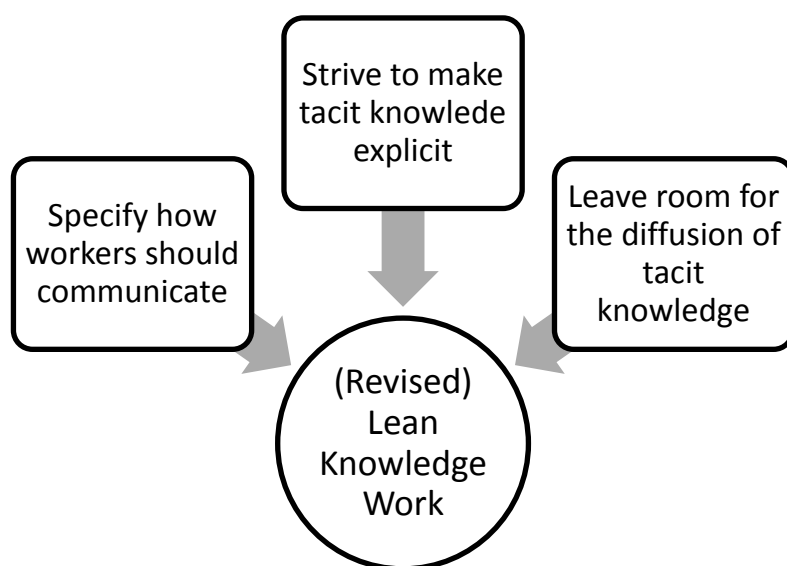


FIGURE 5 - BRINGING TOGETHER STAATS AND NONAKA

and Johnson claimed that in order to pass on the knowledge required to perform high variability operations a training system should be set in place, Staats and Upton replied that a lot of the knowledge assumed to be tacit does not necessarily have to be so. Specifically, continually questioning which knowledge can be made explicit and striving to

make it so while at the same time clearly specifying how workers should communicate are the keys that allow even judgment based, knowledge work to follow Lean guidelines. In fact, the remaining principles they propose for Lean knowledge work are not different from the ones proposed by Womack and Jones (2007): waste should be rooted out, problems should be quickly solved by using the scientific method, work towards continuous improvement and finally, have leaders who champion the implementation of Lean. While viewed in this perspective the idea of Lean and variation seem to find common ground the question remains as to what to do with the different views of knowledge coming from Staats and Upton and from Hall and Johnson. The two need not necessarily to be at odds, as it was discovered already in the mid '90s by Nonaka (1994) who, not without reason, pointed out how in the same way *"manufacturers around the world have learned from Japanese manufacturing techniques, any company that wants to compete on knowledge must also learn from Japanese techniques of knowledge creation"* (Nonaka, 2007). Knowledge, argues Nonaka is not created or shared in an either/or way, rather in a combination of systems which change according to the nature of the knowledge being exchanged. Tacit knowledge which cannot be made explicit is shared through Socialization, which involves *"observation, imitation and practice"* (Nonaka, 1994) and can be compared to training. Explicit knowledge which remains explicit is instead shared through combination which usually occurs within meetings and telephone conversations. In order to turn tacit knowledge

into explicit knowledge, Nonaka turns to the concept of externalization, and to the use of metaphor as a method for achieving such process. It is true that a more concrete alternative to the abstract concept of metaphor can be found already in Staats and Upton and in their simpler asking which tasks are repeatedly performed and successive proceeding to write them down, but it is not the method, rather than the principle Nonaka's knowledge creation model rests upon which is important: the idea of redundancy. Redundant information among the employees in fact makes it easier to deal with a wider array of problems and makes the system more aware of itself (Nonaka, 1994). This does not mean that everyone should know everything, but rather that it should be clear where the knowledge is stored and no employee should ever be too far from it. In conclusion, while following Staats and Upton's advice grants for an efficient sharing of knowledge, room should still be left for the diffusion of tacit knowledge, as it is an important component in knowledge based work.

2.6. COMPARTMENTALIZING VARIABILITY: AN ALTERNATIVE APPROACH

A complementary approach to the integration of Lean and variation is the possibility of compartmentalizing those activities with embedded high variability and having them follow a different track than the others. This is the approach advocated by Swank (2003) who, while writing about how Lean was successfully applied in a judgment based context similar to the one from Staats and Upton, described how Jefferson Pilot Financial dealt with complex operations which could not be easily standardized as the rest of the company's activities. What was done in this case was to separate such activities from the rest of the operations, assign them to a specific group of employees who would be in charge of those activities only and would have, in line with what proposed by Hall and Johnson (2009), their own set of performances measurements. Adopting this caveat while maintaining a more textbook like implementation of Lean for the rest of the operations, brought positive results in terms of increased employee satisfaction and reduced lead times.

Following this approach leads to the question of how to manage these compartmentalized, high variability processes. According to Meyer et al. (2002), it depends on where such processes locate in what could be defined as a variation spectrum. There are four points on this scale: variation, foreseen

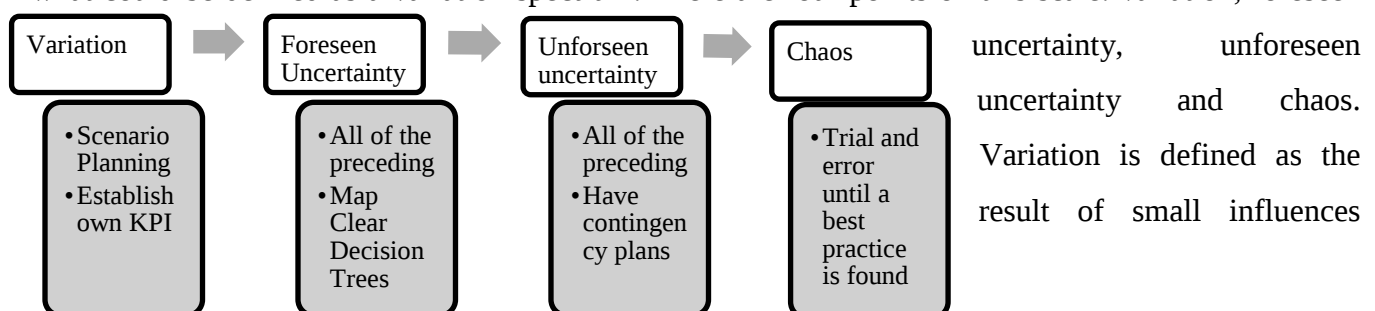


FIGURE 6 - MANAGING DIFFERENT DEGREES OF VARIATION

which, when taken together, affect the proceeding of the activity. They are too small to be taken into account singularly, but usually teams have plenty of room to plan for them. Foreseen uncertainties are larger forces that teams can single out, whose influences are understood but whose occurrence is not certain. This type of variation requires the creation of alternative plans. Unforeseen uncertainty is the point where things get complicated, because it is the event which cannot be predicted and whose influence on the project is not sure. Still there remains a main difference with chaos. Unforeseen uncertainty stems from a structured project, which is then posed under the influence of an event which could not be anticipated or under unforeseeable interactions between events. Chaos has no such structure, it stems from uncertain premises and the goal itself is hardly defined. So, how do project managers deal with such circumstances?

In case of plain variation, they essentially make use of scenario planning and establish KPI to check whether the project is on track or small adjustments are needed. The process of scenario planning assumes more relevance in the case of foreseen certainty, where decision trees ought to be made with clear steps on how to deal with the consequences of uncertain episodes actually happening. Decision trees are also made in case of unforeseen uncertainty and shared with all the members of the teams, but a higher level of flexibility needs to be granted in order to come up with an alternative plan on the spot, where an event that could not have been foreseen presents itself. Finally chaos requires a more entrepreneurial approach with a continuous iteration until the best approach is found. Science has progressed enough for oncology care to have moved beyond the chaos phase, the goal is clearly set: cure the patient or when that becomes impossible, grant the best possible quality of life and the treatments have been tried out enough times to create a structure of what is achievable and what is not with them.

Alternatively, Frei (2006) proposes a two way street (with some middle ground) to deal with variation. On one hand there is the necessity of reducing variation and thus reducing the breadth of services provided, targeting customers with a specific set of skills which will then require a predefined amount of work on the company's side and, similarly to the Lean's fashion, smoothing

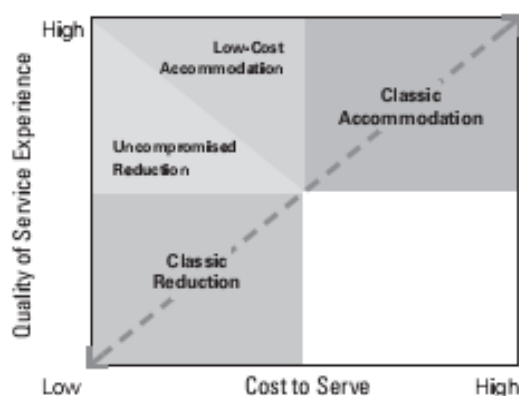


FIGURE 7 - FREI'S ALTERNATIVE APPROACHES TO VARIATION

out demand. On the other hand instead there is the accommodation of variation and therefore hiring experienced personnel who knows how to deal with unexpected situations, can adapt themselves to the customers' different skills and eventually do the customer's work. In the middle there is the possibility of low-cost accommodation, which implies outsourcing the issuing of services with high variability to third parties or to the customers themselves and the possibility of uncompromised reduction which involves training the customers in providing variability in a standardized form. Unfortunately, while the author points out examples of where these middle ground options are successfully applied, they rely on the assumption that in the case of low cost production it is possible for the industry at hand to outsource the production, and that in case uncompromised reduction is chosen it is instead possible to educate the customers. While the first assumption might hold in many cases, the second one is not so universal. It is hard in fact, to imagine how a cancer patient, already in distress because of her condition, can be educated to follow certain procedures aimed at reducing the company's variability.

2.7. DISTINGUISHING BETWEEN GOOD AND BAD VARIATION

Building on Frei's dichotomy between keeping variation and reducing the question can be raised as to how it is possible to distinguish between "good" variation, that should not be eliminated and "bad" variation that, in Womack's word, should be stamped out. The solution is to look at all the activities which experience a significant degree of uncertainty and ask which ones add value and which ones do not. But, in order to answer this question, a definition of value is needed. Beyond Womack's (2003) definition provided in the introduction, Modig and Åhlström point out (2012) that value is defined by the receiver's needs. Therefore two hypotheses can be formulated:

- Hypothesis 1: Lean can be used in high-variation contexts to reduce the variation that does not add value to the flow unit
- Hypothesis 2: Lean can be used, albeit slightly reshaped by the necessity to share knowledge within the unit, to accommodate the variation that adds value to the flow unit
- Hypothesis 3: Alternatively, Lean can be used to establish support structures for high variation processes which need to be managed according to different parameters.

3. METHODOLOGY

This section starts by explaining the rationale behind choosing a case study for the research, continues with outlining the approach followed in collecting and analyzing data and concludes by raising attention towards the limitations and the ethical issues that the author considered while conducting the study.

3.1. ESTABLISHING A RESEARCH DESIGN

It is traditional in the field of operations management, to which this work can be ascribed, to use quantitative modeling to look at processes. Quantitative modeling stems from the assumption that it is possible to capture through models the behavior of real-life operation management and compute the changes that occur when altering the variable under study (Will et al, 2002). While this rational knowledge generation approach (Meredith et al, 1989) first appeared to the author, two problems emerged: one is its unsuitability for theory development (Schmenner and Swink, 1998), as the claims made by the models that are developed are hard to verify in the real world (Will et al., 2002). The

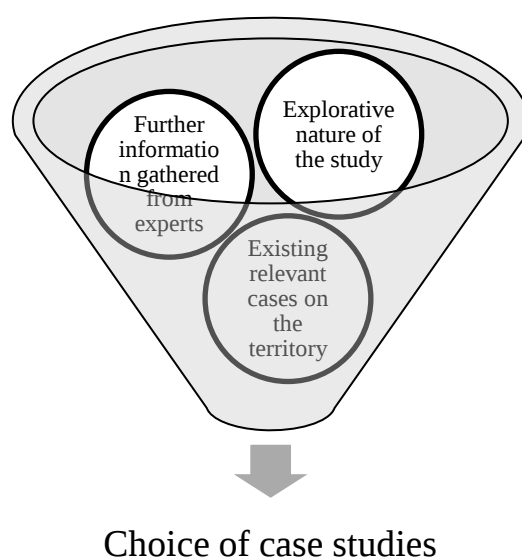


FIGURE 8 - CHOOSING THE RESEARCH DESIGN

second problem with this approach is that it fails to capture the aspect of the problem the author is most interested into: the interplay between the harder aspect of managing processes under increasing resource constraints and the intrinsic variation that in this case comes from having

to administer care to patients in peculiar conditions ad

people affected by cancer are. Such interplay has been hardly touched by the existing literature, so no secondary data could be used and even, if such data existed, they would be ill-suited for quantitative modeling. For these reasons quantitative modeling was discarded in favor of case study research. Case study research is in fact particularly well suited in case of exploratory research, which is a “research

problem where there currently exists very little work to refer to and where the aim of the study is to develop a better insight into a particular topic” (Wilson, 2010). Given the lack of research in both oncology departments and lean in contexts of high variation I deemed the case study research method particularly relevant. The data gathering process was divided in two parts; during the first part data were gathered through in-depth interviews with experts who are currently working in the field. In the second part instead semi-structured interviews were conducted with the medical personnel working in the hospitals that are currently trying to apply the Lean philosophy in their oncology departments. Finally, while I started to collect and analyze data from the earliest stages of the research process and thus followed grounded theory’s routines, I always kept the existing theory about Lean at hand and tried to impose its categories on the data, thus following a more deductive method. I tried to reconcile these two perspectives by following an abductive approach.

3.1.1. GATHERING PERSPECTIVES THROUGH IN-DEPTH INTERVIEWS

One of the reasons for choosing oncology departments as case studies was their increasing relevance in the society. Yet, even after making this choice the field still remained too broad for me to explore. The necessity of focusing on a special kind of patients was an ongoing dilemma, together with which processes to encompass in my study. While looking at a single process might have been very relevant from a practical point of view, the results of such study would not easily be applicable outside my field of research. On the other hand a focus too broad would result in a theoretical framework whose assumptions find no confirmation in the real world.

It became crucial therefore, to simply “talk” to people, in order to grasp their point of view (Burgess, 1982). Such “talk” was held in the shape of in-depth interviews which, according to Webb “use extensive probing to get a single respondent to talk freely and to express detailed beliefs and feelings on a topic” (1995). Two people were identified as holding the knowledge necessary to narrowing down the focus as people who are currently working with Lean and cancer care. Their prominence in the field was later confirmed by the successive interview collected. The author’s personal experience in cancer care was used to compile the key topics and themes to be addressed during the interview. The respondents’ views on these themes were object of inquiry, rather than a set of direct questions. In fact the respondents were encouraged to talk freely and I based my intervention according to the interviewer’s response. In this phase I tried to keep a more passive role. I was fully immersed in the interview and I tried as much as I could not to analyze at the moment what was being said or to draw

fast conclusions (Ritchie et al., 2003). The data gathered in these interviews shaped the interview guideline questions, but also helped the author narrowing down the focus of her successive data gathering phase. What emerged was the necessity of an holistic approach, in contrast with looking at how to improve a single process using standardization techniques (Process Consultant 1) and an existing project aiming at mapping processes (Process Consultant 2) so that little contribution could be brought from my side in that respect. As Wilson points out (2010), in-depth interviews are harder to analyze and interpret because due to the lack of structure the answers might lack consistency and there could be a sensible amount of information not related to the topic. But considering the very small amount of interviews conducted and the emergence, already in this early stage, of common themes, the conclusions drawn from such data can be considered as reliable.

3.1.2. CASE STUDY AS THE RESEARCH DESIGN

The design chosen was that of a multiple case study, with three units in the analysis' radar: Radiumhemmet at the Karolinska Institute, the Breast Center at Södersjukhuset and the Breast Center at Capio St. Goran. The choice of the case study approach has been criticized in that it does not easily lend itself to generalization (Yin, 2009). But focusing on this aspect means not understanding the essence of case studies. The purpose of this method is, in fact, the generalization to a theoretical proposition, rather than an universal population (Yin, 2009). In other words the case study cannot be brought outside its context exactly because it is the relationship between context and phenomenon that is under analysis. Nonetheless, in order to control for this criticism, I looked at three different sites, rather than just one.

There were two criteria guiding the research for an organization to study: the first criterion was that the organization was working on applying the Lean principles to these practices and the second, that such organization had to be located in Stockholm, in order for the author to be able to conduct face-to-face interviews. That Karolinska and its sister division Södersjukhuset were experimenting with Lean was discovered through informal talks with professors and consultants knowledgeable about the issues relating Lean to health care. Karolinska University Hospital is one of the leading cancer centers in Europe (Karolinska website, press kit). At Karolinska the oncology department is defined as the unit where all types of cancer are treated and all types of non-surgical interventions provided. In the majority of the cases this is not the place where a cancer diagnosis is made. Patients are in fact usually referred here from other departments like the District Health Centre (Karolinska Oncology Department

Homepage). The hospital is in reality a union of different physical structures: Karolinska Solna, Karolinska Huddinge, Södersjukhuset and Danderyd Sjukhuset. In this respect the Breast Center at Södersjukhuset can be considered a part of Karolinska. The data gathered from this study were collected only from Karolinska Solna and Södersjukhuset. At the Södersjukhuset breast center the specialists (surgeons, cytologists and the mammography doctor) are on the same corridor, few feet apart from each other. The center also works in close collaboration with the oncologists in the rest of the hospital. They work with their own flow inspired by the Lean philosophy, centered on the patients' needs.

Capio's current position instead, was discovered reading an article from the Economist which featured the structure as an example to imitate for hospitals whose demand seemed to exceed their resources. Differently than Södersjukhuset and Karolinska Solna, Capio is managed by a private company, Unilabs whose vision is to *“develop the cooperation between private and public health care and add new solutions that strengthen the position of the individual in the healthcare system”*¹. The Breast Center at Capio was started in the fall of 2009.

Rather than focusing on one of the other of these sites, the author decided to look at all of them. The reason for this choice lies in the different services that are provided at the different sites and in the different applications of the Lean philosophy to the center's operations. Capio St. Goran in fact, has adhered in a stricter way than Karolinska or Södersjukhuset to Lean practices; on the other hand, it only provides surgery as a treatment to patient and refers to Karolinska all the patients in need of chemo and/or radiotherapy. Karolinska and Södersjukhuset instead refer to their own application of Lean as *flödesarbete* and they cover the whole spectrum of treatments that are available for cancer patients.

In light of these differences, I decided it would be interesting to check if the research could be extended from Karolinska and its subdivision at Södersjukhuset to the breast center at Capio St:Göran an lead to either similar results, which Yin (2009) refers to as literal replication regardless of its narrower focus in care, or contrasting results exactly for this focus, defined instead as theoretical replication.

3.2. GATHERING DATA

In order to avoid missing on important aspects of the process of giving (and receiving) cancer care the author gathered the perspectives of the three main parties involved in the process: patients, doctors and

¹ Capio S:t Görans Sjukhus' Fact Sheet: We renew and unite

nurses. The first group was the hardest to reach, probably given the sensitivity of the topic. Two semi-structured interviews were conducted with people affected by cancer. At the same time the data gathered from these interviews were then compared and complemented with existing studies about the needs of oncologic patients. Several studies were chosen, based in different countries, in order to make sure that the needs highlighted were not influenced by culture and thus not representative of the whole population. The results from these studies will be presented in the Empirics section.

3.2.1. SEMI-STRUCTURED INTERVIEWS

Kvale (1983) defines the qualitative interview as “*an interview, whose purpose is to gather descriptions of the life-world of the interviewee with respect to interpretation of the meaning of the described phenomena*”. In this case the phenomenon under study could not be abstracted from the personal perspective of the individual. As highlighted in the literature Lean is an approach which centers on the individual’s capacity to spot a problem and solve it. Also, the examples described from the health care industry showed that Lean is not a cookbook approach, but rather that its implementation changes according to the characteristics of the organizations. Different solutions are implemented when problems are found and such solutions are reflective of the features of the organization. Such characteristics are embedded in an organization and are thus harder to be made explicit through questionnaires. However, before starting with the interviews, the data gathered from the preceding interviews were analyzed and a few general conclusions were made, in order to achieve a clearer understanding of the topic, identify the questions to ask and structure the interviews. Ideas and structures were subsequently refined by a brief review of the major publications about Lean. The resulting script divided the inquiries in three broad categories (for the full question list see Appendix B):

- **Characteristics of oncologic care:** how patients are basically treated, how the different parties in health care (doctors, nurses, patients) interact and what are the constraints imposed by the variation embedded in the practice
- **Wastes in oncology wards:** this section was used to distinguish between variation which was systemic and variation which instead did not add any value.
- **Solutions implemented:** parallel to each waste identified, the respondents provided examples of what solutions they were trying to implement and how those solutions were performing

Notwithstanding the presence of a set of question the respondents were encouraged to talk openly about the subject. This choice was made in order to gain a broader understanding of the topic and of the relationships among the different parties which the author could not have envisioned when compiling her questions (Wilson, 2010). The set of questions was not the same for all the respondents; rather a modified version was used according to whether the respondent was a doctor or a nurse and thus in charge of a completely different part of the process. Also, while at the beginning the questions were of broader nature, as more data was collected, the broadest questions were discarded in order to make room for more targeted questions, aimed at shedding light on the themes that were gradually emerging. Almost all the interviews were conducted face-to-face. One interview was conducted over the phone given the respondent's busy schedule. Following Wilson's (2010) advice, consent was first sought through email and a time was arranged where the respondent could devote enough attention to the questions. The interviews with the patients instead were arranged over Skype after following the same procedure as the one for the telephone interview. The author did not find any difference in the quality of the answers across the different means. The interviews' length ranged from 40 to 70 minutes, they were recorded and transcribed by the author herself. In a few cases follow-up questions were asked by email to enquire for the clarification of some points or the respondent's opinion on a newly emerged category. These data were aggregated with the existing ones, but marked as gathered in a second moment.

3.2.2. SELECTING THE RESPONDENTS

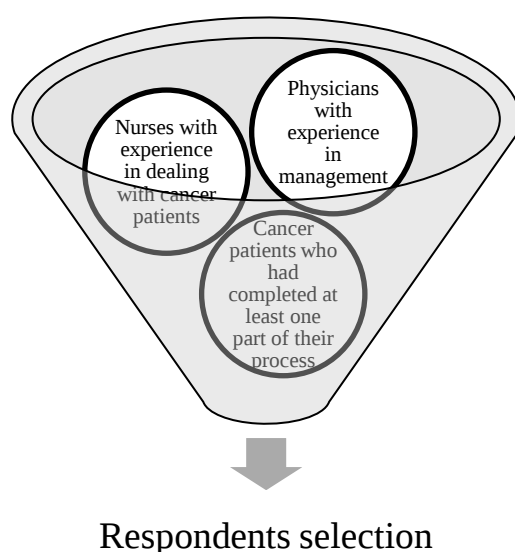


FIGURE 9 - SELECTING THE RESPONDENTS

Information about the categories described in the previous section could only be obtained by individuals working inside oncology departments. For this reason judgmental sampling was chosen to draw a list of candidates (Patton, 1990; Maxwell, 1996). The purpose was to get different

perspectives on the overall process a patient needs to go through from diagnosis to discharge. Guest et al. (2006) claim that all research can and should use probabilistic sampling, yet they also recognize the objective difficulty of respecting this rule in case of hard-to-reach populations. Doctors have long working hours and busy schedules (McGowan et al., 2013); therefore entrusting the research to probabilistic sampling would have significantly decreased the possibility to conclude the study within the given timeframe. After looking for people with this profile on LinkedIn, emails were sent to ask for the chance for an interview. In order for this perspective to be more systemic and thus encompass more parts of the process than the ones a “normal” physician is involved into, people at a higher level of the organization (i.e. department heads rather than regular practitioners) were preferred. This is how the first half of the respondents was chosen. In order to reach the necessary quota for the study to be valid and reliable, the second half was chosen through snowball sampling. The respondents were asked who among their colleagues would have the time necessary for the interview and whose perspective I should gather in order to have a complete picture of the process. In this respect a symmetric doctor/nurse approach was followed. In the cases where my first respondent was the head doctor of a department, I asked if I could talk with the head nurse and vice versa.

The “patient perspective” was gathered through two semi-structured interviews with two former cancer patients. The first patient, Patient 1, is a former breast cancer patient who went through the same procedure described in the previous section for breast cancer patients. Patient 2 instead, is a former colorectal cancer patient. As the procedure for treating this kind of disease is not as universal as breast cancer, Patient 2 underwent chemotherapy, radiotherapy and surgery. As the treatment became more complex, Patient 2 experienced a considerable degree of uncertainty in relation to his prognosis and to the different steps that would make his path as a cancer patient, which mirrors the experience of the patients treated at Karolinska. Patient 1 was reached through the Breast Cancer Foundation in Sweden, while Patient 2 is a personal acquaintance of the author.

3.3. ANALYZING THE DATA

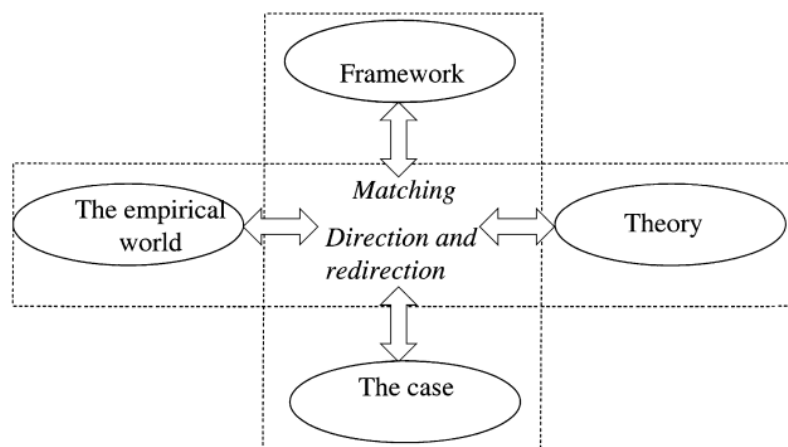


FIGURE 10 - DUBOIS' SYSTEMIC COMBINING

The data collection process proceeded in three steps: in the first step the interviews were framed and conducted with the theory as the only basis for discussion. Subsequently, given the more loose structure of the chosen data collection method, further points were raised by the respondents, which then emerged as patterns and themes after the author read the data for the first time. This

led to the search for new theory which could be integrated into the already chosen one in order to explain the emerging pattern. It also led to the research for new perspectives in terms of respondents which might give a complete picture of the emerging patterns. Once more data in this respect were gathered, a second pause was taken again to analyze whether further theory was needed. Finally, the third stage was aimed at fine tuning the data so to collect the necessary information to clarify all the points. Such approach, which might look similar to grounded theory, is what Dubois and Gadde (2002) call systemic combining. Stemming from the critique to case study as a sound research technique, the authors propose an approach they define as tailored explorative research which aims at the development of existing theory, rather than the generation of new one, thus I considered it more appropriate than a pure grounded theory approach, as the latter requires a data collection approach which is in no way framed by the theory (Glaser, 2007). The peculiarity of this technique is the requirement to keep the framework tight, but evolving. Starting from the necessity to keep an eye open for how the theory ought to reflect reality the authors claim that the framework should be tight in the sense that the author should have articulated the framework it is using, in order to filter the data and avoiding being overloaded by information. Yet there should be a continuous interplay between theory and data in order to highlight emerging meaning which might need a change of the view of the theory. The breaks between these steps were given by the analysis of the data so far gathered and by their continuous comparison with the theory gathered until that point to test the fit of the chosen literature to the data gathered. All the data that did not fit into any of the established categories was discarded. Such

approach is theorized as well in Dubois' paper, as not to give to the reader pieces which are not relevant to the "solution of the puzzle" (2002). The resulting fit of the empirical data with the model provided gave an answer to the question whether that specific part of the Lean framework could be applied to oncology care or not.

The empirical data were coded using an open coding approach. Most of the codes and categories emerged already after three interviews and the remaining additions occurred until around the 10th interview. The author read several times the interviews and highlighted in different colors the quotes pertaining to each area. A list of codes was thus generated which then, in line with the abductive approach, was linked back to the studied theory. These quotes were then brought together in a unique document which was then analyzed for patterns and conflicts whose interpretation led to the conclusion of whether the Lean framework could be adopted as it was, whether it had to be tweaked or it was not applicable at all.

3.4. LIMITATION AND CREDIBILITY OF THE STUDY

A total of 16 interviews were conducted, out of which only 14 were used to draw data in support of the author's conclusions. This number is short of Bertaux's (1981) threshold, who argued that, when doing qualitative research, the minimum sample size is fifteen interviews. Different stances have been taken on this topic: some studies point to as many as thirty-five participants as a requirement for grounded theory studies (Morse, 1994) while others recommend a sample as small as 6-8 interviews (Kuzel, 1992). As pointed out by Guest et al., "*none of these works present evidence for their recommendations*" (2006). The authors then proceed in their study by explaining the concept of theoretical saturation, or "*the point at which adding new data to the existing set does not lead to the generation of further categories*" (Glaser and Strauss, 1967). Finally they prove how they identified 73% of their categories within the first six interviews and up to 92% in the first twelve (Guest et al., 2006). Their conclusions hold as long as there is an objective truth to be discovered in the context that is being studied, that the participants answer independently and the questions asked are similar. Since the topic investigated involves processes and routines, rather than opinions and perceptions, the first assumption is respected. Secondly, the interviews were conducted singularly and with a similar set of questions. It is true that without having conducted further interviews it is impossible to know whether new categories could be generated, yet Romney et al. claim that if the individuals interviewed possess a high degree of competence in the investigated field a sample as small as four respondents leads to very

accurate results (Romney et al, 1986). Since the respondents have been working in their field for many years and most of them are leading figures in their departments, it is safe to assume that the chosen sample, properly analyzed, generates relevant data.

All the interviews were recorded, which might have made the respondents less inclined to talk freely (Kenealy, 2012). On the other hand before each interview, permission to record was always asked and the respondents always granted it without hesitating, which might suggest a lesser impact of the recorder on the responsiveness of the medical personnel interviewed (Britten, 1995). Finally, as the interviews were conducted by one person only, the author deemed using the recorder a more effective method than relying exclusively on hand-written notes, in that it diminishes the chances on missing on something important that the respondents says because of being busy writing. Also, not having to stop the natural flow of the speech in order to catch up with what was being said in that moment was deemed a further advantage of recording the interviews.

Finally issues of reliability and validity were considered. Since Yin (2009) and Wilson (2010) were used as guidance for shaping the methodology, I turned to them in order to identify possible threats to reliability and validity and how to address them. Following Yin's advice a database was created containing all the interviews material gathered, the quotes selected for the study, the list of participants and the guidelines asked. Aside from taking into account confidentiality issues and the logistic challenge of incorporating the totality of the gathered material, the remaining data are included in the Appendix in order to be reviewed. Second I tried, to assess at repeated point in times whether existing biases on my side were conditioning my data gathering and analysis phase and to always maintain, to the best of my knowledge and capacities, an impartial and objective view during the study.

3.5. ETHICAL CONSIDERATIONS

Out of all the interviews conducted, only in one case it was explicitly asked by the respondent not to publish names and to ask before attributing a quote. Nonetheless I chose to leave out all the respondents' names and identify them only according to their role, and even then, making it specific only insofar as the reader needed in order to follow and understand the relevance of each quote. I made this choice because I wanted to keep the attention focused on what was being said, rather than on who said it.

Secondly, I never checked back with the respondents to confirm if my interpretation was the correct one, which was a point worth considering even more when recalling that neither of the parts was a native English speaker. Nonetheless, no conclusion was drawn from one single interview and all the statements published in this research find confirmation in more than one respondent. Therefore the author still claims to have conducted the study in an ethical way.

4. EMPIRICS

This section presents the data gathered relatively to the oncology practice itself, but also to the practices and operations in the different departments studied. It also explains the different sources of variation that affects the delivery of cancer care and how the units cope with them. The data presented come from the interviews conducted and studies the author read to get acquainted with the practice. In order to make the section easier to read not all the quotes are reported in this part. Especially when describing the processes and the patient's journey I chose not to report each single quote but rather to aggregate them in a continuous narrative. All the quotes used as data are reported in the Appendix

4.1. AN OVERVIEW OF ONCOLOGY

To better explain this practice a comparison will be made between oncology and the more common field of primary care. Primary care is defined as “*the provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs, developing a sustained partnership with patients, and practicing in the context of family and community*”. In this context patients usually visit the infrastructure which is geographically closer to them. Diseases treated in primary care usually require a one-off visit or, therefore, the vast majority of primary care patients visit the facility one time per year or less (Donaldson, 1994). There are two main primary care providers: the general practitioner, or family doctor, who usually sees non-life-threatening conditions, and the hospital's emergency unit, where illnesses requiring immediate attention are required. Although in the latest context, it is referred to as emergency care; it is accepted practice to count it as part of primary care (Jacques, 1987). In both cases the physician is a non-specialist who is expected to be familiar with a wide variety of diseases.

Cancer treatment instead, according to the degree of specialization required by the case, belongs to either secondary or tertiary care. As such, it presents three main differences with respect to the treatments belonging to primary care. First, cancer is a chronic disease, which means that the patient will need to pay several visits, over an extended amount of time, to the facility curing her. Second, during the course of her treatment she will see several physicians who are, and here lies the third difference, specialists in their own restricted area that is oncology, radiology, gastroenterology etc. (Sullivan, 2011). Finally, oncology care presents a third feature that sets it apart from primary care: the uncertainty in respect to its outcome. Patients with tumors which, from a clinical point of view, might

be considered similar, respond differently to the same treatment. At the same time, while some patients are cured, others have relapses (Bast et al., 2004). The result is that in several situations the physician decides the best course of action according to his own individual experience rather than following an established procedure. This brings considerable variation to the process which, given the current state of scientific evidence on cancer treatment, cannot be taken away without significantly hindering the quality of the provided care. It is important to make clear that not everything is left to the doctor's own discretion. Sweden, for example, publishes national guidelines for five types of cancer (Swedish Association of Local Authorities and Regions, 2011) which doctors, as emerged from the interviews, follow closely. At the same time the complexity of the disease is such that guidelines cannot cover all the possible outcomes. Already in 1984 Eddy points out to the plethora of tools available for diagnosing a certain type of cancer and how *“the value of any particular procedure depends on who performs it, on whom it is performed, and the circumstances of performance”* (Eddy, 1984). The issue has not changed in 2013 as publications on cancer treatments need as many as 106 chapters to cover all the disease sites (Johnson, 2013). Such degree of uncertainty would seem to be irreconcilable with a philosophy that advocates for the reduction of variation and its negative impact on flow efficiency (Mödig et al., 2012). There are two more characteristics presented by oncology care which make it similar to the craftsmanship described by Womack et al. (2007) and therefore unsuitable to the application of Lean: first, it requires highly skilled workers whose development proceeds through an apprenticeship system. There is in fact a hierarchy in the oncology departments, made by formal title, but also experience.

- Senior consultants need to have a Ph.D., have to have conducted research work and been responsible for a certain clinical area
- Specialists need to have worked for five years full time in their branch of expertise
- Residents, who are still considered “in training” and move among different departments every 6-8 months.

The higher up in this ladder, the more complexity is faced by doctors in the cases they handle. Second, oncology has a very low production volume. At Karolinska, out of 1.3million patient visits, only 4500 are inpatients at the cancer unit (Karolinska oncology department homepage).

Yet oncology departments in Stockholm are widely employing Lean in their daily operations and have seen their performance improve.

4.2. SOURCES OF VARIATION IN ONCOLOGY

In this section the different sources of variation that affect oncology will be classified following McLaughlin's model presented in the Literature Review.

4.2.1. INPUT VARIATION: HOW PATIENTS' NEEDS AFFECT THE DELIVERY OF CANCER CARE

The patients' primary and secondary needs affect oncology departments in several ways. First, they impose constraints on the timeframe for the delivery of care is affected. Talking with the Process Consultant 3 revealed how some people need time to adjust to the news they have cancer, while others want to deal with the problem as quickly as possible. Both Patient 1 and Patient 2 belong to the second category but they both admitted that they were satisfied with the waiting times they experienced. For Patient 2 one month passed between receiving the diagnosis and starting the treatment, during which he underwent more examinations. Patient 1 instead had to wait for one month between her mammography and seeing the surgeon and around two more to have the surgery performed, though this last period was affected by a pre-existing medical condition.

Second, patients are nowadays more informed about the different options for treating cancer and about their rights as patients. It might happen therefore that they ask for a specific kind of treatment they have researched on the Internet, or that they might know about a clinical trial that is ongoing in the US, which puts the doctor in the difficult position of trying and finding a spot for the patient in that trial. The doctors and the nurses from Karolinska interviewed on this subject pointed out how they did all they could for accommodating such requests. The Oncology Nurse 1 expressed particular satisfaction at this part of her job but, view confirmed by the Head Physician 1 who claims that having more treatment savvy patients makes it easier for him. On the downside not finding the required treatment causes a certain level of disappointment in the patients.

Finally, they want information; they want to be reassured about what is happening to them and whether the doctors are in control of the situation. According to the Oncology Nurse 1, the Oncology Nurse 2 and the Head Nurse, understanding should be shared and communication should be unambiguous among the different parties involved in the care giving process. While a lot of patients have access to

technology and seek for information themselves, tailoring the message to the patient's literacy and education level should not be forgotten. One further step in the standardization of communication is the use of the same words contained in the leaflets given to the patient. Referring to the importance of making sure the patient is well informed from the beginning Oncology Nurse 2 said "We need to take time with the patient right away. If we don't take time to the patient it comes later on." Patient 2's story is explicative of this point. Upon being discharged very little information was given to him about the dietary constraints of his condition, which caused him to be rushed to the hospital's emergency department with the subsequent cost for the patient of a night in the emergency room and for the hospital of the additional days he had to spend in the oncology ward.

Similar conclusions were reached by a series of studies conducted about the needs of cancer patients. In one such study conducted in Italy (Tamburini et al., 2000), cancer patients expressed the need to have as much information as possible about the disease, to be more involved in discussions concerning their health and to be reassured that the medical personnel was in control of the situation. Similar findings are shared in a study conducted in Australia (Sanson-Fisher, 2000) about unmet patients' needs where desires like being informed about the cancer and their test results are completed by secondary needs stemming from the lack of information, as fear concerning the disease itself, but also its effects on the patients' daily life. A second Australian study pairs the need of further information with the management of cancer-related physical symptoms (Mackenzie, 2013). Such symptoms are handled as much in the hospital as at home, yet patients feel the lack of support from medical personnel after they have left the hospital (Suominen, 1992; Tierney et al., 1992). Finally a study from Cancer.gov points out how patients might be in shock at the moment of learning their diagnosis and may thus not be able to receive and recall information correctly. The possibility should be given, therefore, to have access to the information at a later point in time (Cancer.gov, 2013).

4.2.2. PROCESS VARIATION: HOW THE CHOSEN TREATMENT AFFECTS THE DELIVERY OF CANCER CARE

There is a certain degree of variation embedded in the treatment which changes, according to which cures are chosen for the patient. Out of the therapies available, surgery is the least problematic in this respect. Assuming no further complications arise, it is a one-off treatment which sees the patient well on her way shortly after the procedure is completed. In this case, the patient can be moved to the follow-up routine.

Chemotherapy instead is a cyclical treatment, whose effects need to be monitored by the nurses in charge of the patient and which can bring the patient back to the oncology ward ahead of her scheduled time because of the side effects of the treatment. Were this to happen the doctors might have to reconsider the choice of the treatment and eventually come back with an alternative. Secondly every administered chemotherapy is tailored to the patient and as emerged from the interview with the Head Nurse, once prepared it cannot be administered to a different patient than the one it was arranged for.

Radiotherapy, finally, is an even more complicated issue for the doctor, as it is made by two components: the treatment and the technique, in other words, not only what radiation is administered, but also how. As Patient 2 pointed out, this cure is also the hardest one for the patient to bear, which might lead to unscheduled interruption in the treatment plan. As explained by the Head Physician 3, doctors are well aware of this fact, and while “*there are a lot of studies that tell us when and where a treatment is effective*”, there is also “*a big gray zone where we don’t know*”. In this area it is up to the doctor to decide whether a treatment will be beneficial or not. According to the Head Physician 3 “*that’s the essence of being a doctor*”.

4.2.3. HOW VARIATION IN INFORMATION AFFECTS THE DELIVERY OF CANCER CARE

The term information in this case is used to refer to the information that is not shared with the patient, but that is necessary to the actors who are in charge of delivering care. This information involves the patient and her condition, the latest advancements in the cure of cancer, but also the way tasks should be completed. In the first case, as explained by the Head Nurse and the Oncology Nurse 2, it is important that this information is spread in a consistent way throughout the department. This importance is further increased by situations in which the patient is handled by several departments and inconsistencies or mishandling might arise because of missing information. For example, as the Oncology Nurse 2 recalls, one of her patients was not following a proper rehabilitation path because of information which a nurse had given to him and which were in sharp contrast with what were the department’s guidelines on the subject. It was the Oncology Nurse 2’s task to find this nurse and explain to her the correct procedure. Not much could be done though, for the months of rehabilitation lost by the patient.

When it comes to knowledge about new treatments its importance was found to be different in the units studied. Karolinska is a teaching hospital, so researching, keeping up with and spreading new knowledge is part of its mission. In accordance with this mission several doctors have a percentage of

their schedule devoted to research. At Capio instead seems to have a smaller prominence, for example it was mentioned only once in the interviews, where the Physician 2 said *“This is a clinical ward where we do just clinical pathology. Some people have research, but that is on their spare time”*.

Finally information needs to be spread about the way the patient is handled. For example at Capio all nurses are aware of the topic they have to talk about in the time they spend with the patient while at Södersjukhuset information needs to be spread about the new equipment. Different views were collected on the easiness of spreading information among caregivers. From the first interview with the Process Director, who is a consultant and process facilitator, it became evident that this is an area where a lot of difficulties are still present. She recognized that working in teams is becoming increasingly common, but also that *“Sometimes still you need someone like me or people who are process leaders who can help them form a group and talk to each other in a sensible way. It’s not always that they can do it on their own, because they are not always used to talking across boundaries [...] There are different silos that you need to break down”*. No one among the medical personnel interviewed mentioned the need of a facilitator, but a crucial difference could be found between Karolinska and the Breast Centers. While in the first case there was a general acknowledgement of an effort being put towards the improvement of communication, in the second case, when directly asked about their view on the way communication worked in the department all the respondents were satisfied with it.

4.3. REDUCING VARIATION: THE PATIENT PATH AT CAPIO ST:GÖRAN AND SÖDERSJUKHUSET

At Capio the patient can appear in a few different ways:

- The patient has sensed something wrong in her breast so she calls the breast center right away
- During the scheduled mammography something wrong is detected
- The general physician examines the patients and refers her to the Breast Center

In the first and in the second case the exams that lead to the diagnosis are conducted in the Center, in the third case it might be that the patient comes already with a cancer diagnosis. There is also a fourth venue, which is of the patients that go to the other breast center in the city center and are then lead to Capio for surgery.

Regardless of the entry route, the remaining of the path is similar for all the patients. The patient is discussed at the breast conference which is held every week at the Breast Cancer and is attended by a radiation oncologist, an oncologist, a surgeon, a pathologist and a nurse. The treatment is decided according to the national guidelines and, most of the times, it consists of primary surgery with an eventual second surgery scheduled for breast reconstruction. In some cases chemotherapy is given before the surgery to shrink the tumor. The day after the conference, the patient meets the surgeon who refers the diagnosis and makes a recommendation for the treatment. If the patient does not oppose the nurse

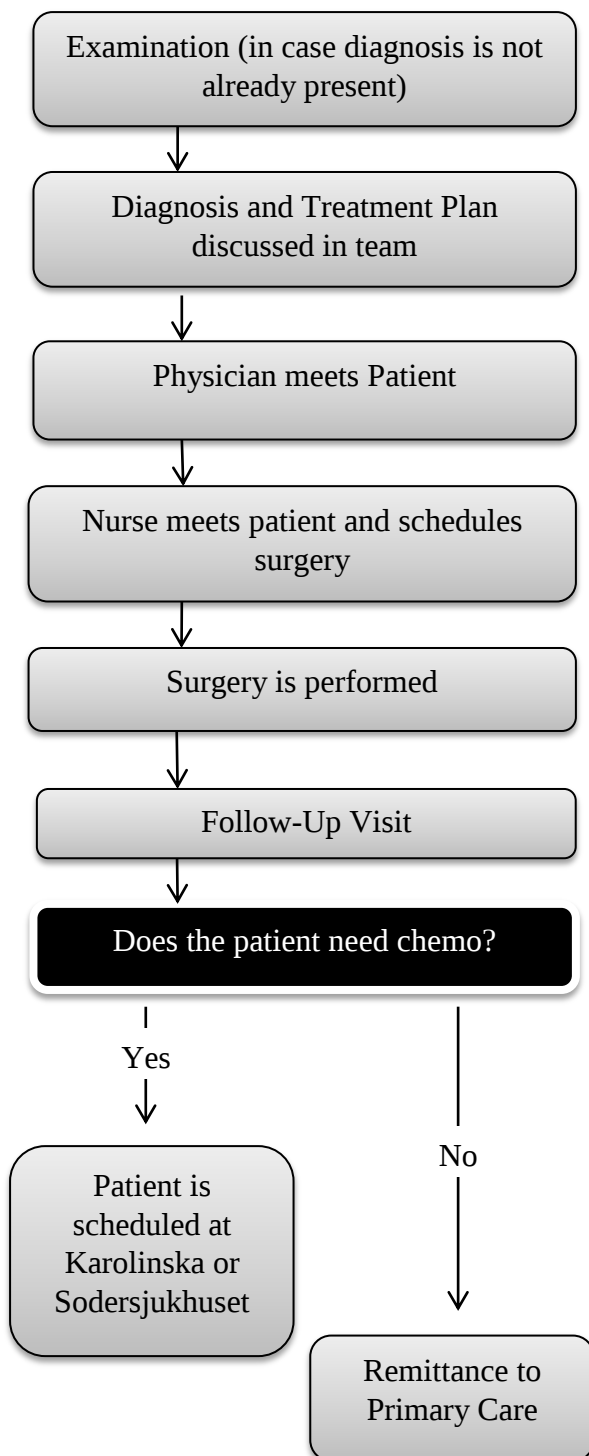


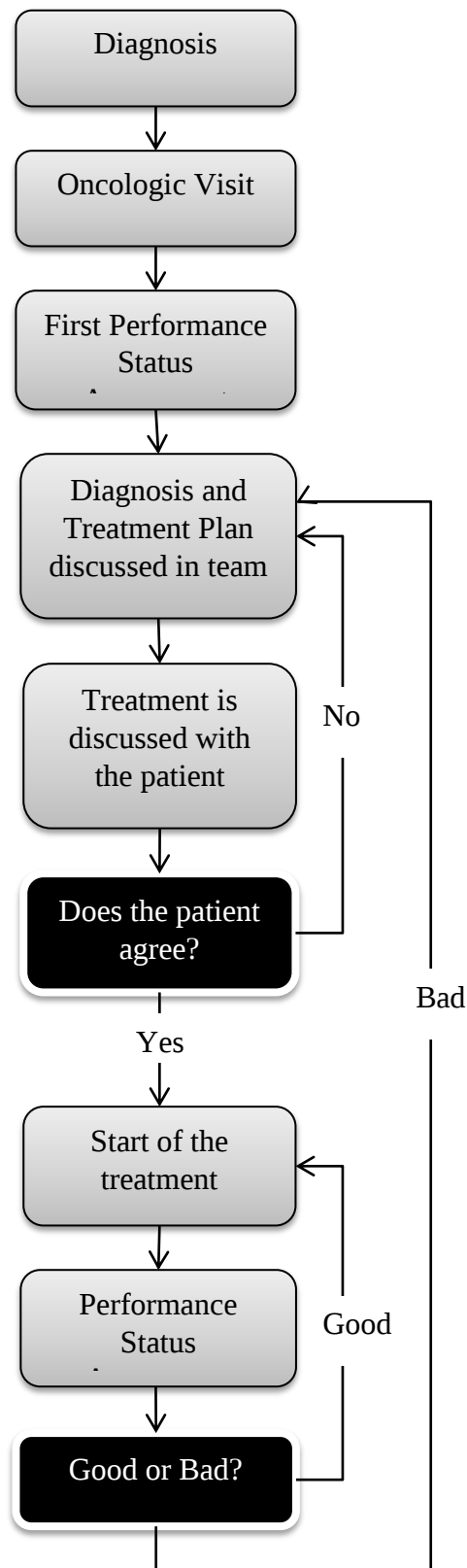
FIGURE 11 - PATIENT PATH AT CAPIO

joins the meeting and starts answering the patient's questions. Finally, the nurse and the patient have a private meeting where the nurse books the patient for the surgery and the post-surgery visit. During this time psychological support is provided in the measure required by the patient and more information is given aimed at reducing the patient's anxiety and uncertainty about her condition. The day of the surgery the patient comes in around 2 hours before the scheduled procedure and leaves the same day, unless complications arise. After the surgery is performed, the patient is discussed again in another conference to assess whether further treatment is needed, if so of which kind. As scheduled in the first meeting with the surgeon, the patient comes back to receive the result of the surgery and to know if another surgery is needed or if she is ready for the next phase of the treatment. If chemotherapy is needed the patient is referred to Karolinska or Södersjukhuset or Danderyd Sjukhuset. If no such treatment is needed the patient is scheduled for a one-year check-up, after which, if the disease does not reappear, they are referred to primary health care for a four years follow-up scheme.

Four or five patients every day follow this scheme. In total 13 patients are visited every day, the remainder is made by women who undergo the mammography and are not diagnosed with cancer or who have breast related issues but do not necessitate oncologic care. The total time elapsed from first contact to discharge is 21 days for 90% of the patients. The waiting times once the patient arrives at the facility are almost non-existing.

At Södersjukhuset the patient enters in contact with the structure in the same ways as Capio. It happens more often that at Capio to see patients after they have undergone surgery and require further treatment in terms of chemotherapy or radiation therapy. When it comes to the patients who have to undergo surgery in this facility some of them are treated in the day care center, some others in the operation ward, where they stay overnight. Receiving the patient is a scheduled task that each nurse covers in turn for her own cohort of patients. The routine in this case is similar to the one outlined by Capio, except that there is not a slot where the nurse, the doctor and the patient sit together. Another nurse instead is in charge of answering the phones for calls coming from the patients. In case a patient presents severe side effects she is recalled to the ward for immediate blood sampling and a medical check-up. The doctor decides if the patient is to be hospitalized, in which case it is the nurse's duty to find her a spot either at the oncology ward or in another ward or even in another structure. In this last case the patient's care is handled to the structure that receives them, although this does not happen often.

4.4. ACCOMMODATING VARIATION: THE PATIENT AT KAROLINSKA



The following description comes from aggregated data from different interview. Its accuracy was tested with two different oncologists (Head Physician 2 and Process Consultant 4)

At Karolinska different kinds of patients are treated, which makes curing cancer a multi-step process which involves the following actors:

- The Patient
- The Oncologist
- The Radiologist
- The Surgeon
- The Contact Nurse
- The Nurse taking care of the patient in that particular step

In order to reach the diagnosis of cancer the Patient has to go through several tests, according to her type of cancer and wait for the results. If the diagnosis of cancer is confirmed by the tests, the Patient is referred to an Oncologist for her first Oncologic Visit. Here the doctor explains to the Patient her condition, checks the Patient's overall physical condition and gives her an overview of what is going to happen in the near future.

Next a multidisciplinary conference is convened where all cancer patients are discussed. In this

FIGURE 12 - PATIENT PATH AT KAROLINSKA

conference are typically present the Oncologist, a Radiologist, a Surgeon and a Nurse. During this phase a treatment plan is discussed for the Patient. The options are:

- Surgery
- Chemotherapy
- Radiotherapy
- Hormonal treatment

These options can be used singularly or, increasingly often in combination. The variables in choosing the treatment are the patient's overall physical condition as assessed by the test and by the oncologist's opinion, the location of the tumor and its state (whether metastasis are present and if so, of what severity).

Once the treatment is defined, it is posed under the Patient's attention for her approval. If the Patient agrees, then the cure can be started, otherwise it is necessary to discuss the Patient again in another multidisciplinary conference and find an alternative treatment, which will then again be submitted to the Patient for approval.

Assuming an agreement has been found and the cure has been administered the next step is checking the Patient's physical condition. If her status is deemed as good the treatment proceeds as planned, alternatively, if the patient is not responding to the treatment or if she cannot stand the side effects coming from it, a second conference is called to discuss her situation. In this case though, it will usually be composed of oncologists.

The proceeding of the cure plan depends on the treatment chosen. While surgery is meant as a one-off procedure, chemo and radiotherapy call for several sessions to be administered at intervals of around three weeks. During these intervals patients are required to submit their blood tests in order to understand if their bodies can go through a new session of chemo or radiotherapy. If this is not found to be the case, the next session of chemo or radio will have to be postponed by the time necessary for the Patient's body to recover.

At the end of the treatment plan the Patient might have been cured of cancer and thus discharged. Some argue that the Patient should not at this point leave the circuit, but be treated as a "survivor" and thus

moved to survivorship care. The rationale lies in the post-treatment symptoms which might hinder in a more or less severe way the Patient's return to a normal routine. Yet the field of survivorship care is far from being officially recognized, which leaves the patient relying on primary care for the treatment of eventual problems arising from treating cancer.

If instead, the Patient's treatment has not proved effective and the Oncologist has no alternative treatment to recur to, the Patient is moved to palliative care. This kind of care is mainly concerned with managing pain and granting to the patient a good quality of life. In Sweden this care is administered by centers that are not affiliated with hospitals, some of them are run by the municipalities, while others are private and the quality of care provided is generally recognized as good. Patients in palliative care might still be treated in the hospital which has tried to cure them. This issue raises the question of whether these patients are being overtreated, issue which is currently being debated in the scientific community (Hewitt and Simone, 1999; Schnipper, Meropol and Brock, 2010; Montesarchio et al., 2012).

4.5. DEALING WITH VARIATION COMING FROM THE PATIENTS' NEEDS

4.5.1. THE ROLE OF THE CONTACT NURSE

Regardless of the different treatments and number of doctors the patient might see, one figure remains constant: the contact nurse. Each patient has one contact nurse and one only (unless the nurse changes hospital which, as it emerged from the interviews, is a rare occurrence) who follows her throughout the entirety of her journey. Her tasks are:

- Joining the doctor when the diagnosis of cancer is given to the patient
- Taking time with the patient alone to go through all the information
- Provide support during scheduled meeting and over the phone
- Booking the patient for the surgery and for the follow up visit with the same doctor who gave the diagnosis and performed the surgery

The first contact point happens at the moment the patient is given her diagnosis of cancer. Several more contact points happen over the phone when a patient has a question about the information that was

given to her during the meetings, the next appointment or in case she needs moral or psychological support. All nurses have received formal training in communication with the patient and pay attention to two issues: first, that communication between the patient and the nurse should not give rise to ambiguities. At Caphio, patients get written information about their condition and what they can expect, but also about the next steps in their process and the date of the surgery. At Södersjukhuset informative material is provided in written form and the staff is explicitly asked to use as possible the same language as that of the leaflets. Second, that information should be given to the patient in a consistent way regardless of the caregiver. Beyond the formal education that all nurses receive, meetings are regularly held in the department to insure that the messages delivered are the same.

Keeping always these issues in mind has, according to the Oncology Nurse 2, its benefits: first, less time is spent in giving information. Since the patient is speaking to the same person all the time, she does not have to repeat herself. At the same time, the nurse can make a faster assessment of the patient's situation. Second, uncertainty on the patient's side is reduced and consequently its negative effect on the treatment plan. By setting time aside to talk to the patient and being the repeated point of contact the patient feels safer. This way, situations where the patient wants to stop the treatment because of the emotional distress are reduced. The nurse takes the call, in case the doctor needs to be alerted, this can be done fast and the patient can get a quick response that brings her uncertainty level back to manageable levels.

4.5.2. SCHEDULING

Scheduling is a very important part of the work conducted in both the visited centers. At Caphio the nurses divide the day in slots of equal length. The patient is first alone with the doctor for 20 minutes, then for 30 minutes the patient is with the doctor and the nurse and for 40 minutes the patient is with the nurse alone. The second slot is extremely important for communication purposes, by attending the meeting herself, the nurse can hear what is being said, so that the risk of giving misleading information is minimized. The last slot is equally important as it is the point where psychological support is provided, where all the questions are asked and where the nurse works actively towards reducing as much uncertainty as she can on the patient's side. The administrative work related to the patient is also handled in this slot, which means reports are filled and, more importantly surgery is scheduled. Four or five patients follow this path every day, they are the patients who have been diagnosed with cancer.

The remainder (around two thirds) is made by patients who come for a check-up or have other breast-related pathologies. The time 40 minutes, was reached by trial and error, after trying both smaller and longer intervals. This method seems to work and leave the staff satisfied. *“It’s no problem at all [...] So when I’ve finished my day, when I’m done with my patient, I forget everything about them until the next time I see them”* says the Oncology Nurse 2. At Capio, scheduling is also used as a way of resolving the problem of the multitude of contact points which is traditional to health care. For this reason each nurse has her own cohort of patients which come at predefined times so that they can meet the same nurse. But the same care is taken for scheduling appointments with the doctors as reported by the Physician 1 *“If I have a patient I try to see it all the way through the step, so I see before surgery, I do the surgery and then I see it after surgery. And then I’m the one who needs to know the most about the patient”*. Scheduling is the mechanism which allows for the realization of this proposition. In fact, the doctor sees the patient for the first time and communicates the diagnosis. Next, the nurse schedules the patient not only for surgery with the same doctor that has given the diagnosis, but also for the following visit. Having very short lead times in between diagnosis and surgery allows the nurse to see the scheduling slots and thus arrange the patients accordingly. What emerged from the interview was also that the schedule was not cast in stone, but a certain degree of flexibility was allowed in order to meet the patient’s exigencies. In fact at times appointments slots were created out of the doctors’ schedule in order to accommodate for the lack of appointment possibilities. Rather than seeing it as a failure of the system, the Physician 1 recognized that they succeed in this respect only in 80% of the cases and therefore *“We are not really good at it yet”*.

At Södersjukhuset they are not quite so specific in the way they divide the work. For the activities they have in common with Capio they follow a similar routine, with a joint moment between the doctor and the nurse and time scheduled between the nurse and the patient alone. But this particular center has to deal also with incoming calls from patients which differ in nature. As the Oncology Nurse 3 points out there might be *“easy questions, I want new recipes, I will book an appointment”* but *“it’s also patients who are advanced in their disease [...] You have to get them to come here [...] You have to fix them a place in the ward”*. Such patients need to be attended right away or at the earliest convenience of their contact nurse. For this reason a certain degree of flexibility needs to be maintained. As pointed out by the Head Nurse *“We have to have a little hole if we have emergency visits”* At the same time though there is a certain degree of awareness of the hospital’s own resources. As explain again by the Head Nurse: *“It’s a waste of resources if we have lots of spare time in our schedule”*. For this reason the

medical personnel at Södersjukshuset is working towards smoothing the flow and combining administrative and medical work. They are for example, aware that on Mondays more patients will ask for advice over the phone because they have not been able to call during the weekend, and thus they schedule accordingly. On Mondays they look over the week, point out the slow days and fill the available slots in those days with administrative work. Finally an attempt emerged at coordinating with the doctors' schedule and thus at having conferences at the same times in order to continue to give care to the patients together. Attention is also paid to the way tasks are scheduled for the individuals. *“The nurse shouldn't have too many tasks at the same time [...] Now I have a couple of hours and I can focus on this and I don't have to be disturbed all the time”*. In order to take into account for patients who might not be able to come for their next chemo session, the nurses often have overbooking. Even so, the day before the patient is scheduled she undergoes a test to make sure she can sustain her next session. Doing so avoids having to order the medication and then having to throw it away, which is a big waste as chemo medications are expensive and cannot be used on patients other than the ones they are used for.

4.6. DIFFERENT WAYS OF TREATING CANCER: FROM STANDARDIZED PRACTICES TO “GRAY AREAS”

4.6.1. THE DOCTOR AND THE NURSE AS PROJECT MANAGERS

The doctors interviewed held different positions on how standardized cancer care really is. Medicine has moved forward, yet uncertainty still looms over current practices. One particular case is exemplar, the Head Physician 2, when asked whether he knew ahead of time how a patient would react to a treatment, replied at first that with current tests it was possible to know it beforehand. Yet, after further questioning and a moment of reflection replied: *“It's not very common that we know beforehand [...], it's really uncommon that we really know that this is going to be a very good treatment for you”*. The same reluctance was found in all the people interviewed. When asked about the most common way of treating cancer emphasis was always placed on the science behind the practice, on the routines, the exams and the importance of using evidence when deciding which treatment to use. Equally universal was the opinion that medicine should further proceed in this direction. Nonetheless, a certain amount of trial and error emerged as well. The Head Physician 2 claimed that: *“Some tests that we do are not*

100% (sure), so some of those patients that we feel would not have effect from the medication, they could have it anyway.” The Head Physician 3 instead claimed that “On the other hand, I think it’s important that we are in a field where there are no black and whites and that we always should do it, think if the guidelines, if the checklist are the right thing to do for this patient or should I make an exception”.

Nurses’ practice is equally characterized by a certain degree of variation, although in a lesser scale than its medical counterpart. When asked how she dealt with situations which deviated from the norm the Oncology Nurse 2 replied: “[...] *We don’t have fixed plans for that.[...] Sometimes it happens and then we handle it when it happens*”. When asked on further elaboration she talked about patients who would call her every day. There is no specified routine or limit to the assistance provided to the patients. Each of them has a contact nurse which she contacts “in case of need”. Even in extreme cases as patients calling every day, the same nurse did not feel it as burden. Her way of reducing the amount of variation in her practice was to take time with the patient from the beginning, to ensure that the patient had understood everything, that all her doubts were answered and clear indications were given as on what to expect in the following stages. In those cases, she added “... *they don’t need much time with me*”. Secondly the nurse felt she was the master of her own work and that her experience was her most important asset in handling variation. All the nurses working in the breast center had been working there for years and “when you have worked so many years like a nurse you should handle variation, when it comes you don’t need checklists”. Also, having tried different times and decided that 40 minutes is the time which works best gives the nurses room to handle a wide variety of responses from the patients and still manage not to overdue the slot assigned to them.

4.7.2. CONTINUOUS CHECKS IN THE PERFORMANCE

The system is not rigid in its condition. A universal tendency among all the personnel interviewed was the one of not focusing on the mistake itself, rather on how it could be solved. Reports are filled out at all the sites and passed on to the local chief which then checks with the worker who has done the mistake and asks for ideas on how to prevent the mistake from happening again. The local chief is also in charge of checking for emerging trends and recurring mistakes. If recurring mistakes emerge at the next conference the issue is raised and the team as a whole takes on the task of introducing a new routine to prevent it from happening again. The routine undergoes then a testing period, after which it is eventually approved or disregarded and a new one is found. This feedback mechanism is executed

also in the cases where there is no trend in mistakes emerging. Internally discussions are in fact often held as to whether a certain practice is still good or needs improvement, whether a certain standard is still valid or needs updating. In cases where an improvement needs to be made, the plan is made in group and it is quickly implemented and tested. By keeping this focus a certain standard in quality is maintained. But that is not the only system in place for ensuring a constant improvement in the services provided. Dual quality checks are indeed continuous. On the quantitative side there is the national registry system where doctors and nurses are obliged to put in all the available data (but keeping the patient anonymous) about the treatment the diseased has gone through and the outcome. On the qualitative side instead surveys are often made to check how care is perceived by the patient.

In one of the Breast Centers focus groups are monthly held with patients with the purpose of analyzing how the center is performing, if the experience can be improved for the patient and as a first reality check of new ideas for improving the flow.

4.7. DEALING WITH VARIATION IN INFORMATION

4.7.1. FORMAL SHARING OF KNOWLEDGE

Knowledge is acquired and shared through formal and informal ways. Formally, the most used mean is the conference. They are held by both doctors and nurses, at times together and they serve several purposes:

- To update each other on medical knowledge acquired after attending national or international conferences
- To establish routines and guidelines for the care of the patient
- To check how the established practices are faring, if updates are needed
- To raise and solve problems

4.7.2. TRAINING AND INFORMAL SHARING OF KNOWLEDGE

Training new doctors and new nurses is a mix of checklists and gaining experience on the field. Checklists are given to newcomers (or would be given, as in all the centers interviewed the personnel

had remained unchanged for several years) so that they know what is expected of them, how to handle the majority of the cases and can operate without being continuously under supervision.

On the other hand, a component of the medical practice is the training on the field. At one of the sites doctors in training were in charge of seeing patients for their follow up.

But training is not only limited to the newcomers. There is a certain hierarchy in terms of experience and roles in the visited sites. First there is the senior consultant, then the specialist and finally the resident. There are requirements in terms of degree and years of experience to achieve each of the title and senior consultants are the referral point for difficult cases.

Several of the doctors interviewed highlighted the importance of having different degree of experience available on the floor. This way it becomes possible to have access to a vast pool of knowledge without having to go far, which comes in handy for more complicated cases which do not respond as expected to standard treatments.

At the same time it emerged that knowledge is created and shared through less formal means. The Head Nurse example mentioned above happened over coffee while the one from the Head Physician 3 happens in a room with several doctors where it is easy to get someone's attention. Interestingly, this way of sharing knowledge was criticized by the Physician 2 from Capio. In her routine, asking for a coworker or a senior doctor's opinion was a structured point in her schedule. She would look at her cases, set aside the ones she needed a second opinion on and every day at a certain hour all the doctors in the department would get together in the same room and help each other out in diagnosing the most complicated case with the additional help of the appropriate instrument.

According to the Business Consultant 3, the best part of health care is that when *“you have responsibility inside that level, if you have a patient that is not within your responsibility or within your expertise then you have to go to the next level”*. What is meant with next level in this case is the hierarchy in oncology departments pointed out in section 4.1. The same approach towards creating knowledge in the department was expressed by the Head Physician 3, regardless of his senior position. When asked about ways of sharing knowledge he replies *“I think for our work it's a lot about discussion”*. Unsurprisingly, this emphasis on discussion is accompanied by the presence of a lot of variation in the practice *“It's not black and white and you have to define. Should I do this or should I do that and maybe this or maybe that. And you want to do that, maybe you decide yourself, but you want to do that in a conversation with a colleague, just to try to see if what you are doing is the best*

one and if maybe you should change the way you think.” Nurses go through the same process when it comes to their knowledge as well. The Head Nurse recounts how she checks her own knowledge against her coworkers and, upon finding discrepancies, a discussion is started and its result listed down for the rest of the department to see.

Finally, when it comes to catching up on new knowledge, it was recognized as an essential part of the medical profession, yet at the same time doctors and nurses were aware of having barely time left for such activity. Two proxies were found to be used to overcome the problem: on one hand limiting the the search of new information strictly on the area of the doctor’s competence (for example, cancer of the head and neck or breast cancer), which was a solution implemented at an individual level. On a departmental level instead, in the case of radiation oncology at Radiumhemmet, a person was appointed with the role of acquiring and spreading new knowledge.

4.7.3. CHECKLISTS AS A MEANS OF SHARING INFORMATION

A second universal trend was the praise of checklists and mapping of value chains. The Oncology Nurse 2 claimed *“Some time ago we just worked and we didn’t know what we did, now we have marked everything down, what we do with the patient, which gives you more understanding about how important your work is all the time”*

4.8. SEPARATING GOOD AND BAD VARIATION

One story told by the Department Head shows quite well the difference between good and bad variation. When inquiring about the average time a patient is treated at the ward, the resulting figure is five days. When broken down per category there are the patients on schedule for chemotherapy and the patients with side effects that are treated at the ward. The scheduled ones are treated mainly for three days and there is no room for improvement there because three days is the planned length of their treatment. The patients with side effects instead have an average of six days in the ward. What this average hides is that there are patients who are discharged after one day and patients discharged after 45 days. Upon further inquiry it emerged that such a long time was not due to a particular treatment, but to mistakes in planning and in the way the information about the patient was handled.

Ramsey and Schickedanz point out the difficulty of defining value in cancer care. For example, while aiming at the surviving of the patient, the treatments administered usually worsen the patient’s quality

of life. In some other cases instead, the cancer is so aggressive that even when the best treatment is given, the patient still does not survive. Furthermore, the high costs of anti-cancer therapies create a burden that is carried by the patient, by the hospital and by the society as a whole (Schnipper et al.,2010). How to decide then what is valuable in oncology care and what is not? Ramsey and Schickedanz propose an answer to this question as: “An intervention in cancer care can be described as having value if patients, their families, physicians, and health insurers all agree that the benefits afforded by the intervention are sufficient to support the total sum of resources expended for its use.” The rationale behind this definition is that patients should have their saying since it is according to their preferences that their quality of life and the relative benefit of a treatment are assessed. The medical personnel, on the other hand, should use the evidence in their possess to advise the patient on what it is best for her, but also to avoid giving treatment to the patient that are costly and do not give any real benefit.

In all three centers the same objective was expressed: to provide care that was better from the patient’s perspective. At Södersjukhuset “the patient is always first and we try to keep that in mind. So, every time we discuss something, it is our task [...] to see the right patient, at the right time and to do the right thing”. At Capio instead Oncology Nurse 2 claims “I have always been interested in ways to make the work more effective in helping the patients. The patients should be satisfied with the care that we are giving”. Finally, at Karolinska one of the respondents the Head Physician 3 stated that “*the essence of our work is to put the patient first and we do think that way, in our decision making, most of the time.*”

4.9. RESULTS FROM APPLYING LEAN TO A HIGH-VARIATION CONTEXT

According to the Process Consultant 3 applying Lean to the cure of breast center patients “*for the experience of the patient, it’s so much better and it costs less. You cut the waiting times; you get much better patient journey*”. At the same time, when talking about the results of years of applying Lean at Södersjukuset, the Head Nurse says that thanks to the efforts of all the frontline workers and the short improvement cycles, care has been getting better and better all the time. A similarly positive view was posed by the Oncology Nurse 2 talking about applying Lean at Capio: “*Some time ago we just worked*

and we didn't know what we did, now we have marked everything down, what we do with the patient, which gives you more understanding about how important your work is all the time." The results are, according to the respondent, that performing tasks is easier for the nurses but also safety is enhanced. The Economist (Schumpeter, 2013) points out how doctors and nurses have brought down the barriers typical of their professions and now work together and suggest improvements together, and how waiting times have been reduced together with the patient's likelihood to pick up an infection. The latest press kit released by the Karolinska institute highlights the positive results obtained by applying Lean as well, although without giving details about the single departments. It should be said that during the interviews several more avenues for improvement were highlighted: the need for shorter waiting times between referral and seeing a doctor was highlighted in four interviews, while in three interviews better communication among departments was the issue to be tackled. Other issues came up in one or two interviews like the need to improve patient's access from the emergency ward to the oncology ward, better quality measurements and a higher inclusion of patients in clinical trials. But while this finding show that the Lean initiative is not completed in the cases at hand, it should be recalled that Lean per se is an ongoing process whose pillars include continuous improvement and the capacity of workers to keep on spotting problems and finding solutions to solve them. In this light the capacity of almost all the respondents to point out a problem and in some of the cases propose a solution can be viewed as proof that the Lean implementation has been successful.

5. ANALYSIS

The following section will present the framework that binds the chosen literature and the empirical data collected in order to answer the research question. First a distinction will be made into which variation to keep and which to take away. Second the framework will be presented which brings together Lean in a context of variation. Finally two different strategies will be highlighted for dealing with variation: reduction and a textbook application of Lean and accommodation which calls for further adjustments to the model presented.

5.1. ESTABLISHING VALUE: GOOD VARIATION AND BAD VARIATION

The problem with contexts that present high variability is realizing that not all the uncertainty relative to the practice needs to be there. While seeing a patient in the emergency room because of the side effects caused by the treatment is an unavoidable part of curing cancer patients, seeing them because of variation in communication that made the patient unsure about dos and don'ts of her condition does not add value to the patient itself and adds costs to the ward in terms of resources spent on the patient for which there objectively is little benefit. It is crucial therefore to realize which variation is necessary to have quality in the activities performed and which one adds waste.

The way of doing so is to have a clear vision and a clear set of priorities. The personnel interviewed at the sites claims that for everything they do, they always keep the patient as their main focus, rather than the hospital's resources (although that is a thought always present in the back of their minds). What they actually claim is that they are focusing on making the process flow efficient rather than resource efficient. Their purpose is first and foremost to limit the waste for the patient, therefore as small waiting times as possible, as little defects as possible, the least number of visits and, as possible as it is in a delicate area as cancer care, no unnecessary treatment. This is the starting point, the philosophy that guides doctors and nurses at the centers researched. From here, the dilemma good variation/bad variation is solved more easily than what it might seem at first sight. As mentioned in the Empirics, patients have three distinct set of needs: time requirements in terms of wanting to be done with the treatment as soon as possible but also needing time to adjust to their condition, management of the symptoms coming the treatment and, above all, information. So, following the Lean Consumption's principles any variation in the process which directly answers to these needs is good variation, which ought to be accommodated when deciding to provide the service which is causing variation; all the

variation which instead does not answer to these needs is bad variation and therefore needs to be rooted out. The way out of this dilemma is to reduce the range of services provided to those with the least amount of variation, although always keeping in mind that as long as there is a human component; variation cannot be completely “reduced away”.

5.2. MANAGING VARIATION: KNOWLEDGE AS AN “ANDON” SYSTEM

In classical lean manufacturing settings there are big electronic boards which show all the relevant information to all the workers in the plant. Unfortunately, big lighted boards are not practical in the hospitals and, even if they were, they would not be as useful as in a manufacturing system. Doctors and nurses do not work in large common areas; rather they go back and forth between enclosed spaces. Furthermore, the amount of information for each patient is considerable and its relevance for doctors and nurses not dealing with that specific patient can be questioned. That does not mean that the Andon system should be disregarded all together. If once transcends from the materiality of this practice, its application can take a different form and a completely different mean than a physical board: the flow of information. Making the relevant information crystal clear in the minds of all those involved in the process can work as well as having it displayed on lighted boards. And this applies to workers as well as to customers. First the workers’ perspective will be analyzed, followed by the inclusion of the customer.

The starting point of the knowledge system is the individual. In a knowledge intensive system like the one studied the individual is bound to be seeking for new knowledge, be it the latest development in a certain technique or how to improve a certain process so that it drains less resources. Once this knowledge is found by the individual, it is also bound to be diffused in the department as the individual interacts with her peer. But, as everyone has tasks to perform the way this information is shared will be unstructured and reach a variable number of other people. It might hold value for several individuals, yet it might never reach them or it might reach them in a distorted way. This will cause the emergence of conflicting information, the adoption of different standards and the consequent waste of resources every time one protocol causes problems with the other. It will also hinder the ability of employees to fix problems and help each other since there are no clear guidelines as to what the help should aim for, what the desired state would be. Henceforth the occurring of patients being readmitted to the unit more often than they should be and the waste in time spent in harmonizing different practices which are

bound to be disrupted again by the next round of conflicting information. The way out of this system is to take a step back and start again from the individual. The first question that needs to be asked is: “What is the nature of the acquired knowledge?” In other words, is it possible to make it explicit? The answer to this question can define a whole different process for sharing knowledge.

5.2.1. STRIVING TOWARDS MAKING COMMUNICATION EXPLICIT

Hospitals are often viewed as broken down in silos which are not communicating with each other. Yet, this concept was disproved in the case of breast centers. All the personnel interviewed in these sites in fact, when explicitly asked about communication, replied that it was not an issue either between doctors and nurses or between different departments. Upon closer inspection it became clear the extreme attention to having all the knowledge needed in an explicit form that could easily be shared and reproduced inside the department and outside. Nurses have check-in and check-out conferences every day where they share not only the schedule, but also eventual issues arising from the handling of patients. At the same time the atmosphere in the department is of one where it is easy to communicate and where there are no walls between nurses and doctors. The existing Lean literature provides an explanation as to why communication in the Breast Centers works better than in

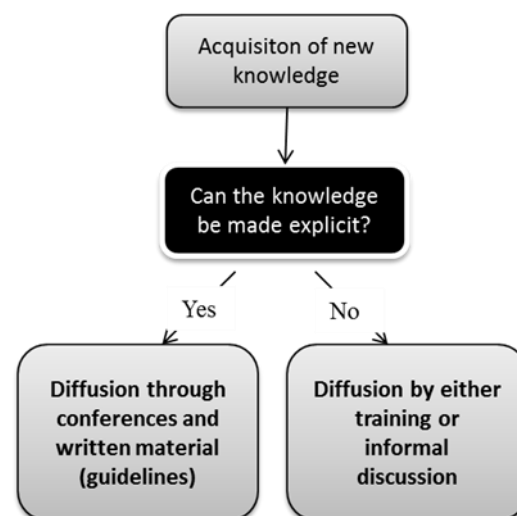


FIGURE 13 - KNOWLEDGE SHARING

the average ward. In explaining the progression of Lean from a manufacturing centered to a service centered philosophy it was highlighted how the necessity for standardization and coherence inside the department was a constant. This concept encompassed knowledge itself, but also the way procedures ought to be set throughout the company. In order to understand why this statement is so important the journey of the same information will be retold, but according to what the data gathered point out as a more efficient path. The individual comes across new knowledge either from reflecting on her own or from an external source. This time though, the individual knows what to do about it, because clear practices have been established for information sharing. Assuming that the answer to the question posed above is that yes, the information can be made explicit, during the next scheduled conference with her peers, she can proceed to expose her knowledge and this knowledge can be then codified into

the most appropriate way, for example a new series of steps to perform in order to complete a certain operation. In order for this mechanism to flow seamlessly a series of conditions need to be respected: the information needs to be made explicit, although this condition can be relaxed, as it will be explained in the next section, there needs to exist an environment where information can be easily shared and the sharing points need to occur often.

5.2.2. SHARING KNOWLEDGE THROUGH REDUNDANCE

It was previously mentioned how knowledge needs to be made explicit in order for the sharing to occur successfully. This does not always need to be the case. In fact in a well-functioning system there is room for making tacit knowledge explicit and for the transfer of tacit knowledge without making it explicit. In the first case in fact knowledge can emerge through discussion. Evidence of this practice was found in both Breast Centers to occur inside and outside conference rooms. One way this can happen is through the emerging of conflicting information. Whereupon, in fact, conflicts emerge between nurses in the way they conduct the same operation, a discussion is started about which practice is the right one to pursue. This discussion can be conducted formally and informally. A formal discussion is to be preferred as it reduces the amount of resources used in the process but a certain degree of flexibility in this respect needs to be allowed in order not to make the communication system too rigid. The second reason for allowing flexibility is the creation of redundancy. The benefit of such practice is not only the creation of a common knowledge base from which everyone can work and which makes the system more stable, but also the creation of a workforce who can act promptly on problems and solve them.

5.2.3. SHARING KNOWLEDGE THROUGH TRAINING

In case instead the information is to be passed from tacit form to tacit form the only solution that emerged from the data and that found confirmation in the literature is the establishment of a training system inside which knowledge that cannot be codified can be passed on. One characteristic of operations with intrinsic variation is that they can hardly be written down. The sheer amount of possible scenarios and the swiftness of change from one to the other is such that coding such experiences is extremely difficult. Even assuming that it would be possible the amount of information created would be such that it would make it hard for those who require it, to acquire such knowledge in a way that is time efficient. Finally, the capacity of distinguishing between different scenarios is

something that comes with experience only. Experienced doctors and nurses know that they might face a very wide range of possibilities, but all the personnel interviewed were confident of their capacity to deal with the situation in a prompt way. Their knowledge does not come from the scrupulous memorizing and following a checklist, but from the years spent training and dealing with progressively more complicated cases. For this reason the experts who are already in possess of this knowledge, need to pass it on to the newer generations. In doing so, they also manage to reduce the sensitivity of the unit to their departure. This training system should have two components: one is the formal, scheduled “ladder” to climb where the newly graduated doctor is presented with cases of increasing complexity. But there is also a second component which is much more similar to what happens with the nurses. Similarly to the check-in, check-out conferences in fact doctors hold multidisciplinary conferences where the outcome is to find a solution for the patient, but also where knowledge is shared about the latest development in medicine and experiences is recounted as to what happened when applying a specific treatment. And similarly to nurses, doctors regularly talk to each other in order to solve the most complicated cases together. In this case as well, the process can be more or less structured. It was found that in one of the sites all the doctors were in the same room and that experts were almost always at arm’s length. In another site instead the knowledge sharing procedure was much more structured, as time was set aside every day explicitly for the task of solving the cases the doctor was not able to solve on her own.

The results of establishing such a training system is that it is the only way to create employees who can deal with embedded variation, which is a crucial skills in contexts as the one examined. In order to deal with variation in fact workers need to be able to know in the first place from what sources the unexpected might come from, be able to spot the moment the unit starts to deviate from what was its foreseen course of action and thus act accordingly either to bring the unit back to its path or to adapt the work to the emerging process. In order for the last condition to be enacted on time, the worker in charge of the process needs to have already crafted one or more contingency plans to which it is possible to switch in the least possible traumatic way. For example experienced doctors do not know from the start whether a certain treatment will be beneficial for the patient, neither do nurses know whether the side effects will be so severe that an emergency recovery will be required. What they do know is a range of possible outcomes that they might be facing and their response in this respect is to have a backup plan so that if treatment A fails, treatment B is available and so on.

5.2.4. REDUCING INPUT VARIATION: THE CUSTOMER AS ANDON SYSTEM

It was mentioned that knowledge can work as an Andon system also when dealing with the customer. Actually, in that case knowledge and the customer become part of a unique Andon system. In this context the purpose served by including the customer in the knowledge sharing system serves at reducing the unnecessary variation coming from the input and from the process. In fact, by knowing exactly how far along in the process the customer currently is, what she can expect and what is expected of her, uncertainty can be reduced on her side and with it, its negative effects on the treatment. Making an example from the case study, the likelihood of the patient inadvertently doing something detrimental for her health is reduced, together with the possibility of the patient deciding to stop the treatment out of a poor management of the symptoms caused by the treatment. At the same time the patient can work as the process stopper, by highlighting variation in the information she is given, the way she is treated or in her process. Examples of these cases were seen in the Patient that had to point out to the nurse that she was not supposed to take that drug or the patient who called her contact nurse to check that her appointment was still as scheduled and thus revealing to the nurse that she had forgotten to put her in the system.

When it comes to sharing information with the customer it should be noted that limiting the communication to fixed, structured point in time might not be wise. It is in this case in fact, that “good” variation lies. As part of the variation lies outside the control of the caregiver, rather than “looking at the Andon board” a few scheduled times; interaction is required more often and at times in a more casual way. In fact, by increasing the interaction, the experienced worker will be able to pick up on the clues that indicate that unexpected variation is occurring, and therefore there needs to be an adaptation either on the unit or on the customer’s side. Such flexibility can still be controlled for by appointing a single individual in charge of each set of unit, as it is the case for the contact nurse. This choice on one hand reduces the scenarios the worker could possibly face and the consequent variation. Moreover as the number of exchanges between worker and unit increases more knowledge is shared on both sides with the reduction of uncertainty coming from a single unit.

The final reason for establishing a knowledge sharing system is that it is on the generation and sharing of new knowledge that work can continue in the context of high variation. On one hand in fact generating new knowledge and sharing it continuously will bring to light repetitive patterns, which are the signal that a process can indeed be moved from art to science and hence standardized. On the other

hand, knowledge allows the making of better project managers who can detect variation faster and create better contingency plans.

5.3. A WORD OF CAUTION WHEN IT COMES TO KNOWLEDGE SHARING

Everything works so far. Yet a word of caution is due. In fact the context we are dealing with is a Lean context, whose focus is to waste the least possible amount of resources. Therefore, enter scheduling and support structures to insure that there is a healthy degree of variation in the knowledge sharing process, but that this degree does not turn into a situation which cannot be controlled.

A point was raised in the Empirics section about the idea of having all the workers in the same room “borrowing” on each other’s experience. Such discussions occur in fact in less formal contexts, where knowledge that can be formulated but has not yet been written is called into questioning. At this point a new discussion is started about which of the existing paradigms is the correct one. This practice was criticized by one of the respondents in favor of a more structured approach.

Taking a look back at the theory might reveal why such criticism is founded. If bad variation comes from ambiguous knowledge, the way to reduce it is to make standardized knowledge available to all workers. Hall and Johnson talk about the importance of having support structures for artistic processes, which are as standardized and scientifically managed as possible. Similarly, Frei claimed that processes with higher variation should be separated from the others. While logically sound, this argument hides its complexities. As mentioned in the empirics, the higher up in the oncology hierarchy the more complicated are the cases that the doctor faces, which makes them more “artists” than scientists. As such they need an appropriate support structure to do their work, henceforth structured moments in which to share their knowledge. Making knowledge interactions less formal might facilitate the sharing of knowledge, but it is not the most efficient approach. In fact, upon finding conflicting information between two parties, at least a third one needs to be called in the discussion to check which information is the correct one. In a context which is time and resource intensive keeping a worker off her duty to check the correctness of the existing procedures is a waste in terms of resources as no one of the people involved are performing an activity which adds value to the unit and of flow as the ongoing process needs to be stopped in order to check that compliance with the established practices is respected. That

said, there is no reason for stigmatizing the diffusion of tacit knowledge. It can and it should still be shared, but such sharing moments should be structured.

Formal knowledge sharing moment should be established, where the purpose of the process is clear, as in “talking about what” and “to what purpose. All the participants who are responsible for generating the knowledge discussed need to be involved, but also all the ones who are directly affected by the knowledge generated. For example, when discussing the patient’s diagnosis, all the actors that contributed to the diagnosis should be present in the site of the discussion, but also all the prospected caregivers. In these meetings the role of written report is the key to the process of combination highlighted by Nonaka. Reproducing the knowledge in written word creates a firm point to which all the caregivers can refer to and which can be more easily exported to those who did not receive the knowledge during the conference. Similarly, when reporting about knowledge generated outside the unit, like the knowledge generated in international conferences that the doctor is bringing to the unit, the doctor himself should obviously be present, but also those whose work is directly affected by the newest scientific discovery.

5.4. REDUCING VARIATION: SCHEDULING

When dealing with a high variability situation the way to control such variability is to perform only those operations which can be standardized and for which, in line with the Lean philosophy, a clear path can be designed and followed. The Breast Centers prepared in this study are examples of this practice. Their conscious choice of dealing with patients affected by breast cancer only and, in the case of Capiro, to focus mainly on surgery allows for a shift in paradigm from how to cure the patient to how to cure the patient in the way that is most efficient for the patient and for the hospital. The consequence of such choice is that Lean can be applied in quite a literal way. The way variation affects the centers was highlighted in the Empirics and in the previous section when talking about the different ways of sharing knowledge. The same quest for structure is to be found in the way the schedule is handled. Scheduling is the glue that binds all the variables together. The more detailed the schedule is, the easier it is for the nurse to keep track of the flow and quickly react if there is an obstacle to the regular flowing of the patients, to be on top of the workload and to avoid scheduling misshapes. At the same time extreme care is taken in making the patient and all the material related to her is made visible throughout the whole journey so that it is possible to trace every mistake back to its source. Finally focusing on reducing lead times makes it easier to check that the flow unit is proceeding as it should. In

conclusion, in cases where the choice has been made towards reducing variation, the application of Lean does not differ in a significant way from applying Lean in a context where a lower degree of variation is present.

5.5. DEALING WITH THE CHOICE OF KEEPING VARIATION

If, after deciding on its own definition of value, an organization agrees that it is part of its mission to provide services which are characterized by a high level of variation, the discussion shifts towards how to manage the operation in the least possible wasteful way and at the same time delivering value adding variation. In other words, differently from the previous scenario where dealing with variation was only an additional component to be prepared for, in this case handling variation is the main focus of managing operations. The founding point of this choice is the necessity of keeping high variation and low variation processes separated. While low variation processes can be standardized in the way that has been shown so far, high variation processes need to follow their separate track. Inside this compartment the people at work need to have a different set of skill, share their knowledge in a different way and be monitored with different indicators than the rest of the business.

5.5.1. THE DOCTOR AS A PROJECT MANAGER

The further away we move from the standardized best case scenario, the more important becomes the figure of the doctor and how it is empowered within the structure. Patients treated with radiotherapy are patients whose problems are more complex than the best case scenario and which are for this reason, more refractory to checklist. Attending to a set list of tasks when curing them, risks on missing out on what is the most effective way of curing them. As it emerged from the empirical data, the practice adopted for these patients is the discussion on what might be the best approach towards treating them. At the same time highly experienced individual can react faster to unforeseen situation and bring the situation back to normality with little alteration to the flow inside the unit. In the cases of the most complicated patients doctors and nurses switch to a role of project manager. Following the patient closely and making ready to switching from treatment A to treatment B the doctor makes sure that the patient follows the path that was established or decided that there is a new path that the patient need to walk down. This is also the case of the oncology nurses in the breast centers who had been working in the unit for years. They knew they could handle the vast majority of the patients' reaction to their

diagnosis within the allotted time and the most extreme ones would not take much of a deviation from the schedule.

5.5.2. HAVE OWN SET OF KPI

The problem with operations with high variation is that they escape the same rules that govern the rest of the operations. For example, in cancer looking at the survivorship rate is an incomplete measure as it does not take into account that some patients might visit the hospital at a later stage where reaching a favorable outcome is already harder. At the same time, it penalizes those structures which cover the whole spectrum of treatments as they get patients which are sicker and more complicated to handle than those units which have chosen to focus on a certain kind of patient. It becomes much more informative to have key measurements that look at the process while it is in action, than once it is completed. In order to be truly “Lean”, the final feature the system needs to be present is the capacity of continuously improving itself. Stemming from a clear definition of value in a well-functioning Lean unit its workers are always looking for ways to root out waste and to improve the flow. They are in this respect the best judges of the quality of the system. At the same time the variation factor might mask the effective reach of improvement efforts. The method to overcome this issue was advised in theory and has found confirmation in the data: keep in place a dual system, by allowing the unit to choose the KPI that it deems more informative and then double check with the customer whether the reality experienced is the same as the one described by the organization.

5.6. A FINAL NOTE ON CHOOSING TO ACCOMMODATE OR REDUCE VARIATION

Given that the above mentioned tactics work both for reducing and accommodating variation one could wonder whether variation should be accommodated at all. The question is that it depends. Sometimes an organization might not have a choice in regards to what services to provide due to regulations or other external factors. Most of the times though it boils down to the organization’s priorities. In the example of Capio they had decided to focus on the needs of breast cancer patients, given the relatively higher simplicity in treating them. As such, a major focus was put on establishing a separate path for these patients where their needs could be served faster than the usual by reducing all the variation inherent to the process. Karolinska instead, being a teaching hospital, places its emphasis on providing

a wide range of treatment, including experimental practices whose results with the patient will add to the existing body of medical knowledge. It is not in author's intention to decide which philosophy might be best. Some services have to be provided, like the chemotherapy that is provided by Karolinska for patients from Caphio as well, regardless of the fact that they make the process harder to manage. On the other hand it was argued that an organization's priorities set defines also its idea of waste and therefore good and bad variation. Having conflicting priorities in this respect will lead to shifting paradigms whose result will be the retaining of unnecessary variation and reduced effort in pursuing the practices that allow the unit to make the most out of its "good" variation.

6. FINAL REMARKS

This final section summarizes the results achieved by the study and the contribution to the existing body of literature. Furthermore, the research's limitations are highlighted and perspective new avenues of investigation are proposed.

6.1. CONCLUSIONS

This paper was written with the purpose of stretching Lean beyond its established boundaries to try and see if this philosophy could be successfully applied in a context which is in evident violation of one of the founding assumptions of Lean: the presence of a clear path for the flow unit, which in turn leads to the impossibility of removing part of the variation that characterizes the processes under study. In order to clarify what is mean with variation McLaughlin's model was used which separates variation in three components: input, process and information. Three hypotheses were made: first that Lean could be used to remove unnecessary variation, second that after being slightly modified for knowledge intensive contexts it could help dealing with necessary variation and third that it could prove useful in establishing support structures for processes characterized by a high degree of necessary variation.

In order to test this hypothesis the practice of oncology was chosen as a field with high in-built variation, part of which cannot be eliminated. The cases used were the department of oncology at Karolinska and the breast centers at Södersjukhuset and Capio, since they have been applying Lean in their processes for several years.

The research brought support for all three hypotheses. Lean can indeed be used to reduce unnecessary variation even in a high variation context as oncology. It is in fact by applying Lean principles and the notion of value that the units investigated were able to differentiate between variation that ought to be kept and variation that instead should be rooted out. Stemming from this result is the subsequent dual effect of Lean: it can in fact help in reducing unnecessary variation as it is, just by applying the principles theorized by the existing literature. But it can also help in making the most of the variation that should not be eliminated through the establishment of an appropriate knowledge sharing system that can be likened to a traditional Andon system and through support structures for high variation processes achieved by scheduling and standardizing all the processes whose variation is unnecessary. Consequences of applying this model are, in the context at hand, the creation of a path that is more centered on the flow unit, rather than on the resources of the organization performing the operation.

More in general, uncertainty related to the input and to the process can be controlled by making explicit all the knowledge related to a process, scheduling moments where tacit knowledge can be shared and, in case the input is a sentient being, by including her in the Andon system. Second, by supporting high variation processes with a solid base made of standardized tasks and little variation artists can focus on their job and make sure that they perform it in the best possible way. This last point is particularly important as high-variation processes escape traditional performance measurements therefore needs to be evaluated both internally by establishing a continuous improvement system and externally in terms of customer satisfaction which ought to be targeted more at the ongoing process than at its outcome.

6.2. THEORETICAL CONTRIBUTION

This paper stems from Staats and Swank's attempt to bring Lean beyond its last frontier, that is the environment where personal judgment and expertise make up a big part of the work. Efforts were made in overcoming the limitations highlighted by Staats. Lean in health care is not a new concept and, while a definition of Lean oncology might be missing, the personnel interviewed claimed to be following Lean guidelines. Second, the implementation is not complete as in Staats' case, but clear cut improvements have emerged in terms of increased satisfaction for the working conditions on the employees' side as gathered from the interviews and better performance, as gathered from the data published by the hospital. Finally, bringing Staats' framework from software development to health care proves the model's versatility beyond the context it was tested in.

Second, this paper provides a framework which binds closely knowledge generation and Lean. Creating and sharing knowledge is in fact viewed as a way of standardizing certain practices, but also of handling the in-built variation of the context at hand. As a consequence, knowledge can be shared in a more structured ways which allows for reaching more people by exacting a lower toll in term of highly valuable resources as employees constantly dealing with high variability are.

6.3. LIMITATIONS

The identified sources of variation are particular to the area that has been studied, oncology care, and might not be easily extendable to other industries or processes where the relationship with the customer is not so close. The classification taken from McLaughlin still turns out useful in understanding the sources of waste, yet it remains particular to each industry what elements belong to each category.

Furthermore the conclusions were drawn on semi-structured interviews rather than direct observation. The perceptions that the respondents had of the way the work was conducted could have biased their response to the questions, with the author none the wiser. Similarly, the author's lack of knowledge of the medical field might have brought her to miss on important issues and rival explanations which would have been evident to the more experienced researcher. This leaves room for my results to be confirmed either through direct observation or, even more interestingly, through longitudinal research, to realize whether there is a dynamic component in the debate whether to accommodate or reduce variation that the author might have missed.

6.4. SUGGESTIONS FOR FURTHER RESEARCH

During several interviews a vision emerged for the future of work in oncology, a work that was much more team based and more patient-centered. Rather than a production unit, treating the patient would become something more similar to the shusa system in the Lean framework aimed at designing processes. There would be *“one place where you really have all the needs around the patient”* which *“would give a more creative environment and a more stable environment for the patient because they would not have to go here and go there.”*. It is also worth noting how the doctor interviewed believed such work could be achieved within the current infrastructure. The Business Consultant 3, who is also a practicing doctor, elaborated on this concept, by explaining how they should be built around the contact nurse, as this is the constant throughout the patient's journey; how there should be different levels of knowledge inside the team and thus have figures at different levels of the hospital hierarchy inside the team and how, finally, by incorporating the patient in the team the problem of sharing the relevant information with the diseased would be solved. Both breast centers investigated during the study are actively working in this respect, by having all the facilities in one place and having many contact points between doctors and nurses. This practice is though still restricted to breast cancer patients and, in the case of Capio, to breast cancer patients which are treated through surgery only. Furthermore, even in these cases it emerged from the interviews that more work could and should be done in this direction.

Parallel to this argument, it emerged from the interviews the possibility of adopting the Breast Center modality for other kinds of cancer as well. It would be interesting to assess the feasibility of this statement, where the demarcation line should be for different centers in terms of diseases covered, but also competencies and what logistic constraints it would entail.

Finally, given the small amount of studies existing on the topic, taking the framework proposed in this study and applying it to a different context would be an interesting proving ground for the model itself.

BIBLIOGRAPHY

- A Hospital Case; Schumpeter. (2013, May 18). *The Economist*.
- BallÃ©, M., & RÃ©gnier, A. (2007). Lean As A Learning System In A Hospital Ward. *Leadership in Health Services*, 20(1), 33-41.
- Bast, R. C., & Hortobagyi, G. N. (2004). Individualized Care For Patients With Cancer â€” A Work In Progress. *New England Journal of Medicine*, 351(27), 2865-2867.
- BERGER, L. (n.d.). Cancer Care Seeks to Take Patients Beyond Survival - New York Times. *The New York Times - Breaking News, World News & Multimedia*. Retrieved August 3, 2013, from <http://www.nytimes.com/2007/05/22/health/22canc.html>
- Bertaux, D. (1981). *Biography and society: the life history approach in the social sciences*. Beverly Hills, Calif.: Sage Publications.
- Bohmer, R. M. (2009). *Designing care: aligning the nature and management of health care*. Boston, Mass.: Harvard Business Press.
- Braun, P., & Kessiakoff, R. (2012). *Introduction to Lean: Overview, Experiences and Reflections*. MalmÃ¶: Liber AB.
- Britten, N. (1995). Qualitative interviews in medical research. *British Medical Journal*, July 22(311), 251-253.
- Burgess, R. G. (1982). *Field Research a Sourcebook and Field Manual*.. London: Routledge.
- Bushell, S., & Shelest, B. (2002). Discovering lean thinking at progressive healthcare. *The Journal for Quality and Participation*, 25(2), 20.
- Champy, J., & Greenspun, H. (2010). *Reengineering health care: a manifesto for radically rethinking health care delivery*. Upper Saddle River, N.J.: FT Press.
- Cooper, R. G., & Mohabeersingh, C. (2008). Lean thinking in a healthcare system â€” innovative roles. *Journal of Pre-Clinical and Clinical Research*, 2(2), 110-117.
- Cusumano, M. (1994). The limits of lean. *Sloan Management Review*, 35(4), 27-35.
- Donaldson, M. S. (1994). *Defining primary care an interim report*. Washington, D.C.: National Academy Press.
- Dubois, A., & Gadde, L. (2002). Systematic combining: an abductive approach to case research. *Journal of Business Research*, 55, 553-560.
- Eddy, D. M. (1984). Variations In Physician Practice: The Role Of Uncertainty. *Health Affairs*, 3(2), 74-89.

- Erikson, C., Salsberg, E., Forte, G., Bruinooge, S., & Goldstein, M. (2007). Future Supply And Demand For Oncologists : Challenges To Assuring Access To Oncology Services. *Journal of Oncology Practice*, 3(2), 79-86.
- Fillingham, D. (2007). Can Lean Save Lives?. *Leadership in Health Services*, 20(4), 231-241.
- Frei, F. X. (2006). Breaking the Trade-Off Between Efficiency and Service. *Harvard Business Review*, November, 1-12.
- George, M. O. (2010). *The lean six sigma guide to doing more with less cut costs, reduce waste, and lower your overhead*. Hoboken, N.J.: John Wiley & Sons.
- Glaser, B. G. (2007). Constructivist Grounded Theory?. *Historical Social Research / Historische Sozialforschung. Supplement*, 19, 93-105.
- Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: strategies for qualitative research*. Chicago: Aldine Pub. Co..
- Graban, M. (2009). *Lean hospitals: improving quality, patient safety, and employee satisfaction*. Boca Raton: CRC Press.
- Grove, A. L., Meredith, J. O., Macintyre, M., Angelis, J., & Neailey, K. (2010). Lean implementation in primary care health visiting services in National Health Service UK. *Quality and Safety in Health Care*, 12:28, 19-24.
- Guest, G. (2006). How Many Interviews Are Enough?: An Experiment With Data Saturation And Variability. *Field Methods*, 18(1), 59-82.
- Hall, J. M., & Johnson, M. E. (2009, March). When should a process be art. *Harvard Business Review*, dummy data, 58-65.
- Hewitt, M. E., & Simone, J. V. (1999). *Ensuring quality cancer care*. Washington, D.C.: National Academy Press.
- Hines, P., Holweg, M., & Rich, N. (2004). Learning to evolve. *International Journal of Operations and Production Management*, 24(10), 994-1011.
- Jacques, A. (1987). Emergency medicine: primary-care medicine. *Can Fam Physician*, 33, 2681-2682.
- Johnson, F. E. (2013). *Patient surveillance after cancer treatment*. New York: Humana Press.
- Kenealy, J. (2012). Grounded Theory: A Theory Building Approach.. *Qualitative Organizational Research Core Methods and Current Challenges* (pp. 408-425). London: SAGE Publications Ltd.
- Kuzel, A. (1992). Sampling in qualitative inquiry. *Doing qualitative research* (pp. 31-44). Newbury Park, Calif.: Sage Publications.

- Kvale, S. (1983). The qualitative research interview: A phenomenological and a hermeneutical mode of understanding. *Journal of Phenomenological Psychology*, 14, 171-196.
- Liker, J. K. (2004). *The Toyota way: 14 management principles from the world's greatest manufacturer*. New York: McGraw-Hill.
- Mackenzie, L. J., Sanson-Fisher, R. W., Carey, M. L., & D'Este, C. A. (2013). Radiation oncology outpatient perceptions of patient-centred care: a cross-sectional survey. *BMJ Open*, 2, 1-10.
- Maxwell, J. A. (1996). *Qualitative research design: an interactive approach*. Thousand Oaks, Calif.: Sage Publications.
- Mazzocato, P., Holden, R. J., Brommels, M., Aronsson, H., Bäckman, U., Elg, M., et al. (2012). How does lean work in emergency care? A case study of a lean-inspired intervention at the Astrid Lindgren Children's hospital, Stockholm, Sweden. *Health Services Research*, 12, 28.
- McCarthy, M. (2006). Can Car Manufacturing Techniques Reform Health Care?. *The Lancet*, 367(9507), 290-291.
- McGowan, Y., Humphries, N., Burke, H., Conry, M., & Morgan, K. (2013). Through doctors' eyes: A qualitative study of hospital doctor perspectives on their working conditions. *British Journal of Health Psychology*, 18(4), 874-891.
- McLaughlin, C. P. (1996). Why Variation Reduction Is Not Everything: A New Paradigm For Service Operations. *International Journal of Service Industry Management*, 7(3), 17-30.
- McLaughlin, C. P. (1996). Why Variation Reduction Is Not Everything: A New Paradigm For Service Operations. *International Journal of Service Industry Management*, 7(3), 17-30.
- Meredith, J., Raturi, A., Amoako-Gyampah, K., & Kaplan, B. (1989). Alternative research paradigms in operations. *Journal of Operations Management*, 8, 297-326.
- Meyer, A. D., Loch, C., & Pich, M. (2002). Managing Project Uncertainty: From Variation To Chaos. *IEEE Engineering Management Review*, 30(3), 91-91.
- Modig, N., & Åhlström, P. (2012). *This is lean: resolving the efficiency paradox*. Stockholm: Rheologica.
- Montesarchio, V., Grimaldi, A. M., Fox, B. A., Rea, A., Marincola, F. M., & Ascierto, P. A. (2012). Lean oncology: a new model for oncologists. *Journal of Translational Medicine*, 10:74, 10:74.
- Morse, J. M. (1994). *Designing funded qualitative research*. Thousand Oaks, CA: Sage.
- Murray, M., & Berwick, D. M. (2003). Advanced Access Reduced Waiting and Delays in Primary Care. *Journal of American Medical Association*, 289(8), 1035-1040.
- National Cancer Institute. (n.d.). *Adjustment to Cancer: Anxiety and Distress (PDQ®)* -. Retrieved

December 8, 2013, from

<http://www.cancer.gov/cancertopics/pdq/supportivecare/adjustment/Patient/page2>

Nonaka, I. (1994). A Dynamic Theory Of Organizational Knowledge Creation. *Organization Science*, 5(1), 14-37.

Nonaka, I. (2007, Jul. - Aug.). The Knowledge-Creating Company. *Harvard Business Review*, dummy data, 162-171.

Patton, M. Q. (1999). Enhancing the Quality and Credibility of Qualitative Analysis. *Health Services Research*, 34, 1189-1208.

Radnor, Z., & Boaden, R. (2010). Editorial: Lean in Public Services—Panacea or Paradox?. *Public Money & Management*, 28(1), 3-7.

Ramsey, S., & Schickedanz, A. (2010). How Should We Define Value In Cancer Care?. *The Oncologist*, 15(Supplement 1), 1-4.

Ritchie, J., & Lewis, J. (2003). *Qualitative research practice: a guide for social science students and researchers*. London: Sage Publications.

Romney, A. K., Weller, S. C., & Batchelder, W. H. (1986). Culture As Consensus: A Theory Of Culture And Informant Accuracy. *American Anthropologist*, 88(2), 313-338.

Sanson-Fisher, R., Girgis, A., Boyes, A., Bonevski, B., Burton, L., & Cook, P. (2000). The Unmet Supportive Care Needs Of Patients With Cancer. *Cancer*, 88(1), 226-237.

Schmenner, R., & Swink, M. (1998). On theory in operations management. *Journal of Operations Management*, 17, 97-113.

Schnipper, L. E., Meropol, N. J., & Brock, D. W. (2010). Value and Cancer Care: Toward an Equitable Future. *Clinical Cancer Research*, 16, 6004-6008.

Sjönnell, G. (1986). Effect Of Establishing A Primary Health Care Centre On The Utilization Of Primary Health Care And Other Out-Patient Care In A Swedish Urban Area. *Family Practice*, 3(3), 148-154.

Spear, S. J. (2005). Fixing health care from the inside. *Harvard Business Review*, September, 78-91.

Spear, S., & Bowen, H. K. (1999). Decoding the DNA of the Toyota Production System. *Harvard Business Review*, 77, 96-108.

Staats, B. R., Brunner, D. J., & Upton, D. M. (2011). Lean principles, learning, and knowledge work: Evidence from a software services provider. *Journal of Operations Management*, 29, 376-390.

Ständiga förbättringar och flödesprocesser. (n.d.). - *Om Karolinska*. Retrieved December 9, 2013, from <http://www.karolinska.se/OM/Om-sjukhuset/Strategiskt-utvecklingsarbete/>

- Sullivan, R., Tannock, I., Boyle, P., Khayat, D., Amir, E., Meropol, N., et al. (2011). Delivering Affordable Cancer Care In High-income Countries: A Lancet Oncology Commission. *European Journal of Cancer*, 47, 6.
- Suominen, T. (1992). Breast Cancer Patients: Opportunities To Participate In Their Care. *Cancer Nursing*, 15(1), 68-72.
- Swank, C. K. (2003). The Lean Service Machine. *Harvard Business Review*, October, 123-129.
- Tamburini, M., Gangeri, L., Trimigno, P., Brunelli, C., Beltrami, E., Boeri, P., et al. (2000). Assessment of hospitalised cancer patients' needs by the Needs Evaluation Questionnaire. *Annals of Oncology*, 11, 31-37.
- Tierney, A. J., Taylor, J., & Closs, S. J. (1992). Knowledge, expectations and experiences of patients receiving chemotherapy for breast cancer. *Scandinavian Journal of Caring Sciences*, 6(2), 75-80.
- van Hoek, R. I., Harrison, A., & Christopher, M. (2001). Measuring Agile Capabilities In The Supply Chain. *International Journal of Operations & Production Management*, 21(1/2), 126-148.
- van Lent, W. A., Goedbloed, N., & Harten, W. v. (2009). Improving The Efficiency Of A Chemotherapy Day Unit: Applying A Business Approach To Oncology. *European Journal of Cancer*, 45(5), 800-806.
- Webb, J. R. (1995). *Marketing research: understanding & designing*. London: The Dryden Press.
- Weick, K. E. (1969). *The social psychology of organizing*. Reading, Mass.: Addison-Wesley Pub. Co..
- Wennberg, J. (1987). Are Hospital Services Rationed In New Haven Or Over-Utilised In Boston?. *The Lancet*, 329(8543), 1185-1189.
- Will, J., Bertrand, M., & Fransoo, J. C. (2002). Operations management research methodologies using quantitative modeling. *International Journal of Operations & Production Management*, 22(2), 241-264.
- Wilson, J. (2010). *Essentials of business research: a guide to doing your research project*. Los Angeles: Sage Publications.
- Womack, J. P., & Jones, D. T. (2003). *Lean thinking* (e¹dition revue et mise à¹ jour. ed.). London: Simon & Schuster.
- Womack, J. P., & Jones, D. T. (2005). *Lean solutions: how companies and customers can create value and wealth together*. New York, NY: Free Press.
- Womack, J. P., & Jones, D. T. (2007). *The machine that changed the world* (New ed.). London: Simon & Schuster.
- Yin, R. K. (2009). *Case study research: design and methods* (4th ed.). Los Angeles, Calif.: Sage

Publications.

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

APPENDIX A – LIST OF CONDUCTED INTERVIEWS

ROLE	REFERRED AS	DATE OF INTERVIEW
In-depth interviews, Pre-Study		
Deputy Secretary at Health Care Think Tank	Process Consultant 1	2013-05-07
Manager Stockholm Regional Cancer Center	Process Consultant 2	2013-06-04
Semi structured interviews, Study		
Process Director at Landstinget Sörmland	Process Consultant 3	2013-06-19
Former breast cancer patient and retired nurse.	Patient 1	2013-08-06
Former cancer patient	Patient 2	2013-07-19
Senior Consultant at the Karolinska University Hospital	Head Physician 1	2013-07-25
Oncology Nurse at the Karolinska University Hospital	Oncology Nurse 1	2013-08-06
Senior Consultant at the Karolinska University Hospital	Head Physician 2	2013-08-07
Head of the Department of Oncology at the Karolinska University Hospital	Department Head	2013-08-08
Business Developer at the Stockholm Regional Cancer Care Center	Process Consultant 4	2013-08-21
Head Nurse at the Oncology Department of Södersjukhuset	Head Nurse	2013-08-27
Contact Nurse at Capio St. Goran	Oncology Nurse 2	2013-09-23
Section Leader at Södersjukhuset	Oncology Nurse 3	2013-10-10
Head of Radiation Oncology	Head Physician 3	2013-10-18
Breast Surgeon at Capio	Physician 1	2013-11-14
Specialist Pathologist at Capio	Physician 2	2013-11-21

APPENDIX B – INTERVIEW GUIDELINES

The following list contains all the questions that were asked. It looks extensive for a one hour interviews because not all the questions were asked in all the cases. The interviews were in fact tailored to the job function of the respondent.

GUIDELINES FOR INTERVIEW – MEDICAL PERSONNEL

CHARACTERISTICS OF ONCOLOGIC CARE

- What do you say is the most common way of treating cancer? An iterative way until the best cure is found or a sequential way where an established routine is followed?
- From my readings it emerged that one of the main problems that causes wastes and bottlenecks is variation, like variation in medical practices, protocols etc. What is your experience with this issue? Have you found it? Have you solved it?
- Do you think work should be standardized or do you think room should be left for the doctor's or the nurse discretion?
- What do you think patients want from the hospital, from the doctors, from the nurses?
- Are jobs highly specified in terms of content, functions and responsibilities? How is this translated in the everyday work?
- Can you please tell me what the vision that guides the way treatment is provided at _____?
- What would you say are the main differences between being treated at the breast cancer and being treated in a "normal" cancer department?
- Can you walk me through a typical day as a nurse here at the breast cancer?

WASTES IN ONCOLOGY WARDS

- Do you think the case can be made for overprocessing care? That is giving more medications than necessary, improper use of high-cost drugs, more surgery and more treatment than what are really needed?
- What about hand overs? I have read that it is in this step that a lot of things go wrong? What do you think? How would you fix it?
- How do you deal with communication? Do you experience lack of communication among the different figures that work around the patient (say nurses and doctors, or nurses from different departments or doctors from different departments)?
- How is it customary to deal with oncologic patients that have a problem and go to the emergency room? Do you think some of these readmissions could be avoided?

SOLUTIONS IMPLEMENTED

- If I asked you for KPI, which would be some really informative ones?
- How do you do benchmarking? Before-after? Against other structures?
- How do you deal with scheduling?
 - Who is in charge of scheduling?
 - How do you take into account that some patients might not be able to undergo the next session of chemotherapy (or radiotherapy)?
 - Do you experience peaks and troughs in the hospital's activity?
- (In case the problem of communication was highlighted) How are you solving it?
- Do you think contact nurses reduce the number of patients that check in for emergencies?
- How do you deal with the problem of discontinuity of care?
 - Do you try and have the same doctors and nurses always see the same patient?
 - Do you instead try and make sure that the knowledge needed to treat the patient is spread throughout the department and easy to access so that everyone among the personnel can take care of any patient?
- What kind of changes did you have to make to Lean? Did you take it as it was or?
- (In case the problem of readmission emerged) What is being done towards reducing the readmission rate?
- What is the common practice when dealing with mistakes?
- How do you make sure that what you have scheduled is flowing as it should?
- Are you trying to standardize the work?
- How do you ensure that the knowledge is consistent throughout the department?

PROTOTYPE FOR INTERVIEW – PATIENTS

- Can you please walk me through your path as a cancer patient?
- How did it work in practical doing the chemotherapy? Did you ever have to wait? If yes, how long? Did you have problems?
- How much freedom, as a patient, would you like to have? Is there anything in your treatment that you would have liked a saying on but you did not have it?
- What did you feel doctors and nurses were giving you?
- What would you have liked doctors and nurses to give you?
- What is most valuable to you, as a patient undergoing cancer treatment?
- Did you see a lot of doctors and nurses in the course of your treatment? Did you feel that there were too many and that they didn't know you?

APPENDIX C – SELECTED QUOTES FROM RESPONDENTS

Quote	Code	Respondent
We are basically dealing with two kinds of treatment: chemotherapy, therapy with anticancer agents which does not necessarily have to be chemo, it could be antibiotic agents, pharmaceuticals; and then we have radiation therapy. In the chemotherapy business we also have hormonal and anti-hormonal therapy, mostly breast cancer. So we're dealing with the pharmaceutical side and the radiation side. Many times we combine these treatments;	Oncology characteristic	Department Head
I work closely with my controller and hopefully my reports can be comfortable. And then production. So we do a yearly budget, we try to estimate, which we can do fairly well, how many patients do we have next year, divide them up in diagnosis and from that we can do a planning, because it's fairly good.	Measuring Performance	Department Head
Well, you know, I realized that I, of course, it's a lot of planning. The planning is fairly good. But that's a team work. I have nine direct reports that people give me and let's see, at least five, most of them they have their responsibility for personnel and schedule, some county working in order to improve the scheduling.	Scheduling/Standardizing	Department Head
So we investigated that and found that up to 30% of patients at the ward could be discharged to the palliative care.	Oncology characteristic	Department Head
The patient might find a young physician, who does not know the patient's history	Information Variation	Department Head
what we do is expensive; the new pharmaceuticals are extremely expensive	Oncology characteristic	Department Head
the bulk of our patients are patients with generalized cancer.	Oncology characteristic	Department Head
Because there are two areas within oncology, but the people working in the respective area are specialized, highly specialized and given the specialization that is high, it's very hard and probably not possible to keep up 100% with the latest modalities and treatments.	Information Variation	Department Head
(about the centers that provide palliative care)they're fantastic, they know how to take care of patients, to provide terminal care	Oncology characteristic	Department Head
You see Karolinska was in large part academic, it was the largest clinic	Setting priorities	Department Head
We also have an outpatient service, where we see new patients when they are referred to us and we also see patients that are under treatment, that we evaluate for treatment response, so we give a treatment for a couple of weeks or months and then we evaluate the response, normally by radiology, CT scans, to check if the tumor is stable, it's shrinking or it's growing. If it's growing you have to change treatment, otherwise you continue	Process Variation	Department Head
At oncology, historically, we are trying to be open to different treatments that are beyond science. We try treatments even if they're not scientifically proven to work, sometimes they work anyway, but this proportion of not scientifically based treatments given to patients has to be reduced, in order for us to implement new treatments, otherwise you'll face cut-offs	Oncology characteristic	Department Head

I follow up on pharmaceuticals to see if they're within the budget, if they don't I have to go and see what happens, because you do stuff up there sometimes which they're not supposed to do, not because they, you know, it's a difficult situation in the patient-doctor meeting, it's not suitable to talk money there so sometimes we give treatments that are not maybe not. I try to get my physicians to treat according to national treatments recommendations which are evidence based, as far as possible	Measuring Performance	Department Head
It's a waste that we do not schedule the physicians in a proper way, that's a waste.	Scheduling/Standardizing	Department Head
operation-wise, these people have to talk with each other and manage patients between units and structurally that's a challenge. And of course we have other units within the department which have to talk to each other	Information Variation	Department Head
Patients are staying at the ward, treated at the ward, for complications that we cause by our treatment, nausea, vomiting, fatigue, infections, they're prone to infections. Some are treated with continuous chemotherapy, so they have to be in-house, most of treatments we give in the polyclinic.	Oncology characteristic	Department Head
So, what's the mean time a patient is treated at the ward, is treated at the ward, each time they are at the ward? It's five days, they tell me. Okay, we are talking about throughput times. Then I say, okay we have patients on schedule, which means they have to do chemotherapy, we have patients with side effects that are treated at the ward. If we break down the figures, the scheduled ones are treated mainly for three days, there is not much improvement to do there because their treatments are usually three days. The acute ones, they are there for six something days, alright. And how does it look? Well some are discharged after one day and then I have patients that are there for 45 days. I have a report from SSE about that. The question is, how did that happen? So we have to break it down. Sometimes they come in, it's Friday afternoon, the physicians have not scheduled the ward very well, so before they get the CT scan is probably one day, instead of getting it directly, so the treatment planning is important. Change of doctors, scheduling, I have doctors that work up for two days and the next one is scheduled for one day so we are losing time and decision power so think about, well let's discharge this patient tomorrow. Because they are feeling comfortable, they know the patient, there have been continuity, probably the patient can be discharged. And some patients go in palliative care, and that was the 45 days patient and that is related to the thing about the electronic medical records. This unit that this patient was supposed to go to didn't have a connection, they only had a fax, so the fax paper just disappeared, they could take it, no one knew that it had disappeared, it took a couple of days and there was a bunch of mistakes on the way to the patient that should have been discharged on day 7 but who was at the ward for 45 days.	Good Variation/Bad Variation	Department Head
survival figures or the time-to-relapse figure are not a good instrument in managing the daily operations, because when we look at it, we look at five years survival so what we do today, we can read off in five years, so that's not suitable, that's suitable for deciding what kind of treatment we do, also if you have a clinical study here at the clinic	Measuring Performance	Department Head
they're supposed to do research and it's a good thing to do	Setting priorities	Department Head
We have a lot of information. What we don't have is the daily production information of what do we do every day and how do we plan the daily work so that we can take care of all the patients that we have to see	Information Variation	Department Head
we have a strong brand, we have strong research, which is another important area we're interacting with, the Karolinska Institute and then we have research and we have education.	Setting priorities	Department Head

But it's a way of handling it when we are aware that this is a problem, this is an issue. Because it's very important that we are consistent in our department.	Information Variation	Head Nurse
We are trying to improve written information and made brochures about the common short time and longtime side effects so the patient shouldn't be so worried when she has a side effect "oh, this is common, I shouldn't call" and "oh, this has happened, I'm really worried" so we have done that, but there is a lot more to be done of course	Reducing Variation through spreading knowledge	Head Nurse
if it's a small mistake, there is no catastrophic damage, maybe we discuss it, this has happened, how can we, why did it happen do you think, how can we avoid that it happens again, so we discuss it locally in the nursing group and in the team with the administrative cohorts	Reducing Variation through spreading knowledge	Head Nurse
we have a meeting every two weeks that we get a list of all the mistakes that have happened during the last week in the clinic we can see if there is something that tends to be, like a medical mistake, that's the most common thing, we discuss that among us leader, how can we do, how can we manage, how can we improve the way of handling this. It's quite systematic	Reducing Variation through spreading knowledge	Head Nurse
the individual patient that has to be taught to handle, to sort of self-care of course. It's a part of avoiding re-admittance	Reducing Variation through spreading knowledge	Head Nurse
I can open the journal and see what appointments the patient has and how often has she been calling and if there is a worry situation or what kind of questions she has been asking and we report that thoroughly in the journal it would be easy to see and I see that yes, she is speaking to my colleague about that a couple of days ago. I'll talk to her and make her call you.	Reducing Variation through spreading knowledge	Head Nurse
Often we have overbooking, we have too many patients so if two or three drop off then it's full. But we don't want to order the chemo, because it's a very expensive medication. So the day, or the day before the planned treatment, the patient is prepared for the next treatment with taking blood test and if the test doesn't allow the treatment, we contact the patient from the ward and say "you can't have your treatment because the blood count is too low, for example" and then the medication is not ordered to come to us	Scheduling/Standardizing	Head Nurse
But here in the outclinic where we have nurses and doctors and a lot of follow ups maybe we sometimes, we can say "Oh we have some appointments free tomorrow and the day after". So we can see do we have new admittances from other caregivers that are giving their patients to us and we can call. So we use the time for that or there can be patients that have said "I can come with short notice for my follow up" for example and we can say "Do you know we have a room for you. Is it possible?" And if it is possible, fine, if it is not then we will have another time for you. But we don't have a problem then because of course it takes time. We try not to have holes in our schedule. We have to have a little hole if we have emergency visits but this is a balance because we have to produce, we can't of course. It's a waste of resources if we have lots of spare time in our schedule.	Scheduling/Standardizing	Head Nurse

We are not really waiting for patients; because we have ups and downs in our week. We try to work with the flow to make it more stable, to have the same amount during the week. That is not always possible, we know that Mondays are, people call us more on Monday, because they have not been able to call during the weekend and there are issues that wait until Monday and then I'll make a call to the oncology department and ask my question. So there is always more on the phone on Mondays but if we have a slow day, we have always loads of administration, with handling calls, sending appointments to the patients and developing our way of work. And if we know that we are going to have, for example, we know that the doctors are having a meeting, we can plan for us to do the same and try to be effective during that time and discuss a routine or our cooperation or whatever. So we don't wait, we don't ever wait. We try to schedule all the time because there is no room for waiting, because there are so many things that should be done, that is not, every little thing is not, may be speaking to a patient, there is a lot of other things that should be done in our department.	Scheduling/Standardizing	Head Nurse
This is why we have to have administrative routines when we book patients and that parallel with the actual patient care, because this is the same nurses that make appointments and then see patients and then.	Scheduling/Standardizing	Head Nurse
And I've talked to my colleagues and there is actually quite little in the amount of medicines that we order that is needed to throw away because this works often sufficiently.	Results of applying Lean	Head Nurse
if a patient is contacting us, we don't work with the same patient at the same time; we check who was the last time in contact with the patient, who knows more, instead of try to find out what is actually, why she has been calling	Keeping track of the patient	Head Nurse
So it has been a natural way for us here to change things, that we can see that, the staff can see that nobody else will make us have a better time at our work and do better things. That's about us, working together, it's not bosses that decide what to do, it's us. If we have a problem we discuss it and we try to find solutions together. That has been going for a great many years and then you need to have models for that, to do it better and we have tried to learn, to improve but we were in a project that SQL had called council... For better cancer care, that is getting better all the time . This is, I think it's about 10 years ago and then Karolinska had this Flödesarbete and we haven't been in that with the central support but we have continued to try to be a little systematic about our changes and try and make small changes and evaluate and go back, like a PDSA model but we don't call it that, we just do it that way.	Results of applying Lean	Head Nurse
That is why it is important that we are all together because we are teaching each other all the time. But there is also maybe a risk that the colleague that is teaching me is misinformed but I have to take that risk because then I talk to another colleague and my colleague say "have you given that any thought?" and if this is very different maybe we should list it and how was this and what was the result of this but that's how we learn I think, every day. Every day I'm here.	Reducing Variation through spreading knowledge	Head Nurse

This is, I think it's about 10 years ago and then Karolinska had this Flödesarbete and we haven't been in that with the central support but we have continued to try to be a little systematic about our changes and try and make small changes and evaluate and go back, like a PDSA model but we don't call it that, we just do it that way. We have in the back of our minds, that is a model we can use but when we're talking to doctors and nurses we don't say now we're going to develop this model we go this is a problem for us, so how do we do	Dealing with uncertainty/Project Management	Head Nurse
we do it together because I am the head nurse of this department here but we discuss this at the staff meeting, in the nursing team and in the whole team with the doctors and others who are involved in care of course	Reducing Variation through spreading knowledge	Head Nurse
They call us here at our clinic and preferably talk to the contact nurse and describe their symptoms and the issues of worry and if we think that this is a medical emergency that should be handled the same day for example a chemo patient has a fever and low white cells count we usually, they are welcome to us, they pass the laboratory so we can see the blood values and they see a doctor here and we can get antibiotics and sometimes they have to stay at our ward because they have to get IV antibiotics. So, if it's not a real emergency, like ambulance emergency we try to handle everything at our clinic and in cooperation with the ward.	Dealing with uncertainty/Project Management	Head Nurse
We have a daycare department where they administer chemotherapy and if there are emergency issues during this day when the chemo is administered they handle it and if it's so severe that the patient can't go home the same day we will try to arrange a place in our ward that is open every day of the week so that she can stay overnight but that is very rare, usually it shouldn't be necessary	Dealing with uncertainty/Project Management	Head Nurse
(the oncologist and the surgeon)they talk to the patient about the treatment plan. Because sometimes it's not, it can be discussed if it's better to do first surgery or first oncology treatment. It's good to have both competences together with the patient so she can ask a question	Reducing Variation through spreading knowledge	Head Nurse
In the morning we start out the department, the patients come from around 9 o'clock and we have meetings and developing time in the morning because we have all our meetings and all our staff education moments and we try to do that in the morning because in the afternoon we are so into the day's work it's harder to attend. So it's easier to start with that and then take care of the patients. So we have, you can work with one or two doctors in a team and take care of the patient here for our outclinic visits and you can have your own appointment booked for. They can be management of things and side effects for example or psychosocial support or questions about medications. We have, it's the same actually on the phone, it's the same kind of question. And then we have of course administrative. In our clinic there is a lot of administrative work, so, that's the way it is. And then we have patient conferences at several times a week, we have Mondays and Wednesdays and Thursdays and on Mondays and Thursdays nurse does attend these conferences as a contact nurse.	Scheduling/Standardizing	Head Nurse
Sometimes the patient attends after, they speak about the patient, they make the care plan and, or treatment plan and then the patient on the same day sees the team and discusses the treatment plan, that can happen to a patient that for example has been diagnosed to the surgical department and we have plans for treatment and they can be discussed and "okay, this is probably a good idea and we should make this offer to the patient" and the patient comes and the oncologist and the surgeon talk to the patient together and tell them "this is our plan for you" and we take over the patient. It's a nice way to leave the patient between departments.	Reducing Variation through spreading knowledge	Head Nurse

nurses, they are, we call contact nurses. That is the foundation in all the nurses' work. All our patients should have a contact nurse. So these contact nurses, they are every day, mostly from telephone or from a nurse's visit or a doctor's visit	Keeping track of the patient	Head Nurse
a systematic way of improving patient care and it's a very big focus on organization and to make things easier, we don't overdo things, we do the right thing, at the right time, at the right place.	Lean Consumption	Head Nurse
In our hospital we have a vision that the patient is always first and we try to keep that in mind so every time we discuss something it's our task to don't lose the patient in that, if we are going to do that, how does that affect the patient, we always try to bring that with us	Lean Consumption	Head Nurse
that is a model we can use but when we're talking to doctors and nurses we don't say now we're going to develop this model we go this is a problem for us, so how do we do. So somebody "maybe we could do this" or "maybe we could do that" and ok, what would we try, ok we try this and when do we evaluate, we evaluate and see, okay this is good but we have to make some changes and this was no good, we have to find another way.	Informal Sharing of Information	Head Nurse
So that's basically what we try to do, to make the best for the patient and to use the best of our resources because we have to use our time effectively.	Lean Consumption	Head Nurse
we try to discuss our way of managing our work and the patient care and identify how we can work more effectively	Lean Consumption	Head Nurse
Of course we know that the risk for a certain tumor is higher in the first year or something but if you're going to see the patient every 2nd or 3rd or 4th month, there is no study showing this. We can see from studies that you should be careful during the first months, then a couple of visits during this span of time, but there is not much science about this.	Process Variation	Head Physician 1
some seek a treatment that we don't give here at Karolinska and maybe they get disappointed	Input Variation	Head Physician 1
Usually I explain what we know and what we recommend for the treatment. If there are side effects and there usually are, if there are alternatives. Even if I recommend a treatment there are other ones you can use with different side effects. Usually I recommend a treatment, then there is a discussion after this information part, I discuss with the patient, do you think it's reasonable, how does it sound and if they have any, if they think it sounds wise we go forward with the plan and if they don't, if they don't believe in me, if they don't trust me then we discuss that.	Input Variation	Head Physician 1
We are not only clinicians but also researchers so we are camping back and forth from the lab to the clinic. I'm not working 100% at the moment, I'm working 50%, so I have 50% research job	Setting priorities	Head Physician 1
The treatment is more or less standardized but it's personalized, the follow-up schedule is quite fixed, not so much depending on what kind of tumor is it. I'm working on the head and neck tumor which can be anything from base of the skull to nose and of course it's different diseases but we're having these follow-up schedules in the same way	Scheduling/Standardizing	Head Physician 1

But usually, what we are doing here with radiotherapy, we are documenting so much and when I'm treating the patient with chemotherapy there is a specific system for that where you have to log into and then you have all the treatments, doses, intervals and if I have done some doses reduction and so on.	Reducing Variation through spreading knowledge	Head Physician 1
Usually we are seeing the patient on a regular basis after the end of the treatment. We are seeing them every three months or every six months, there are differences according to the treatment. It is very common with certain side effects, they get a recurrence of the disease, that's more or less planned, to have this information collected during these visits, after the treatment	Scheduling	Head Physician 1
We have guidelines and today it's very personalized, it's based on the patient's not only conditions but also on what kind of mutations the tumor has. Today we are conducting these individualized therapies and we are also working to build up on that one to be one of the personalized cancer centers medicine in the world where you have some level of quality. So that is the focus for us at the moment, to not standardize the treatment, but to personalize the treatment, mostly from what the tumor status is	Process Variation	Head Physician 1
when they are in good conditions that you often combine different treatments, depending on where the cancer is placed. For example, if you have a cancer placed at the tip of the tongue you can treat it with radio, with chemo or with biological agents and usually you use them in combination. It might be a long and aggressive treatment so you have to be in a good condition to be able to go through all this program.	Input Variation	Head Physician 1
not 100% but very many of all of our cancer patients are discussed during our multidisciplinary conference where all the different parts from the hospital are brought together. So it could be oncologist, surgeon, pathologist, nurses, from every angle and there will be discussion and there will be a conclusion on what kind of treatment will be given to the patient	Reducing Variation through spreading knowledge	Head Physician 1
you have to give the information according to the patient's level of receiving information. Usually most of the patients today have read something about the treatment before they see me,	Information Variation	Head Physician 1
(on the lack of communication)It might feel like that but during these multidisciplinary conferences we have to discuss, we have to cooperate so it's very... It's done every week or twice a week and there you have to discuss. When it's about the daily cooperation between the clinics, there it's another thing and there is a lot of things to do and everyone is busy so we don't have the best communication system here.	Knowledge as Andon	Head Physician 1
Yes, of course. Same patients with the same tumor and mutation might have the same treatment but because you also take into consideration how the patients are, what is the most general condition. You see, there is a tool called performance status. If they are in a good performance status then they can usually be treated more aggressively, if they are in a bad condition maybe they should not have any treatment at all.	Keeping track of the patient	Head Physician 1

. At least if you have a localized tumor you would quite often come to an agreement with the patient, what is the risk level acceptable to the patient and then you would go for it, but sometimes you have to say no, the risk is too high. If you have a tumor spread around the body, you will take lower risks, because then the disease is outspread and the likelihood of being cured is variable	Input Variation	Head Physician 2
For some persons you can do a short term test to see, for some others you have to test for three months and see if it's effective or not, if the tumor is shrinking.	Dealing with uncertainty/Project Management	Head Physician 2
I think every patient is treated individually, if you have a professional doctor or a nurse or if you have differences that you have sort of balance in some way.	Input Variation	Head Physician 2
if communication is unclear and the papers are not well done and you know, things like that, misunderstandings and... maltreatments can occur.	Information Variation	Head Physician 2
if you give a structured information about the patient, if you give it in a nicely presented way, either written or orally, it is much easier for the receiver to understand what is the patient's problem, what can we do.	Information Variation	Head Physician 2
If you have the same tumor but you don't have the receptor you may fall into this category, but it's not quite sure, some patients, because some tests that we do are not 100%, so some of those patients that we feel would not have effect from the medication, they could have it anyway.	Input Variation	Head Physician 2
In the first discussion is multi-disciplinary and along the treatment lines then the oncology will have a treatment discussion how the patient is performing, if we see no effect on the treatment or if the treatment has many side effects or if the patient won't accept it anymore, then what else can we do and then the discussion would be internally within the team at the oncology department. These multidisciplinary conferences, sometimes it's obvious that this tumor is not for surgery and then you discuss it within the oncology department, but usually you discuss it first with the multidisciplinary team and then oncology will discuss along the treatment line.	Oncology characteristic	Head Physician 2
It's not very common that we know from beforehand, but we do have, if we know how complex the tumor is, it's really uncommon that we really know that this is going to be a very good treatment for you.	Dealing with uncertainty	Head Physician 2
So when the patient (arrives), the first thing you would do is to make all the tests you need to sort of get a clear picture of what kind of tumor, cancer tumor the patient has, where it sits and what it is and all we know about the tumor we, different specialist would discuss, and this is a tumor so and so and then the surgeon would say yes it's possible to operate and then the radiologist would say "maybe it's possible to shrink it, maybe we could, maybe the treatment result long term is better if we start with static treatment or with a specific immune treatment" or something like that, and then we do surgery and then we go back to the oncology again and then you follow-up. It's, if you have a new tumor for the first time, the novel cancer, they follow this very strict, and if you have clinical studies, we would try to get the patient in a clinical study, to even sort of deliver what might be the next best treatment. Because that's what we think when we start a study, that this will be a little bit better than what we already have. So we try to include them in clinical studies and most of the patients would say yes to that and then they follow specific protocols and it's very formalized how you do it. If you have a relapse, say you're treated along that first line, then you have a relapse and you have had the treatment A, then you will say treatment A is not effective anymore so now we should try whether we should have treatment B, C or D and then you make new tests to see how, in what way the tumor has developed during these 2,3,5 years and then you would find that the tumor is not the same as it was from the beginning. So it has become resistant for example to the treatment, so you try a new treatment and then you have a relapse again, and then you try a new	Process Variation	Head Physician 2

treatment and it's more and more like this. And one of the problem is that, which is related to the costs is that many of the treatments are not very effective.		
specialist you have to work at least five years full time, specialty, then you become a specialist	Oncology characteristic	Head Physician 2
The setting, all of what we do, if you don't like to give lectures or if you're not interested in the research, we feel that you should not work here	Setting priorities	Head Physician 2
The setting, all of what we do, if you don't like to give lectures or if you're not interested in the research, we feel that you should not work here and then many doctors have a lot of heart for the patient and they would like to prioritize that so some doctors feel that they are better at doing research and would like to make priority on that.	Setting priorities	Head Physician 2
These are a little bit old numbers, 2006, published 2009 so but this receptive is given if you have breast cancer, of a specific type. But as you can see approximately 10% of all patients with breast cancer will respond to that treatment	Oncology characteristic	Head Physician 2
We have this protocol and we do the follow up and we fill in the forms into registries, quality registries, to then we would know quite a lot about the patients, how they do, how long they live and for some patients we have local registries, the national registries and we have some registries in the clinic to see for example if a certain treatment is good, what kind of side effects it would give, how soon the patient can expect the response and so on.	Measuring Performance	Head Physician 2
when you apply for sort of consultant, or senior consultant position, then you have to have had some kind of research and some kind of clinical area that you have been responsible for. And if you are a senior consultant, there are some exceptions but you have to have a Ph.D.	Oncology characteristic	Head Physician 2
I try to think that there has to be at least one specialist in each site and here at least two, we have to be three specialist here on duty at all times, minimum two, but three is the required number and then the doctors in training add to that	Training doctors	Head Physician 3
there are a lot of studies that tell us when and where a treatment is effective or when and where a treatment is not effective. But then again, you have a big gray zone where we don't know, where it's up to the doctor, really to the doctor and the patient to discuss this and see would this be beneficial or would it not. It's, that's the essence of being a doctor actually, that's where the expertise is really, really, your expertise and maybe your experience is very important	Process Variation	Head Physician 3
we had every year or every second year we have a questionnaire with the patient so they know they can tell us how they, what their view of us. So that's from the patient's perspective. And then we have the hard data, with survival, we have to keep track on how are the Swedish cancer patients survival rates compared with other countries and we are doing good. So I think that's one of our main things to check out. We do have big databases where we are obliged to put in for every patient so that we can check ourselves and see how we do	Measuring Performance	Head Physician 3

(on checklists and inherent variation)It's a good way if you are short of staff, short of expertise, it's a good way to make sure that you have a standardized, that your patients really get the best possible treatment under certain conditions. What you miss is what I explained to you, it's the development of, and it's the possibility of doing your work, achieving a development of skills. But I think, so I think it's good, but I think you should be careful of making a law out of it. I think it's good some days, if you have less experienced colleagues and everybody else is occupied in meeting or everything, it helps that colleague to be able to achieve the work and feeling content that it's the best work and that they are not making mistakes. On the other hand, I think it's important that we are in a field where there are no black and whites and that we always should do it, think if the guidelines, if the checklist are the right thing to do for this patient or should I make an exception.	Checklist/Process Variation	Head Physician 3
As physicians we are working in one room and it can be a bit noisy, but still it's a good way of working together and you are always close to someone to ask so that you don't have to run away and wait, so you have this. Cause I think for our work it's a lot about discussion, it's a lot, how do you say, it's not black and white and you have to define. Should I do this or should I do that and maybe this or maybe that. And you want to do that, maybe you decide yourself, but you want to do that in a conversation with a colleague, just to try to see if what you are doing is the best one and if maybe you should change the way you think. So the way to do that is to have colleagues around that you really can discuss	Informal Sharing of Information	Head Physician 3
if we start with one patient group it's easier because we have to create the workflow for each patient group, so we create one workflow, so that we can start from that, we are going to start with breast cancer patients, just as a trial, you know to insure that we give the best treatment for that group, but that machine actually is better at delivering other kinds of more advanced treatment	Dealing with uncertainty/Project Management	Head Physician 3
Of course I can't do it personally, so we have our system. We have our software system that takes care of that, we have scheduling for each patient, that is assuring that each step in the radiotherapy process is fulfilled before the next is done. And that's helpful. And then I am sure that I have staff that is controlling what we are doing today and that we are controlling that, so that's how it works	Scheduling	Head Physician 3
we are trying to define the patient group, that will have the most use of the MR camera and that is easiest to work with in the beginning, so that we get the learning process from them and then out of that we can expand to all kinds of patient groups, but we try to do that, have a good way of working in the beginning, so we learn from that and then we expand to different patient groups, and that takes quite some time as well	Dealing with uncertainty/Project Management	Head Physician 3
and I think the essence of all our work is to put the patient first and we try to think, I think we do think that way in our decision, decision-making, most of the time	Lean Consumption	Head Physician 3
if we are short of staff, then we have to make some rearrangements of the staff, working hours, working conditions, we try to do that as best as possible for the staff, we do try to keep in mind what would be the best for the patient, at least in the management level, to have that as, to always put that in perspective for the staff,	Lean Consumption	Head Physician 3
we have colleagues for each disease or subdivision of the disease that are responsible to keep track of what is happening and to introduce new modalities	Formal ways of sharing knowledge	Head Physician 3

So what we are trying to do in radiotherapy we are trying to have one colleague that is responsible for one or two diseases, so they kind of look out for what are the new treatment modalities	Formal ways of sharing knowledge	Head Physician 3
we try to spread the knowledge and also that everybody, there can't be one person that has the complete knowledge but I really try to have my colleagues to have different kinds of knowledge and to try to have different parts of the radiotherapy department in that aspect.	Knowledge as Andon	Head Physician 3
(about sharing knowledge in the department)Conferences, mainly, we have multidisciplinary and multiprofessional conferences that you can attend and try to develop your skills. So there are a lot of conferences.	Knowledge as Andon	Head Physician 3
Oncology is quite developing and we are getting new equipment and we have to have that equipment working as good as possible	Oncology characteristic	Head Physician 3
We have training session in communicating with the patients. And then most colleagues here take courses in delivering hard messages and deliver the talk on difficult things.	Information Variation	Head Physician 3
We have guidelines for everything regarding diseases and how we communicate and what we should communicate	Scheduling/Standardizing	Head Physician 3
so we know that it won't be able to join the treatment, we have a backup plan where we kind of think ok, so let's try this and if this doesn't work we'll change it to short course that will give a good effect but maybe not a curative one.	Dealing with uncertainty/Project Management	Head Physician 3
We try to do some different expertise group in the radiotherapy department where we are doctors, physicist and nurses where we try to meet and discuss things. So they work, the projects I think, but of course there are a lot of difficulties. If we do a change for example, it's difficult to inform all the staff so they absolutely know what's happening, that's a real challenge, but we try to do that in the meetings. We know that all the nurses have their supervisor that is in charge of them and should tell them everything that's happening so we try and have meetings to discuss these things. I have meetings with the doctors when I try and discuss these things, but it's difficult.	Knowledge as Andon	Head Physician 3
we try to make it as good as possible to have a schedule where we have professionals with a good level of professionalism, both here and at SOS and we also to be able to supervise the, not the interns, but the doctors in training	Training doctors	Head Physician 3
because how people react to drugs and being ill are dependent on so many individual levels. It's their own personal resources, their own psyches, so many things and that's impossible. [...] Maybe you could get those numbers but they're not very helpful. They're still individual, so you could say that 2% of my patients' caseload are going to fail in treatment number 3, it doesn't really help anything	Input Variation	Oncology Nurse 1

how these are planned today, like the medical doctors, when they are planning their surgeries, that is planned on a very short term basis today and then the nurses have to adapt around the days when the doctors are seeing the patient, because we, if they write a prescription, this is the care that the patient or the treatment that the patient is going to need I am the one who really does all, I'm the spider in the web as a nurse so I provide and see to it that communications are done, ordinations are moved and so on and so on so whatever is decided at the doctor's clinic or meeting with the patient I work around them. And if I don't know my caseload can be extreme at times because the doctor has decided I'm going to work five days in a row, I'm going to have a lot of patients because then I need to have my research leave. So I think the long term planning of rosters for medical doctors and nurses really needs to be faced, because we are putting three times as much energy in trying to organize care because this is short term all the time and that is a huge waste. We also need that. One of the problems in the system is that a lot of medical doctors have research, they get research grants and that needs to be part of their care, so sometimes they have leave of absence for 30% or 40% or whatever and that really impacts how care is organized and it seems like, at least where I'm working, they don't plan that far ahead and it's strange to me if you have research funding for one year and you know that you'll only be working 80% period for this year and that's very poorly planned.	Scheduling	Oncology Nurse 1
I think health literacy is going to be a huge factor in the future. Because there is such a difference in the Swedish society as well as many other societies that low income people have less knowledge and don't really take part in screening programs and they smoke more and they eat junk food and there is a lot of aspects to that so they don't have the same health literacy skills as the higher educated people [...] But there are always the different levels of how much they want to know and we still need to adapt to those same needs as it has been before but patients know so much more from the Internet and using all kinds of information sources today.	Information Variation	Oncology Nurse 1
One of the problems in the system is that a lot of medical doctors have research, they get research grants and that needs to be part of their care, so sometimes they have leave of absence for 30% or 40% or whatever and that really impacts how care is organized and it seems like, at least where I'm working	Setting priorities	Oncology Nurse 1
So the work around those patients who actually demand those things take a lot of extra work for everybody because they just don't fit the bill in the same way as everybody, they don't accept things as they are so we always have to work a lot of extra around them	Input Variation	Oncology Nurse 1
So this one nurse can destroy so much and she's in a different setting than me so then I need to find her and tell her this is not correct, you're saying the wrong things and you're scaring the patients but there's no natural...	Information Variation	Oncology Nurse 1
the resident doctors who move around a couple of months at each, 6 or 8 months at different settings	Oncology characteristic	Oncology Nurse 1
we monitor our patients like there are some blood values which are usually what prevents them from taking the next treatment in time. So you plan a couple of treatments ahead with the mindset that this patient will handle the treatment in the same way as everybody else. But if something happens during a chemotherapy treatment the nurse is the point of contact with the patients, so we also follow up the treatment with a phone call and they also know that they need to take, there are specific time point where you take a blood sample so that we know how far down are the values falling now and is there a risk or if the patient falls ill and needs to go to emergency for blood transfusions, for antibiotic treatment because they're so low on their white cells count.	Keeping track of the patient	Oncology Nurse 1

there is a huge lack of communication between the different parts because patients come to me and say “I was told not to exercise because I have a peak line in my arm” and there are no scientific studies, no base saying that you’re not supposed to exercise when you have a peak line so we encourage patients to move. So this one nurse can destroy so much and she’s in a different setting than me so then I need to find her and tell her this is not correct, you’re saying the wrong things and you’re scaring the patients but there’s no natural...	Information Variation	Oncology Nurse 1
I think people or patients today are asking for so much more because they know their rights in a different way so they ask for rehabilitation, all kinds of things. I love it.	Input Variation	Oncology Nurse 1
Yes, so that we know that in two weeks we’re going to meet the patient who has got the chemo already, so we’re going to plan the surgery.	Scheduling	Oncology Nurse 2
, because the Karolinska are returning the patient, we get the paper from the Karolinska, now the patients are ready and then we talk about the patient on this Thursday conference. Actually the oncologist from RH takes the paper with the patient to the Thursday conference and then we talk about it	Scheduling	Oncology Nurse 2
Every day we start with the check-in, and we see. Here are the patients that we’re going to meet there and then we look it up and then we have a plan. Maybe this patient we can do like that, and maybe that patient we can do like that and blab la bla. And then we work the whole day and before we go home we do a check-out, so we look at that patient “Oh, that worked the way it should do” or “No, that was a terrible patient and it went like that” So you talk like you should do and we have a check-in and a check-out every day, me and the doctors. [...] It’s very informal	Informal Sharing of Information	Oncology Nurse 2
. So we help the patient on that cancer way. I think it’s very important that you take your time with the patient, like I said. From the beginning, if you take time with the patient, they get to be calm, they feel they can trust me, so they can call me, and I can help them. Then they don’t need much time with me, because they feel secure with me. And I think it’s very important. If there’s something wrong, they want to talk to the doctor, and then I can ask the doctor to call the patient	Reducing Variation through spreading knowledge	Oncology Nurse 2
(on answering whether she could manage variation in the patient’s response in 40 minutes) Yes, I can do that. Often anyway, it’s not so often that it happens but yes I can do that, I can fill it in the 40 minutes, no problem at all. But I don’t think you should, you should have a checklist so you can see I should do that, that, that with the patient. Then you don’t know what’s happened. But it’s very important that you have a checklist so if you develop everything right that you should do, but if something else happens, you get to handle it when it happens I think	Dealing with uncertainty/Experience	Oncology Nurse 2
But if there is a new nurse to come, but I think they can do this work too and they can have this checklist and they can learn all the time what to do.	Training doctors	Oncology Nurse 2

We meet the patients, we have 20 minutes time for the doctor to see the patient and we have some 30 minutes time. These 20 minutes time only the doctor sees the patient if nothing special, on the 30 minutes time, we have about 4 or 5 of them every day, me and my colleagues are with the doctor to see the patient. This doctor, this patient got 30 minutes, then the patient comes with me and I talk to the patient, I have 40 minutes until I see the next patient with the doctor. So I have to do everything in 40 minutes, I have to write in the computer everything. Until I see the next patient with the doctor.	Scheduling	Oncology Nurse 2
you go round and sometimes you help that doctor and sometimes you help that doctor and we decide the week before. So you know on Monday that you'll work with doctor X and on Tuesday I will work with doctor Y. So in the previous week we decide who's gonna work with whom.	Scheduling	Oncology Nurse 2
Of course then the same person that takes care of the patient all the time	Scheduling	Oncology Nurse 2
We think that's very important so that the patient does not have to speak once again, then we know the patient. It's much easier and it takes less time	Knowledge as Andon	Oncology Nurse 2
We have something called contact nurse. We have gone to a course, all the contact nurse. We have a course in university. The full psychological and sociological care of cancer patients or something like that and then, that one we've all gone. And in Sweden the nurses that work with cancer patients should have done that course	Formal ways of sharing knowledge	Oncology Nurse 2
So you need to say the same things to the patient, and that's what we talk about a lot, nurses and doctors together. So we handle the patient in the same way, it's very important.	Information Variation	Oncology Nurse 2
So we have 4 to 5 patients like that every day. And that's cancer patients. And between these cancer patients we have other visits to the doctor because I don't have the time to see anymore cancer patients because I need 40 minutes to talk to the cancer patient, to give them all the paper. It takes all the time to arrange everything, to see if that day fits for the patient to get operated and so on	Scheduling	Oncology Nurse 2
No, no we don't have any waiting times. In one day we have 13 patients, of 13 patients it's 4 to 5 cancer patients. It's almost 5 every day, you can take 5. It's 5 patients out of 13 patients in total. But we don't have any waiting time, no.	Scheduling	Oncology Nurse 2
then I as a nurse take the patient to my room and I talk to the patient and I give them all the information in the day	Knowledge as Andon	Oncology Nurse 2
I think we need to take time with the patient, right away. If we don't take time to the patient it comes later on. If you take care of them immediately I think they are satisfied. So I care for them, and then I plan for the operation and then I can say, so I will operate you on the 23rd of October or something and they get 20 paper on how they should get prepared and how the preparations should be and everything. And they even get the date for the next meeting after the surgery. So they have a plan	Knowledge as Andon	Oncology Nurse 2

the radiologist has taken the pictures, so he can talk about the pictures, the pathologist has seen the biopsy and then the surgeon says “Oh I can see the lump, I can take it out like that. The pathologist has seen that it’s a cancer so I wanna take some samples”, so we have the whole picture clear for us, what to do with the patient	Informal Sharing of Information	Oncology Nurse 2
So every time I meet a patient, I keep track and write down in the journal everything about the patient. And I schedule up everything about the patient and when is the next surgery and then I give the paper right away. And then my work with the patient is finished, when the patient leaves the room. So then I automatically see that I’ve done my work. I finish my work when I go home the same day. I don’t leave anything until tomorrow	Scheduling	Oncology Nurse 2
No, we talk a lot to each other, all the time. Because we always work together, we’re like a team. I think it’s very nice to do that. I know different places, different kind of work, but here we do that and it’s been working very well.	Informal Sharing of Information	Oncology Nurse 2
Yes, it’s all written. They get a paper with written down the time and the date and the places and then we have some papers about our department and what’s gonna happen, then they get another paper about me as a contact nurse and they get a lot of papers so that they can handle it, with phone numbers they need. You can see that they call me and things like that.	Reducing Variation through spreading knowledge	Oncology Nurse 2
So you need to say the same things to the patient, and that’s what we talk about a lot, nurses and doctors together. So we handle the patient in the same way, it’s very important.	Knowledge as Andon	Oncology Nurse 2
(about the ways of making sure knowlege is standardized in the department) We have meetings every Friday afternoon, so we talk about every standard thing that happens as we go through. We talk about the week, if we had any trouble during the week and if we have any trouble how can we solve it, we take care of it every Friday, we sit down and talk to each other A meeting with doctors and nurses every second Thursday. Then we sit down all together and we talk things together. It’s important. We work together so we need to talk about changes together too, I think.	Reducing Variation through spreading knowledge	Oncology Nurse 2
They say they come on the first of October for a mammography and ultrasound and they take a biopsy. Then it takes about five days before we get the results and then we talk about the patients in something that we call conference. It’s a multidisciplinary conference with the radiologist, pathologist, oncologist and nurses. And then we decide what the patient should do, if it’s a surgery and then we decide a day that the patient, she will come to us to do the surgery. But between that, on the first of October the patient does the ultrasound and maybe on the 5th of October we do the conference and the patient maybe comes to us on the 7th of October, 7 days later, and then we have a plan for the patient and then maybe we’ll operate the patient around the 15th of October. So, from the first visit, our goal is to operate the patient in 21 days, that’s our mean goal. We’re not really there, yet, that’s for 90% of the patient, because 10% maybe has some arthritis or some complications they have to fix before the operation, so it’s not so easy to fix the surgery so fast.	Patient Path at Capio	Oncology Nurse 2

Because the patient, the most common way, they start at the breast center where the surgeons are and when they have their diagnosis and the operation then they come to us, after that. [...] We are a part of the breast center; we have these meetings around the patients, meetings or conferences. [Phone conversation break] [Break when she tries to find a paper for me, the following part is to be read together with the paper she gave to me] Here is the breast process, this is the same as screening, all women from 40 to 65; this is the way to get into the breast center. Screening or referral from the doctor, from the oncologist or from the vårdcentralen or from other breast centers from other clinics in the hospital, or from other hospitals or the patient takes contact herself because she felt something. And all these go into the... this... [points at the paper]. So all these ways to examine the patient... And then they decide that the mammography should be done, and then ultrasound and then biopsy of any kind. And then after the testing or analyzing of any kind they go to the surgeon who will meet the patient and tell what happens. All patients who have a breast cancer diagnosis, we discuss them at this conference and decide if they are going to be operated or get chemo before the operation. The people who, it's most common that you operate your breast cancer and then after that you come to us. But there are some people who go directly to the oncologist because they decide not to operate or to get chemo before the operation. And this is, some people do it on the day care center, some in the operation ward, where they stay overnight. And this is operation. [...] The typical day, we have a short meeting in the morning, just to check who is going to work with the telephone, who is going to work with the doctors. One or two of the nurses have their own mottagning (reception/clinic), so you check out the day and then you start working. It's always one nurse on the telephone all day, to answer questions from the patients [...] And then we meet new patients who, they have visited the doctors first and they go to the nurse. It's a lot of information of course, all the drugs and the chemo and you lose your hair and you take blood samples and you wait and it's a lot of supportive care, it's hard to get this cancer diagnosis. We have meetings with patients just to talk about everything. I have my own patients who come here, I have them scheduled. So, once a week I have this scheduled practice. But when I work together with the doctor, then the patient comes. I know because I see this patient, this is a new patient and after the doctor we sit, I'm going to sit with this patient for perhaps half an hour. [...] if a patient has chemo or fever or sick, I want to get this patient here for check-up. I always ask this emergency doctor to see the patient. He or she decides if we are going to get a place at the ward. So I will contact the ward and ask, if it's okay it's okay, otherwise if it's full perhaps you have to go in another hospital or in another ward.	Patient Path at Sodersjukhuset	Oncology Nurse 3
The typical day, we have a short meeting in the morning, just to check who is going to work with the telephone, who is going to work with the doctors. One or two of the nurses have their own mottagning (reception/clinic), so you check out the day and then you start working. It's always one nurse on the telephone all day, to answer questions from the patients	Scheduling	Oncology Nurse 3
It's a lot of information of course... We have meetings with patients just to talk about everything.	Knowledge as Andon	Oncology Nurse 3
If I have my own patients who come here, I have them scheduled. So, once a week I have this scheduled practice.	Input Variation	Oncology Nurse 3

I think it's easier with checklists in this healthy patients who had a breast cancer, they have removed it or are here for check-ups and treatments but practically they feel good, they are ok. It's more complicated with patients who have this spread disease and a lot of... There you have to always change the treatment or the patient can be in pain or it's hard to eat, it's more, it's hard to have a checklist perhaps.	Input Variation	Oncology Nurse 3
I think it's very good with routines and checklist. If you read them and try to work with it, I think it's good in a way, because you can do, it can be very, the patient should have the same treatment, if she comes to me or my colleague, so it's very. I think it's very important that you try to talk about it, try to standardize	Standardizing	Oncology Nurse 3
You have the patient and you have forgotten to put her on the waiting list. And if they patients are not calling herself, then she's gone, because you can't remember all the patients, we have so many patients. So it's very important that the patients are well informed about the next step in the treatment or knows what to expect. So now you are going in one year, you are coming here again, or after a week, it's very important that the patient knows, because if she doesn't hear from us, then she can call.	Knowledge as Andon	Oncology Nurse 3
We have meetings every week for the nurses and we talk about these things, if we have something to report, we talk about it, and if it's something you see. Perhaps you have three more, three mistakes who, similar things happen, you try to do a new routine for that	Knowledge as Andon	Oncology Nurse 3
In the nurse, I do. I also do the doctors' schedule. I have, we have one doctor who has, who is in charge here, in this site and she is scheduled the doctors, you know all the conferences, if they are going to be at the meetings or. It's a lot of things they do outside the clinic. And she is scheduling that. Then I get this doctors' schedule and can do the schedule for the patients' time or in the booking system.	Scheduling	Oncology Nurse 3
And I try to get all the nurses to read this, to remember. You don't remember what's in all of this and I think it's very important that you read it because everything you read and everything you say will be more similar.	Knowledge as Andon	Oncology Nurse 3
Yes, I think that, it's extremely important that if you have a patient who has a very good knowledge about her treatment and the sickness and the follow up and the routine, she will notice that the medicine is, the recipe is missing or the booking for the x-ray is not coming or whatever. So I think it's very important that the patient have their own responsibility over their own treatment. You must know what to expect. So I think that information is very important.	Knowledge as Andon	Oncology Nurse 3
So it's very different, it's very different types of cancer. Because we work with these who get breast cancer and they have done a very small operation and they are healthy, they just go here for check-ups for five years. And they you have these patients who have more advanced breast cancer, so they have these metastases in the head, or in the liver, or in the bones, it's a very different.	Input Variation	Oncology Nurse 3
the specialist, they can't see every patient. They can't have the same patient year after year after year because we need to have new patients coming in, so then the ST or these doctors under education; they see a lot of patients.	Training doctors	Oncology Nurse 3

(on asking whether she had to wait a lot)Not really. I had to wait a little extra before the first surgery, but that was because I was sick myself.	Input Variation	Patient 1
Yes, it was when I should do the first surgery. One of the nurses. Before the operation, the night before, you are not allowed to eat and drink and in the morning she came. It was one nurse. She came with some pills that I should take, they called them pre-medicines. And I am taking a pill which is called Voltaren and since I have had a lot of surgeries so far I know that that medicine affects how much you bleed during the operation. So I try usually not to take about five days before the operation. So I had not taken that medicine for several days before and then she came in the morning with that tablet and said “You should take these tablets”. But I recognized and said “But this is Voltaren. That can’t be right” “But it’s written here” she said “The doctor told me. You should take them” I said no and she said “It’s written in the paper” and I said “Show me” and she showed me and it was written Voltaren. Ok, I took it and the next day I had a drainage, she came with Voltaren again and I said “I don’t think I should take this as long as I have this left in the wound” “Doesn’t matter” she said “Does matter” I said “It affects how much I’m bleeding” But she never heard about this and I thought it was strange.	Keeping track of the patient	Patient 1
I did not have to wait much, it was around one month and during this time I also did other examinations	Input Variation	Patient 2
This is a clinical ward where we do just clinical work, some people do research, but that is on their spare time and we don’t have that much education for other doctors or other people, so we are dedicated to clinical work here. And that gives us more time to do our cases.	Setting priorities	Physician 2
We have a focused procedure on the breast pathology. We don’t do it differently than we do in other places... We have decided that the breast specimens have their own line.	Setting priorities	Physician 2
I think it’s good that you try and do something good. Then when you get it work, you transfer it to other patients	Kaizen	Physician 2
We have dedicated one doctor each week that will take care of the breast [and] have the responsibility to have it ready before the multidisciplinary conference. This makes it easier for people not to forget or do things in the wrong order	Scheduling	Physician 2
When we have a new doctor they’re informed about our system, then of course it’s hard to force someone to take something.	Formal ways of sharing knowledge	Physician 2
Everybody works here under their own responsibility but I think we have the structure and the schedule for each week and that also makes it a bit forcing that you have to do what you’re scheduled to do	Scheduling	Physician 2

The pathologist that goes at the conference is the same as the one who has analyzed the specimen	Scheduling	Physician 2
There is a lot of variation in the work. There are certain fixed things that I do but I do a lot of things during the day.	Process Variation	Physician 2
I have one week at a time when I see patients	Scheduling	Physician 2
Maybe we're not sure about the diagnosis. Then we just look at it together. We do that as soon as we see something that we're not 100% sure of, then we try to show it to our colleagues immediately, so that the answer that we give is something that we won't change afterwards.	Formal ways of sharing knowledge	Physician 2
I go through my cases and if it's something I'm sure of I just answer. If it's something that I think I need to discuss I just put it on the shelf and then every day we just sit, maybe all of us, in most of the cases maybe four of us and we sit and discuss and I take my cases and the others take their cases and we do all there and everybody gets their cases closed and can go and answer them.	Formal ways of sharing knowledge	Physician 2
(About department conferences to decide for the final diagnosis of more complicated cases) We do it maybe before lunch or in the afternoon coffee. (It is scheduled)	Formal ways of sharing knowledge	Physician 2
It was never organized so that you sat down and you got a consensus around something (about the place the doctor was working for previously).	Informal Sharing of Information	Physician 2
It's also good cause that makes me judge my own criteria for deciding something. You're always calibrating. These are not really facts, this is our description and our judgment and you really need to calibrate yourself.	Information Variation	Physician 2
Everyday you have a lot of cases that are not textbook cases and... I mean patients are patients and it's biology.	Input Variation	Physician 2
that is often the case because once you've left the oncology department, you're left on your own, you don't have a care plan, you don't know who to turn to if things start happening that you're not sure of so it's a very bad system when you have to go to the emergency department.	Information Variation	Process Consultant 3
those boundaries are as much a nurse from oncology and a nurse from surgery as it is a doctor and a nurse. There are different silos and you need to break down, you need to create teams that look at the whole system, to understand what really needs to be improved.	Information Variation	Process Consultant 3

we have very good quality registers when it comes to cancer where almost every cancer is entered into them, symptom, treatment, outcomes and this gives Swedish professionals the possibility to evaluate treatment in a much better way than most countries online	Measuring Performance	Process Consultant 3
you need time to adapt before you go into surgery otherwise it will all happen while you're in shock, but it turns out if you let the patient control when it's the best time... Some people want to do it quickly, some people need time to adjust but that's more individualized.	Input Variation	Process Consultant 3