CHALMERS
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Managing an effective patient flow -

A single ward´s impact on the acute patient flow

Master's thesis in Master´s Programme Quality and Operation Management

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Gothenburg, Sweden 2017
Report No. E 2017:116

MASTER´S THESIS E2017:116

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Chalmers Reproservice
Gothenburg, Sweden 2017

ABSTRACT

The increasing pressure on healthcare resources in Sweden requires that the system becomes more efficient and not only focus on additional resources as the solution since the healthcare also has legal responsibility for delivering care as cost-effective as possible. An identified factor that creates lower productivity in Sweden than in other Nordic countries is a slow patient flow. To create an efficient and leveled flow it is important that wards that affect each other have synchronized flows and also overview the whole patient flow instead of focusing only on a single ward when making improvements to prevent sub optimizations.

The purpose with this master thesis is to give practical suggestions for a more efficient work with patient flow. This purpose is addressed by investing how a specific ward works with patient flow, both the acute and the elective, at a medium sized hospital. Furthermore, the study examines the coordination of the acute flow on an overall level and how it is affected of the work in the specific ward. Usage of Lean philosophy and process development have been shown to have great results in complex organizational environments. One such environment is the healthcare system, with several ingoing components, as well as different wards dependent on each other's functionality and therefore where it is important to improve the processes across the interfaces.

Based on the analysis and the discussion three major improvement areas where found; i) Planning operations and separation of patient flows; ii) standardization and visualization of communication and processes; iii) Continuously work with improvements to evaluate and improve the processes. Several practical suggestions to create an efficient flow at the studied hospital are also presented in the conclusion.

Keywords: *Healthcare processes, Lean management, Patient flow*

ACKNOWLEDGEMENT

This Thesis have been performed as the final work at the program Quality and operations Management, division Service Management and Logistics at Chalmers University of Technology.

First, we would like to thank Skaraborg hospital in Skövde and all participant contributed in the project by being involved in interviews and workshop etc. A special thanks to the urology ward, certainly Anna-Lena Broberg for all arrangement and willingness. Second, we would like to thank Kristina Lifvergren, Svante Lifvergren, Emma Bodemyr Ekblom, Charlotte Ejerblom and Reza Javid, for their support along the research and guidance in the project.

Further, we are grateful for all feedback and guidance from our supervisor Torbjörn Jacobsson and examiner Ida Gremyr. Lastly, we will thank our family for support along the research.

TRANSLATIONS

Admission	Inskrivning
Care episodes	Vårdtillfällen
Discharge	Utskrivning
Health care guarantee	Vårdgarantin
Hospitalized	Inlagd
Inpatient care	Slutenvård
Operation area	Medicin eller kirurgi området
Operational manager	Verksamhetschef
Operations	Verksamhetsområde
Outpatient care	Öppenvård
Overcrowding	Överbeläggning
Resident municipality	Boende
Round	Rond
Stays	Vistelser
Unit manager	Enhetschef
Ward	Avdelning

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1 Introduction

This chapter aims to introduce the study by presenting the background followed by the problem analysis, purpose, research questions and delimitations made.

1.1 Background

Challenges with the healthcare system, both the current situation and the forecasted future are frequently discussed in a lot of reports (Christensen et al. 2009; Stiernstedt et al. 2016). The population in Sweden gets older, as a result the portion of people with chronic-and multiple diseases increase. That in turn increases the pressure on the healthcare system and the demand of care becomes more complex. (Anell and Mattisson 2009; Christensen et al. 2009; Stiernstedt et al. 2016). Even the cost of chronical diseases is estimated to increase by 30 percent until year 2050 (Hfs 2015). There are several other aspects which create challenges in the healthcare system such as, new technology, limitations in the economy and the health care guarantee are some (Jacobsson 2010). The technology makes it easier to treat patients faster and better with new cure (Hallin and Siverbo 2003). All these aspects increase the demand for an effective, well-functioning and sustainable healthcare system (Stiernstedt et al. 2016). Long waiting times is the result when the demand and capacity is not met, it creates both dissatisfied patients, but also have negative economic effect on the society. Delayed care can generate worse condition for a patient which have to be treated and require extra care in comparison to the initial condition instead of treating the primary diagnose which would need less resources. External actors of care are required when the care-guarantee is not met, which increases costs and sick leave patients in anticipation of care results in loss of tax revenue.

Swedish healthcare is good from a medical perspective in international comparison (Jacobsson 2010) but there is shortcomings in the accessibility and when looking at productivity, the performance at Swedish hospitals is lower than other Nordic countries (Stiernstedt et al. 2016). For example, according to Renstig et al. (2003) more professionals in healthcare generally treat fewer patients than before. Furthermore, Swedish physicians only meet patient's 28 percent of their time at work and spend approximately 70 percent on other things, which is among the lowest numbers in the western world (Fölster et al. 2014).

About 9.5 percent of Gross domestic product (GDP) in Sweden goes to health- and medical care, which is an averaged number according to an international survey (Socialstyrelsen 2015). According to Stiernstedt et al. (2016) the available resources is not the obstacle for a well-functioning healthcare system in Sweden. The author describes several main aspects that affects the efficiency, such as, how the control is done, the organizational structure and culture but also how the work is done. The experienced lack of resources is argued to be caused by the healthcare system itself, and the flow of patients at hospitals have to be improved through development of flow efficiency of the entire chain within the hospital (Stiernstedt et al. 2016). Today is especially the flow efficiency low, which create long waiting queues to the emergency department (ED) as an effect of low availability (Socialstyrelsen 2015; Stiernstedt et al. 2016).

1.2 Problem analysis

The increasing pressure on healthcare resources in Sweden requires that the system becomes more efficient and not only focus on additional resources as the solution since the healthcare also has legal responsibility for delivering care as cost-effective as possible (Stiernstedt et al. 2016). To create an efficient and levelled flow it is important that wards that affect each other

have synchronized flows and also overview the whole patient flow instead of focusing only on a single ward when making improvements to prevent sub optimizations (Haraden and Resar 2004; Jacobsson 2010). Haraden and Resar (2004) also point out that the problem with the flow is often connected to the downstream part of the chain. If the downstream wards do not have enough available bed, then queues of patients arise at previous wards and the upstream wards do not have enough beds available for new patients from the ED. This lead to longer waiting times for the patient in waiting room at ED (Socialstyrelsen 2015) or the time he/she spend lying on a bed inside the ED, waiting for transport to downstream wards (Haraden and Resar 2004). Hence, the availability of care in the initial steps of the hospital chain is affected by the availability of beds in the latter part. Traditionally, healthcare organizations have been organized and managed by individual wards. This is consistent with "more resource"- thinking than flow thinking, neither focuses on how the flow of patients works between wards, and sub optimizations are commonly being made as a consequence. Instead of focusing on increase resources and hospital beds, which is often not allowed due to tight budgets, hospitals should focus on process development and improvement work. Swedish healthcare organizations have for about two decades worked with different management philosophies where Lean has been in focus with great results (Mazzocato et al. 2010). Historically the focus has been on resource utilization but with lean perspective has focus shifted towards flow efficiency (Rognes and Åhlström 2008).

The organization in focus is Skaraborgs hospital in Skövde (SSS), part of Skaraborg hospital group (SkaS), consisting four hospitals in Skaraborgs region, Skövde, Mariestad, Falköping and Lidköping. The hospital consists of two major operation areas, the medical- and the surgical area including six operations each. The hospital is struggling with lack of available beds in several different wards and is also at the forefront of a work with production and capacity planning. A lot of effort regarding flow efficiency has been made at the initial part of the patient flow at the hospital. Since it is a chain of treatment that are connected to each other does inefficiency in downstream wards direct affect the front of the chain since the queue of patient goes backwards. Further, patients get delocalized, meaning that they are placed at a ward that does not usually treat their diagnosis, due to unavailability of hospital bed at the correct ward. That is both a risk for patient safety (Socialstyrelsen 2015) as well as a risk to increase patient length of stay at the hospital. Therefore, a system view is needed to visualize the whole chain. Focus is needed downstream of the chain to be able to connect the organization to each other and creating a pull system. Many problems connected to the downstream wards is related to the outflow of patients. Patients going to be discharged both to home and to residence in municipality are being hospitalized longer than needed due to lack of forward planning and proactive work.

The downstream ward for investigation was the urology ward which is an inpatient care with both acute and elective patients. The availability at the ward has been lower than the goal at SkaS, the occupancy rate was 98 percent at 7:am during 2016, when the organizational goal is 90 percent. The ward is not the one with worst occupancy rate at SkaS but is a part of a pilot project, working with the discharge process in SkaS. By choosing the Urology ward as the primary focus area, this study hopes to come a bit further in the area than choosing a ward that has not focused on the field earlier.

1.3 Purpose and Research Questions

The purpose with this master thesis is to give practical suggestions for a more efficient work with patient flow. This purpose is addressed by investigating how a specific ward works with patient flow, both the acute and the elective, at a medium sized hospital. Furthermore, the study also examines the coordination of the acute flow on an overall level and how it is affected of the work in the specific ward.

Research questions:
In order to achieve the above purpose, the three research questions below will be answered. The questions will work as a help to guide the research in order to be able to find the improvement areas.

The first research question aims to providing an understanding of how the organization is working with patient flow between wards, from admission at ED to discharge form a Ward.

- ***RQ 1: In what way has patient flow been reflected in the hospitals organization?***

The second research question aims to providing an understanding of how a specific ward´s routines and practices affect the patient flow. Routines are defined as how staff are supposed to work and the practices are defined as how they are performing the work.

- ***RQ 2: What present routines and practices affect patient flows within a ward?***

The third research question is divided into two questions. RQ3A connects RQ1 and RQ2 and aims to highlight improvement areas within a ward that in themselves can contribute to improve patient flow on an overall level. RQ3B aims to provide suggestions for improvements on how they work with the acute patient flow on an overall level.

- ***RQ 3A: What improvement areas exist in the individual wards that in themselves can contribute to improved patient flow between wards?***

- ***RQ 3B: What improvements in the hospitals organization will contribute to a more efficient acute patient flow?***

Patient flow between wards refers to the acute patient flow and the patient flow within a ward refers to both the acute and the elective patient flow. The specific ward for this master thesis was the urology ward 63-64.

1.4 Delimitations

The main delimitation of this research is that it focuses on decisions and information connected to the patient flows. The research will only consider the patient flow that are connected to the inpatient care within the hospital in Skövde. The study is also delimited from the staff's work tasks regarding care and medical treatment of patients. Furthermore, the research is delimited to only give recommended improvements, how it will be implemented and the result of it will not be investigated. Furthermore, the way people are affected by or respond to changes are not analyzed in the study. Difficulties in hiring staff have been identified during the study which is not taken into consideration while finding improvement areas.

1.5 Report outline

Chapter 1- This chapter aims to introduce the study by presenting the background followed by the problem analysis, purpose, research questions and delimitations made.

Chapter 2 - In this chapter, the theoretical concepts used in this study are presented, in order to create understanding of the concepts that are important to answer the research questions.

Chapter 3 - The following chapter describes research methods used when conducting this study and motivate the choice of it. Methods for data collection and data analysis are also presented, and lastly, ethical aspects a well as validity and reliability will be discussed.

Chapter 4 - This chapter will present an overview of the hospital operations to create an understanding of the work. Furthermore, the current situation with focus on information and decisions regarding patient flow are presented.

Chapter 5 - In this chapter, the problem found from the empirical data are discussed. Initially is an overall reflection about areas affecting the patient flow is discussed. The second part is discussing the problems based on the first and second research questions. The third research question will be presented in chapter 6.

Chapter 6 - This chapter will reflect upon previous research made in the studied area as well as analysis the third research question. The third question addresses solutions aimed at the organization, and therefore it is reflected in the discussion instead of in the analysis.

Chapter 7 - In this chapter, the conclusion drawn from the analysis and discussion are presented and answers to the formulated research questions are given. Lastly, a prioritizing of the suggested improvements is also presented.

2 Theoretical framework

In this chapter, the theoretical concepts used in this study are presented, in order to create understanding of the concepts that are important to answer the research questions.

2.1 Processes and flows

A process is according to Bergman and Klefsjö (2012) defined as a network of connected activities which are repeated in time. It aims to satisfy the customer of the process while using as few resources as possible. A process has a start and an end within all the activities happens. Rentzhog (1998) describe a process as a boat channel, were the channel itself is the process and the boat is the unit being transported within the channel or process. The unit transported in the process can in an organization be either material, information or people (Bergman and Klefsjö 2012). While transported through the process is the unit refined, which means step by step satisfying the customer need.

Theory of flow

Historically the view of efficiency in organizations have been to use the resources to their maximum, that means high efficiency, called resource efficiency. That is also the most natural way for people to thinking of efficiency. It means that resources are constantly used and the units have to wait for being processed to make sure that the resource constantly is working. (Modig and Åhlström 2015). According to Modig and Åhlström (2015) it is not guaranteed that a resource used to its maximum is working with value adding activities, which means that high focus on resource efficiency tend to increase workload. According to Jacobsen et al. (2008, p.48) efficiency can be defined as the degree of achievement in relations to use of recourses.

Flow efficiency is a new form of efficiency for many organizations due to it contradicts the way of thinking of using resources to their maximum, which have been the natural way thinking of efficiency. Flow efficiency is not a new phenomenon, it has been used since year 1500, but still many organization have resource efficiency in mind while running their operations. Flow efficiency focus on the unit being refined, which as mentioned above can be either material, information or people. It aim to satisfying the customer's needs, the customer is in the hospital context the patients and their primary need is to get their health back. (Modig and Åhlström 2015). Modig and Åhlström (2015) define flow efficiency as the sum of all value adding time relative the total throughput time of the process, more clearly, it is the density of value-transformation from a resource to the unit. Throughput time is the time it takes for a unit to be transported between the system boundaries defined for the process.

According to Modig and Åhlström (2015) flow efficiency is created in the processes. Organizations consist of a lot of processes, and these processes can be defined differently. A common misunderstanding is to think of a process as one single work routine, which it is not, instead as mentioned above a network of activities. In the hospital context as this research is about, the patient and information is the unit being transported through the hospitals different activities in the processes.

Value adding activities is activities that refine the unit, furthermore activities that contributes to satisfy the customer needs. Bergman and Klefsjö (2012) describe an organization to have three different processes; management processes, main processes and support processes. Value-adding activities are the ones related to the main-process. Non-value-adding activities do also exist in all kind of organizations and contribute to the support-processes, which are necessary

to conduct the business, but should not be the main part. Reducing non-value adding activities does according to Ljungberg and Larsson (2012) release resources.

The three laws of process
There are three laws that affect all kind of processes. Littles law, the law of bottleneck and the law of variations impact on processes.

- Littles law means; the throughput time equals cycle time times number of units in the process. Units in the process is all units within the system boundaries, and cycle time is the time between two units get out of the process (Modig and Åhlström 2015).

- A bottleneck appears in all processes, it is the activity that limit the entire chain or process since it is the activity that takes the largest amount of time. A bottleneck is recognizes by having a queue in front of it and free capacity right after it (Modig and Åhlström 2015).

- The law of variation says that, throughput time increase as variation increase and as resource efficiency increases. Variation do exist in all processes, it is impossible to eliminate, but control and decrease the variation is valuable for all organizations.

In order to be an efficient organization shall focus according to Ljungberg and Larsson (2012) be to increase value-adding activities for the customer, it should also be to decrease number of handovers, decrease throughput time and minimize non value-adding activities.

2.2 Processes and flows in healthcare

In a healthcare context both the physical flow of patients and the decision and information flow are processes. The process starts when the patient is admitted to the hospital and ends when the patient is discharged. This is also commonly called as the Length of stay (LoS) which may vary depending on diseases but also for the same issue. The patient flow must be seen and understood as a whole system and not just as isolated units. E.g. if only pushing patients through the ED without taken into consideration the rest of the flow, soon there is not anywhere to place them and the system gets overcrowded (Haraden and Resar 2004). Overcrowding and unavailable beds can lead to patients being placed on less appropriate wards which often contributes to less quality of care (Green and Nguyen 2001). Historically, resource efficiency have been in focus in healthcare, but in the future more focus is needed on flow efficiency instead in order to meet the challenges (Stiernstedt et al. 2016). Aronsson et al. (2011) also stresses the importance of seeing the whole picture of the flow and create a more flow oriented organization to avoid sub optimizations. According to Meijboom et al. (2011) sub optimizations can also be reduced by working cross functionally between units but it is also important to tear down barriers within a hospital (Cao et al. 2015). An organization with lack of goals and where units often works separately, a consistent information flow within the whole organization is important (Alfalla-Luque et al. 2013).

The processes in healthcare can be divided into three stages, the admission stage, the inpatient period and the discharge process. In the acute flow, all these stages are not often done in the same ward which requires the system to be connected in an efficient manner. The bed management is important in each of these stages and a mismatch can lead to cancelled or delayed surgery. (Ortiga et al. 2012).

According to (Walley et al. 2006), in order to understand and change an acute flow it is important to understand how it varies over time. Variation for patient flow can be both internal and external. The internal, can e.g. be waiting times or operational times and external variations can be linked to the recipient for that which is to receive the patient (Stiernstedt et al. 2016). According to Allder et al. (2010) a lot of the variation found connected to the patient flow is linked to the elective flow, e.g. the surgical physicians schedule (Haraden and Resar 2004). The internal and external flow can be connected to Haraden and Resar (2004)´s two main groups of changes that can be done to improve the flow of patients. Either changes that can be done within the hospital and changes that can be done outside the hospital e.g. against municipality. The latter one is often connected to the discharge process where the planning and preparation for discharge is in focus. In a surgical operation area, patients that will be discharge the following day can be predicted with more than 80 percent accuracy. Moreover, by schedule the discharges in advance and standardize the process will lead to optimization of bed assignment and synchronization of patient flow at hospital level. (Haraden and Resar 2004; Ortiga et al. 2012). In medical care, standardized times may be determined for certain diagnoses or treatments (Liker 2004) which facilitates the planning, of when a patient can be discharged. This is also confirmed by Ortiga et al. (2012), who says that the LoS can be estimated for planned admission and that the discharge process should start at the point of admission.

2.3 Production and capacity planning

In order to manage patient flow in an efficient manner the healthcare is in need of better production and capacity planning (PCP) (Stiernstedt et al. 2016). According to Mattsson and Jonsson (2013) recourses in an organization must be used with respect to planning and monitoring. The aim with PCP is to always have the right recourses to match the incoming flow, in order to provide a good quality of care (Stiernstedt et al. 2016). According to Stiernstedt et al. (2016), the use of PCP in Swedish healthcare is still unusual and more focus must be directed towards forecasting of the demand for care to be able to meet the challenges in the future. The healthcare must work more proactive in order to decrease the wastes and sub optimizations in a patient flow. Examination of actual demand will enhance matching staffs schedule accordingly (Brandt and Palmgren 2015).

2.4 Occupancy rate

In a hospital, the occupancy rate is often measured. The occupancy is the level of utilization of beds that is planned and staffed for. The number of planned beds is often set by managers where considerations of cost and number of patients must be done (Green and Nguyen 2001). The occupancy target has often been 85-90 percent and measured at midnight (Green and Nguyen 2001). However, measuring occupancy at midnight as today is questioned, since that is the lowest number of the day (Green and Nguyen 2001). According to Green and Nguyen (2001) an occupancy rate above 90 percent can be achieved in large units for elective patients but in smaller units the target of 85 percent will result in delays and also might cause impact on patient service. Brandt and Palmgren (2015) also claims that overcapacity is necessary to create a leveled patient flow.

2.5 Separating flows

In an industrial environment separating flows is a common phenomenon and can be seen as a prerequisite in order to create a quick and leveled flow (Liker 2004; Skinner 1974). By eliminate unnecessary variations in the flow, enable to increase the productivity. In the industry, usually the activities are organized in different flows depending on how they create value to the customer (Liker 2004). One big difference between an industry and a service organization like

a hospital, is that the customer is consuming the service at the same time as it is given in a hospital (Åhlstrom 2005). The term "The focused factory" was described by Skinner (1974) and describes why some similar factories do not have the same productivity. Those who were most successful were those who separated flows where each flow was focused on similar things and, in turn, becomes less complex. For a hospital, this can be done by organize patients in different flows depending on diagnoses or what kind of treatment they need. It can also be to organize patients with different diagnoses or care in separate geographic places. By separating the flows staff can focus on tasks connected to their patients with similar goals. Further, this makes it easier to standardize the processes, which leads to less errors and variations and increased learning (Jacobsson 2010). In a case study in Hyer et al. (2009) the LoS where improved when changed to a more focus-based approach in healthcare organization. Furthermore, separate flows allow different strategies to be used to avoid excessive overcapacity (Olsson and Aronsson 2012).

2.6 Lean philosophy

Approaches related to operation management and process development originates from the production industry. Industrial concepts as Toyota Production System (TPS) which commonly corresponds to Lean production have had great success in a lot of companies the last decades. TPS was invented in Japan after the second world war at Toyota Motor Corporation (Shingo and Dillon 1989) and the term lean were introduced by Krafcik (1988) in the end of 1980.

In lean production, the customers are in the center, therefore is the customer demand defining what is value-adding activities and waste. Focus in lean is to minimize the activities that do not create value for the customer as well as eliminate waste (Liker 2004). Lean is described differently in the literature but a common description of lean is according to Womack and Jones (2010) that the concept is based on five principles:

1. Define what value is for the customer
2. Identify the value-adding flow for each product and reduce all waste in the processes.
3. Strive for continuous flows.
4. Create a “pull” production between all steps if possible.
5. Strive for perfection by minimize number of steps, amount of information and throughput time continuously improvements to creation of value for the customer.

Lean define eight different wastes which are; *overproduction, waiting, transportations or movements, inventory, motion, extra processing, defects, non-utilized talent* (Liker 2004). According to Hadfield and Holmes (2006), waste in the healthcare context can be explained as everything that is not valuable to the patient, staff or the community. Waste can be concerning both the patient and the staff. It can for example be patients have to wait for a diagnose, staff documenting more than necessary or that patients or information moves around the hospital (Manos et al. 2006).

2.6.1 Lean in Healthcare

Lean in healthcare setting is not as old as in the industry but started to be properly applied during the 2000's (Brandao de Souza 2009). One of the biggest differences between lean in industry and in healthcare is as mentioned when the value is created. Unlike manufacturing processes, care processes are often complex since the patient's condition varies along the flow of activities (Åhlstrom 2005). An important factor that separates hospitals working with lean and those who do not, is the focus on flow instead of recourses (Smith et al. 2008). According

to Jacobsson (2010) it is hard to have short throughput times and also a high recourse utilization due to high variation in the inflow.

Even though several good applications of lean in healthcare have been implemented there is still resistance against it though people consider it belong to industry (Fillingham 2007). The same principles and techniques that are used in the industry can also be used in a healthcare setting but it is important not apply the solutions directly (Åhlstrom 2005). Moreover, Mehri (2006) stresses negative reactions when implementing lean in healthcare, hence poor attention to the staff. Critical perspective appears when conducting investigations regarding working conditions. According to Slack et al. (2010) the methods from lean should be used in processes where the variation is low and where there are possibilities to affect assignable variations. Assignable variations or, local sources of trouble, should be minimized or eliminated to improve the efficiency (Shewhart 1931).

2.7 Standardization

By standardizing different processes, such as work, the possibility to increase the quality of the processes is higher but it also enable to reduce variation (Liker 2004). A definition of standardized work according to Graban (2016, p.96) is *"the current one best way to safely complete an activity with proper outcome and the highest quality, using the fewest possible recourses.* The word, current, is important because it states that it not always will be the best way of doing it, but should constantly be questioned and developed. By standardize and create routines for the processes, it will reduce variation due all staff or groups are able to do it according to the standard (Jacobsson 2010). However, it is important not to use standardization for command-and-control, but to see it as a way to help the staff and create a calmer working environment (Seddon 2010).

The article from Spear (2005), demonstrates how standardization can improve healthcare by improving work routines which reduced the number of incorrect injections. By standardizing the routines, it will be easier to follow them and use them in the organizations continuous work with improving the processes. The routines will become a platform where the organization can take a step further towards an improved position. By default, there is a higher risk that routines and improvements are forgotten and work will return to previous and non-standardized practices (Liker and Meier 2006).

2.8 Visualization

Visualization is a way to show something with help of pictures. In a production process this is commonly used to show how the process are preforming at the moment (Monden 1983). There are differences between production and services, like the hospital process is, where the service is consumed directly when needed and therefore harder to measure the result of the service (Gronroos 1988). Even though the result can be hard to visualize, the status on a process can be shown and followed to improve the process (Jacobsson 2010). In a healthcare setting, examples of visualization can be to visualize on a board, how many patients that are waiting in a waiting room or how many patients that are admitted to a ward. The principle is to highlight a problem that occurred in a system and inform the concerned staff directly, who can quickly solve the problem (Jacobsson 2010). By using, for example, a visual board to show how the work is presiding and what needs to be done, which can be seen clearly in the work environment by everyone working whit the process (Liker et al. 2009).

In a hospital, the staff ask the same question several times. Many of the questions are based on a lack of information and questions such as, “does the patient have any more tests, or can he/she go home?”, “is this room open?” or “have these medications been double-checked?” are very common in a hospital environment (Graban 2012, p.98). By visualize answer to some of these questions it might save a lot of time but also disruptions but by visualize the processes it will also make it easier for staff to make improvements to the processes so the process become more valuable (Slack et al. 2010). One way to visualize a process is to make a process map. A process mapping is a mapping of all steps in a process to clearly see which steps are included and in which order. This makes it easier to see which steps that do not add value and eliminate them or add steps that are important and considered missing. By visualized processes problems can arise in an earlier stage which makes the time from failure to action shorter (Slack et al. 2010). An example that fits for a process mapping is a discharge process (Graban 2012).

2.9 Improvement work and measurement

Continuous improvement, kaizen, is one of the most important lean principles (Åhlström 1997). It aims to continuously refine and develop the processes within the organization for constantly creating better results. The people working within an organization have knowledge of the processes and thus also insight into the problems that arise why it is important that they are engaged in the continuous improvement work (Jekiel 2011). Commitment of the staff is also important to feel responsibility of the processes and furthermore motivation to work for it (Liker and Franz 2011). Great potential for success is managed when the staff is daily involved in the improvement processes (Graban 2012). A care ward working under lean identifies waste in each process and focuses on continuous improvements to solve the causes of the problems (Graban 2012). Liker (2004) also stresses that instead wait for a perfect solution it can be better to try and evaluate smaller steps and if it were not the best solution it is easier to change back.

To see what improvements have been made is measurement important for an organization (Elg 2013). According to Elg (2013) measurement is a way to clarify what goals the organization is striving for, which contribute to that everyone are having the same goal to work for. Measurement do also contribute to increased transparency and understanding between different wards, since it visualize what is making the organization improve (Elg 2013). Furthermore, is continuous improvement and measurement a valuable way to find motivation among the staff (Cassel and Jain 2012).

2.10 The four different worlds at a hospital

The healthcare organization is according to Glouberman and Mintzberg (2001) one of the most complex system in the society. It consists of four different organization which collectively creates the healthcare system. Glouberman and Mintzberg (2001) call these four organization for the four worlds which are: (1) health professionals “care”, (2) the physicians, “cure”, (3) managers, “control” and (4) representatives from the society, “community”.

Healthcare professionals

Healthcare professions in this context is first of all meant nurses and assistant nurses. Those are the ones that run the wards, they provide care, constantly observe the patients and support the physicians as well as the administrative workload and coordinating. However, their duties is according to Jacobsson (2010) sometimes inefficient, but also not coordinated as well as performed within routines.

Physicians
According to Glouberman and Mintzberg (2001) does the physicians have a weak connection to the hospital where they are working but rather closer connection to the patients. In comparison to the healthcare professions do the physicians meet the patient a rather short amount of time per day, but still the most influential in the healthcare organization.

Managers
The managers are the administrative hierarchy in the hospital organization and have the formally responsibility. The managers have formally authority especially over the members of the hospital organization with the lowest professional status. The administrative managers can not directly affect the medical process, only indirect by allocate recourses in terms of regulate budget, hospital beds and working positions. As mentioned above, the physicians are the most influential in the healthcare organization, and the administrative hierarchy is not as important.

Representatives from the society
Representatives from the society which is called "community" can be politicians, buyers, representatives from other organizations etc. The distance between representatives from community and the actual healthcare is larger than they usually thing it is. Glouberman and Mintzberg (2001) describe how they sometimes think they can affect the behavior within the hospital, but the only way of affecting is regulating the recourses and budget and pressure the managers.

2.11 Situation awareness

Situation awareness is according to Endsley (1995) concerned with understanding of the environment critical to decision making especially in complex and dynamic systems. Further concern the perception of environmental elements and events with respect to time or space. To create situation awareness is awareness of what is happening in the vicinity important to understand how information, events, and one's own actions will impact goals and objectives, both immediately and in the near future. Situation awareness means high degree of knowledge with respect to inputs and outputs of a system. To create situation awareness is the system according to Endsley (1995) highly dependent on a current assessment of the changing situation. Which continuously requires accurate and complete information about relevant parameters, otherwise unable to effectively perform their function. Operators must observe the state of numerous system parameters and any patterns among them that might reveal clues as to the functioning of the system and future process state change. Without this understanding and prediction, human control could not be effective (Endsley 1995). In dynamic environments, many decisions are required across a fairly narrow space of time, and task are dependent on an ongoing, up-to-date analysis of the environment. Wright and Endsley (2008) addresses the importance of sharing this situation awareness in the system for collaboration. Hence unawareness that other teams do not have required information or else need certain information, commonly results in not communicate it.

2.12 Summary of the main areas affecting efficiency

In order to overview the theoretical framework a summary is conducted in table 1. Table 1 below highlights the main areas from the theory that affect the efficiency of patient flow in the healthcare context.

Table 1 Main areas affecting the efficiency in healthcare

Main areas affecting the efficiency in healthcare					
Processes & flows	*Production & capacity planning*	*Separating flows*	*Lean & continuous improvement*	*Standardization & visualization*	*Situation awareness*
Focus on the unit being refined instead of resource utilization. Decrease variation in order to decrease throughput time.	Examining actual demand will enabling matching the capacity accordingly. Thereby efficient use of resources.	Separating flows in order to decrease complexity of operations. This enabling reduction of variation by focus on similar activities.	Identify value-adding activities by focus on the customer demand an eliminate waste. Focus on continuous improvement, to continuously evolve the processes.	Standardize work routines in order to reduce variation. Hence, acquire stabilized processes. Visualization highlights problem and thereby enable improvements.	Adopt situation awareness to improve assessment of the current and future situation to increase efficiency of patient flow.

3 Method

The following chapter describes research methods used when conducting this study and motivate the choice of it. Methods for data collection and data analysis are also presented, and lastly, ethical aspects a well as validity and reliability will be discussed.

3.1 Research methods

This master thesis was designed as a single case study using a mixed methodology, which is a combination of both quantitative and qualitative methods. The mixed methodology allow using several kind of methods which help to better express the fact (Bryman and Bell 2015). Since the study conducts process solutions in the hospital context that originate in industrial concepts, a single case study design was appropriate. It enables to study a phenomenon within a complex system in which the boundary between phenomenon and context is not clear (Yin 2003). The data were mainly collected by qualitative methods, since it is preferable by studies that aims to increase the understanding of social phenomenon (Bryman and Bell 2015), but quantitative methods were also used to understand the system and behavior of patient flow.

The research was divided into three main phases called: understanding and defining the problem phase, investigation of the problem phase and lastly the suggestion of improvement phase (See figure 1). During the first phase, the focus was to understand and define the problem in its own context at the hospital. The second phase included an investigation of the problem and lastly suggestions for improvements were generated.

Figure 1 The research process in three main phases

There are different ways to relate theory against empirical data when conducting a research. The relationship between empirical data and theory was chosen to have an abductive approach, which is a mix of the inductive and deductive approach. Inductive approach bases the conclusions on empirical data, while deductive is the opposite and bases the conclusion on the hypothesis being developed through theory and tested against the empirical data (Bryman and Bell 2015). The most suitable approach for this study was the abductive approach because the flexibility between the inductive and the deductive methodology, since it bases the conclusions on empirical facts but does not reject existing theories (Alvesson and Sköldberg 2008). This can be clarified by the model in figure 2 below from Kovács and Spens (2005).

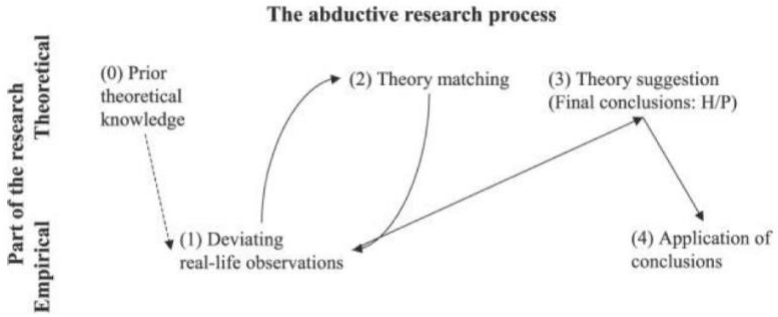

Figure 2 Method for an abductive approach (Kovács and Spens 2005)

The conclusion of this study was generated through an investigation of the identified problem areas in the empirical data and iteratively reflected upon, by the researcher themselves as well as in collaboration with the organizational staff. Furthermore, a comparison and analysis of the existing theory were made to verify success of suggested improvements, which is a typical reflection of an abductive approach in research.

Since the research use a mixed methodology, multiple methods were used for collection of data to answer the research questions. The main methods of data collection were interviews and conversations with people at different levels in the organization. Observations of meetings and daily work activities were another part of the data collection. A workshop with several staff in the organization was also made to generate the problems areas and possible solutions, which is further presented in section 3.3.5.

3.2 Action research

According to Bryman and Bell (2015) the outcome of research is influenced by how the researcher relate to the researched subject. This study will have the action research approach since it is based on a real ongoing project at the hospital. This is typical for an action research and were the research is designed to assist a solution for it (Bryman and Bell 2015). By using this course of action staff in the organization will get involved through a workshop in order to get them to interact with the researchers and contribute with their knowledge and experiences. The action research method is suitable for processual problems and provide the study to include both quantitative and qualitative data (Bryman and Bell 2015) which correspond in a great way with the mix-methodology used in this research and therefore the reason of choosing the action research method.

Benefits of an action research approach is the involvement of practitioners, in order to bridge the gap between the researcher and practitioners. Hence the workshop and meetings, which were held iteratively during the project. In this way jointly developed solutions could be embedded within the organization itself. A collaboration like this usually affect the outcome positively, since it makes it more relevant and more interesting to both the practitioners and academic audience. By involving practitioners in the process, the possibility of making the changes consisting within the organization after the implementation increases due to the common development of the solutions. An action research intends to contribute both to academic theory and practical action within the organization. (Bryman and Bell 2015).

3.3 Data collection

In research studies, the collection of data is often separated by primary and/or secondary data (Holme et al. 1997). Primary data are often collected by for example, interviews and/or observations while secondary data is collected by other researchers for example, articles, local documents or others thesis (Lundahl and Skärvad 1999). The empirical data collected, both qualitative and quantitative, in this thesis were gathered from both primary- and secondary data. The qualitative primary data was gathered from observations, conversations, interviews and a workshop. This kind of data is often build on a person's perceptions and can sometimes be hard to validate correctly. The data collection began in September 2017, and the most intensive data collection was made in the beginning of the research but continued until December 2017. In total, about 200 hours was spent on the field to get an understanding of how the organization works. Table 2 shows where these hours were spent. Secondary qualitative data was collected from different types of documents from SkaS. Secondary quantitative data were mainly collected from different computer systems at SkaS in order to investigate, strengthen and

validate statements. In addition to the information in the table 2 below, questions by mail or telephone were made to get further information, or answers to questions that arise when the researchers were not in place.

Table 2 The collected primary data

Position	Un-structured interviews	Semi-structured interviews	Conversation	Observations
Study visit SÄS			**1**	**1**
Team leader Stroke	**1**			
Coordinator surgery	**1**			
Coordinator MAVA	**1**		**1**	
Section leader KAVA		**1**		
Coordinator KAVA	**1**		**1**	
Unit manager Hematology		**1**		
Operation manager M4	**1**			
Section leader MAVA	**1**			
Chief Physician Medicine		**1**		
Unit manager MAVA	**1**		**1**	
Project leader M3			**1**	
Unit manager Urology		**1**		
Urology ward				**2**
Physician Urology			**3**	
Nurse urology			**6**	
Assistant nurse urology			**7**	
Business Developer	**2**		**4**	
KAVA-meeting				**3**
MAVA-meeting				**2**
Meeting production and capacity planning			**1**	**1**
Workshop - Assistant nurse, nurse, physician, unit manager		**1**	**1**	**1**
Operation manager urology		**1**		
Section leader ED	**1**			
Total	**10**	**6**	**27**	**10**

3.3.1 Literature Study

Initially, a minor literature study was conducted to understand the initial topics that were presented as the problem from the hospital. Evaluation and reflection of different authors aspects of the subject were made to get familiar with the context that were going to be studied. During the second phase of the study deeper literature review were made of the defined problem in parallel with further investigation of studied subject. The literature review was important and valuable for the interviews, due to knowledge within the subject helped to design a suitable questionnaire and made the researcher able to ask in-depth questions during the interviews (Bryman and Bell 2015). Keywords used during the literature research were: process improvement, patient flow, lean and healthcare. Databases used for literature research were Chalmers library and Google Scholar.

3.3.2 Observations

In order to understand the current situation of the patient flow and grasp the context of the hospital environment, several observations were made. There can be different types of observations, e.g. structured, participant or unstructured observations (Bryman and Bell 2015). In this case study, the unstructured method was used, which according to Bryman and Bell

(2015) is a good way to gather as much information as possible. The researcher used the observer-as-participant approach, which means that the researcher mainly is an interviewer or complete observer, but almost non-participation (Bryman and Bell 2015). The unstructured observation method, with an observer-as-participant approach, were used because the focus with the observations were to gather as much information as possible about the acute patient flow, the work of planning the daily work as well as grasp the context of the hospital environment. In order to understand the context of the hospital environment it is important to understand the local culture at the hospital and the language used among the staff and management. Except from observing the daily work connected to the patients, planning meetings and coordinating meetings were observed as well as the work in the administrating reception (nurse's office).

During the observations, field notes regarding what was discussed and what happened connected to the area of interest was continuously taken. The aim with field notes is to capture all relevant details directly when they happen, and make the possibility of analyzing the information afterwards easier (Bryman and Bell 2015). To get as much details as possible the observations were made during relatively short periods, and straight after the observations reflections were written down and discussed between the two researchers. Later the same day, the notes were reflected upon and written down in a document in the computer.

3.3.3 Interviews

There are different types interviews (Bryman and Bell 2015) and two kinds of interviews have been used in this study. In the first phase of the study, unstructured interviews were used, which means that only a few bullet points of questions were prepared before the interviews. Moreover, while conducting unstructured interviews there is no need to ask the questions in a specific order. (Bryman and Bell 2015). This interview method created an atmosphere where the respondents could talk about things they had in mind around the subject and develop their own reflections on a deeper level due to unexpected discussions appeared. The aim with the unstructured interviews were to understand and define the problem to be able to investigate and understand the current situation of the patient flow at the hospital.

In the second phase of the research, semi-structured interviews were used. The reason for change of interview method was that at this stage of the research the problem was defined and the interviews were needed to keep concentration to the studied subject on a higher level. Semi-structured interviews enable the researcher to dig deeper into the problem and to get under the surface of the problem. The semi-structured interviews are still a flexible interviewing method, where it is possible to have predefined questions but also follow-up questions based on the answers from the respondents (Bryman and Bell 2015). Using the semi-structured model, enable the interviewer to rephrase a question but also to dig deeper into an area (Kvale and Brinkmann 2009). Furthermore, the semi-structured method was also chosen because of the type of questions in the questionnaire. According to Justesen and Mik-Meyer (2011) the semi-structured method is suitable when the questions mainly starts with "*how"* or "*what",* so called open questions, which these questions did. Open questions give the respondent the opportunity to express their experience of what is being questioned. Even though the semi-structured interview method has many benefits, it is important to be aware of that the interviewer can affect the respondent, and therefore the answer. This since the follow-up questions are based on the interviewer's interpretations and knowledge in the field (Bryman and Bell 2015). To prevent this from happening both researchers were present at all interviews to able to discuss and reflect upon the interpretations of the answers.

A suitable interview technique can minimize distractions that could affect the interviewer and the respondent (Justesen and Mik-Meyer 2011). To minimize distractions during the interviews the researchers did behave calm and tried to get the respondent to feel comfortable in the interviewing environment. The purpose of the interview and the research was told at the start-up as well as subject of the questions to ask. The questionnaire was commonly created for all the interviews in order to collect different perspective of the subject and compare the answers with each other. This in order to get a fair perception of the reality investigated. The questions where however adjusted to the respondent's position within the organization in relation to the purpose of the investigation. Notes were taken during the interviews and complemented straight after, to fill in gaps and reflections.

3.3.4 Conversations

During the observations, several short conversations were held with staff at the hospital. A conversation is a relaxed form, where exchanging of opinions about the organization was made (Jacobsson 2010). The conversations were mostly random and lasted for about 2-20 minutes. They took place when the staff had some free time to answer some questions, e.g. between meetings or during a break. In some cases, the researchers were looking for certain people in order to discuss subjects that had been discussed in a previous conversation. If the person itself was not available, staff within the same profession were contacted to comment the subject. Conversations were held only if the respondents had time and everyone was informed that the information only should be presented at an aggregated level. Conversations were held both with and without taking notes, mostly no notes were taken during short conversations. If no notes were taken during the conversations, it was then done shortly after. In the end of each day, the notes were written on the computer and further developed if needed.

3.3.5 Workshop

A workshop was made during the study, which from the researcher's point of view was a time for learning for themselves and briefing the practitioners about the ongoing project. Further, development of suggestions and new ideas could be created jointly, when people with different competences and different knowledge about the organization were able to work together. Involvement of the practitioners also create trustworthiness about the ongoing project among the staff which is valuable for future implementation. To review the work together with the people within the organization at the workshop was also a method to verifying and validating the material, since misinterpretations and uncertainty could be explained and sorted out. Like other qualitative methods action research is criticized for the lack of repeatability. It is a lot focus on organizational action as expense of research findings. But on the other hand it is hard to create the richness of insights that is provided by involvement of practitioners about a problem that is important for themselves (Bryman and Bell 2015).

The workshop took place in the investigation phase in the beginning of November, representatives from each of the hierarchical level in the care process were attended. Members of the workshop were a unit manager, a physician, a nurse, an assistant nurse and a controller and the workshop lasted for two hours. Prior to the workshop three major question were given the members of the workshop, in order to reflect upon the subject in advance and thereby be able to contribute to a discussion. The questions served as a starting point for the forthcoming discussion, which led the discussion to identified problem areas that continuously was written on a whiteboard. When problem areas were identified the second half of the workshop were aimed to discuss suggested solutions to it.

3.3.6 Quantitative data collection

Quantitative data collection involves statistics of inflow of patient to the ED, KAVA, the urology ward, and the distribution of the incoming patient over a day and week. Further statistics on the division between urology patients at the urology ward and number of external patient belonging to another ward. The data was collected from the computer program Elvis[1] and was used primarily to understand the patient flows and as support to the improvements in the study. The data was made anonymous by SkaS data unit before sent to us so there was no possibility to see identity data.

3.4 Data analysis

According to (Bryman and Bell 2015) there is no single correct way of analyzing qualitative data. Barley (1990) stresses that manage the vast amount of data is a challenge. Therefore, the data analysis was made iteratively along the research. This means that that the researchers shifted between data collection, use of theoretical framework and analysis. It is an advantage according to Miles and Huberman (1994) to analyze the qualitative data in parallel with data collection, in order to successively identify weaknesses or demanded complementary, and ensure it not get overwhelming.

For the analysis in this study a modification of the KJ-Shiba model was used, which include data reduction, data production and verifications of conclusions that should be included in a qualitative data analysis (Shiba 1987). The aim of the data analysis was to find results that can answer the purpose of the study. The data were iteratively clustered according to problem areas, further two hierarchical levels were identified as micro and meso level at the hospital. The micro level involves all staff at the specific ward working in the daily operations that constantly is in contact with the patients. The meso level involve all actors at mid-managerial level that in some way is connected to managing the patient flow. The meso level was described as the overall lever in chapter 1.

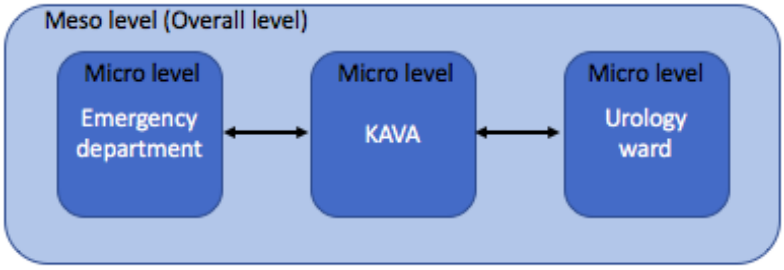

Figure 3 Visualization of the division and connection between micro- and meso level in this report

Immediately after the time on the field, detailed reflections were made of what has been observed or discussed during the conversations and interviews conducted during the day. Through successively reflection after each occasion on the field, problem areas were identified. Further, the workshop was made to verify the identified problem areas according to the staff's perception of the organization. The problem areas were later connected to each of the hierarchical levels, micro and meso, to visualize the interaction between them.

The quantitative data was used to understand several different aspects, e.g. the variation of inflow and outflow of patients both for ED and the urology ward. Furthermore, the data was

[1] ELVIS is the overall system for registration of care process. Times, diagnoses and where a patient has been during his or her stay are registered in the system.

grouped to see similarities and differences e.g. variations, median and the average length of stay (Eriksson and Wiedersheim-Paul 2008), which is important when planning the number of available beds in a ward. The data could also show, e.g. if something was a real problem or only an effect of a problem caused by another ward. Knowing what kind of data that is being processed is important to be able to understand how to interpret the results (George 2005). The quantitative data obtained from the hospital was sometimes difficult to interpret and some data could not be obtained because it was not registered in the system. E.g. data regarding the acute patients admitted by ED and stayed at another ward before arrived at urology ward, the LoS could not be calculated only for urology ward. When the researchers were unsure of certain data, the data unit was assisted.

3.5 Ethics

According to Bryman and Bell (2015) there are four ethical considerations. The four areas are whether there is:

- Harm to participant
- Lack of informed consent
- An invasion of privacy
- Deception is involved

Ethical aspects that was important to consider during this master thesis was essentially lack of informed consent and invasion of privacy. In order to confirm consent with the participants in the research and prevent invasion of the privacy, it was important to be informative. To be certain about that participation in interviews and conversations was optional and that they had the possibility to withdraw whenever they wanted. Initially, all participants were informed that they were anonymous, all names of the participants have been anonymized and all answers in this study have been presented in an aggregated manner to avoid the identities of the respondent being revealed. The purpose of the study was clarified as well as how information about the data was going to be used and analyzed was also informed prior to the interviews. Since the study followed an action research, it was important to not reveal previous respondent while discussing at the workshop. The study was conducted in an overt manner where discussions about the findings was made with the participants. This may have affected the result since it is built upon the researchers' interpretation of only some participants. However, this has been actively taken into consideration throughout the study. Furthermore, the numerical data collected at the hospital was handled with secrecy and according to the restriction of the hospital. Since the study was conducted at a hospital it was possible to overhear sensitive information, which always must be handled with care. Lastly, as the study did not treat any patient data, no ethical review was necessary.

3.6 Validity

Validity is an assessment of the quality of the research. Validity is about whether the survey design measures what the researcher intends to measure, furthermore, high validity means high relevance of the collected data. The relationship between the collected data and the theory is also important for high validity. (Bryman and Bell 2015). This means that it is important to control, question and theoretically interpret the collected data to increase the validity of the study (Kvale and Brinkmann 2009). To increase the validity of this research, two people were present while the interviews and observations were conducted. This in order to discuss and compare any interpretations of the collected material afterwards, as well as make a comparison with theory. In qualitative research it is extra hard to ensure the validity due to the risk that the

material is interpreted in another way if someone else would make the same research (Bryman and Bell 2015). To ensure the validity it is important to behave neutral and with objectivity during observations and interviews to not affect the respondent to answer in a certain way. Triangulation, which mean usage of different types of data collection does also contribute to strengthen the validity of the research (Yin 2003), hence the researchers look at the problem from multiple angels. The review of the work together with the staff within the organization at the workshop were also a method to verifying and validating the material, since misinterpretations and uncertainty could be explained and sorted out. The workshop served as a good method for clarification of uncertainty, further were complementary conversations and meeting made if uncertainty or misunderstandings appeared.

3.7 Reliability

High reliability means that the same results are obtained regardless of who conducts the study, thus repeatable without varying results from one study to another (Hartman 2004). Reliability is most critical in qualitative research, certainly within healthcare since it is a social phenomenon being studied. Further, a negative aspect of a case study is that when a specific case is studied, general conclusions are difficult to achieve (Bryman and Bell 2015). On the other hand, a case study provides the opportunity to use multiple sources of data collection, which increases the prerequisites for a fairer picture of the reality and credible results of the survey (Denscombe 2010). This research uses as mentioned a mixed methodology where triangulation in data collection have been used and thereby increase the ability to a fair perception of the reality. Other factor that aim to increase the reliability of research are an impartial interviewer, thus there is no need or advantage of interpreting the material in a certain way (Starrin and Svensson 1994). An impartial interviewer tries to be objective and neutral when asking questions not to affect the answers of the respondents. Moreover, discuss and clarify the meaning of terms and concepts is also valuable to prevent misinterpretations. Qualitative studies are criticized for being hard to investigate how the research have been planned, executed and analyzed (Bryman and Bell 2015). The reliability is increased in this research by detailed explanation of the approach of the study, further describe methods used and how the data analysis was made.

3.8 Generalization

Moreover, generalization of the findings is challenging while performing a case study, in comparison to other research designs. Generalization means that the findings of the study is applicable in similar situations. Performing a detailed description of the study aim to make it possible to judge if the findings is applicable in other contextual setting. (Bryman and Bell 2015).

3.9 Research process reflection

During this research, there were several different approaches due to changing purpose. The first approach was to conduct a quantitative research with the purpose to match resources against demand based on historical data. The hospital had an ongoing project with production and capacity planning, why detailed investigation was focusing on patient flows in number across the hospital. Further the prediction of actual demand was in focus, which is important for production and capacity planning. After some days, the research was changed to a second approach due to change of supervisor and a more practical research was initiated to define the actual problem at the hospital. During this approach, several hours were spent at the hospital to understand the problem and gather data from people through conversations and interviews. At the same time a lot of quantitative data was gathered since the purpose still was use historical

data to analyze. After some weeks, another meeting was arranged to clarify the purpose of the research towards the organization, were the study changed focus again due to misunderstandings in the initial part of the project. The focus was instead changed towards, what information and data were missing within the organization to make decision to improve patient flow. However, later on, during more gathering of information it was understood that processes within the organization was too unstable at the moment in order to properly succeed with production and capacity planning. Then the direction again was changed towards the last approach, to focus on examining what improvements can be made at a certain ward and on an overall level, to contribute to improve patient flow. The whole process, with the different approaches is visualized in figure 4 below.

Moreover, different actors were involved in the project which contributed to a split vision about the actual purpose of the project hence several perspectives that influenced the researchers was experienced difficult to handle. Hence this way of conducting the study were unstructured interviews and conversations made as well as a major quantitative data collection to get familiar with the context and enable defining the problem. Since the approach changed from quantitative to a mixed method a major amount of quantitative data that was collected and were an analysis of it was initiated, later on were shown not able to be used in the research. However, some data were still relevant to be able to understand the healthcare context and the behavior of the patient flow.

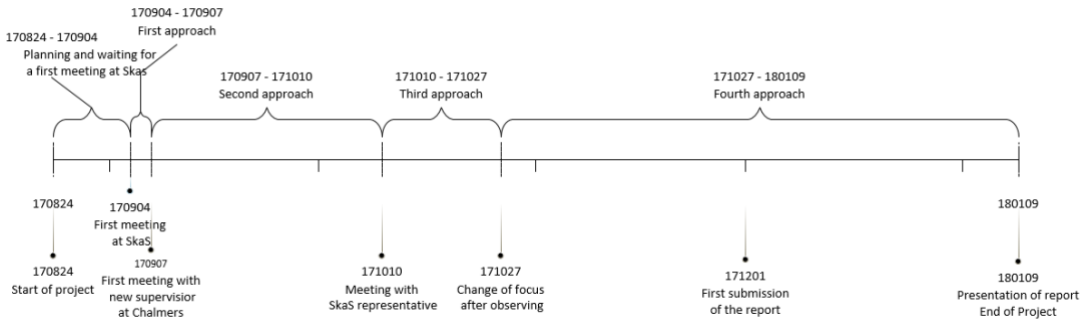

Figure 4 The research process

4 Empirical Data

This chapter will present an overview of the hospital operations to create an understanding of the work. Furthermore, the current situation with focus on information and decisions regarding patient flow are presented.

4.1 Introduction of hospital operations

Skaraborgs hospital (SkaS) consists of four hospitals located in Skövde, Lidköping, Falköping and Mariestad. SkaS has a catchment-area of about 260 000 citizens (VGR 2015). It has two ED´s, located at Skövde and Lidköping hospital, and offer care specialist in about thirty medical areas, thereby a medium sized hospital. In 2016 were 36 470 inpatient cases produced and 419 380 outpatient cases at SkaS (SkaS 2016a). Number of surgery's in 2016 were 18900, whereas 5500 of them were acute surgery's (SkaS 2016b). The inflow of patients to the inpatient care at SkaS is mainly from the ED´s. The average occupancy at SkaS in somatic health care is 91 percent and 83 percent in the psychology health care (SkaS 2016a). Within SkaS they are familiar and have worked with and are working with several different management approaches such as, Lean, Six sigma.

This research is conducted at Skaraborgs Sjukhus Skövde (SSS) which is a hospital divided into six operations in each of the medical and surgical operation areas. The urology ward number 63-64, in focus for the research, belongs to area number two in the surgical operation area (called, K2) together with the surgery ward and palliative ward. Treats both elective and acute patients. The figure 5 below presents the hospital's organizational structure.

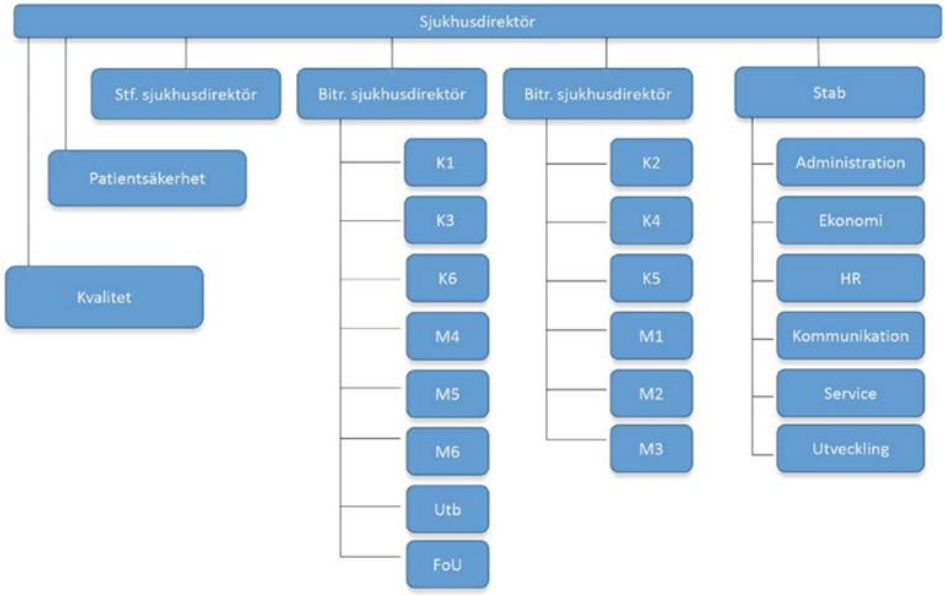

Figure 5 Organization chart of Skaraborgs hospital

4.2 Division between the surgical and medical patient flow

Even though the hospital formally is divided into the operations shown in figure 5, is the work with patient flow (decision regarding hospital beds) divided into medicine and surgery. The incoming patients with problem connected to medicine belongs to the medical wards, whereas patient with problems connected to physical complications belongs to the surgery wards. Both flows consist acute and elective patients.

The acute medical flow is mainly coordinated by a coordinator at the acute medicine ward (MAVA) (Medicinsk akutvårdsaavdelning) and the acute surgical flow is mainly coordinated by a coordinator at the surgical acute ward (KAVA) (Kirurgisk akutvårdsavdelning). The purpose with the coordination are two things, first of all, to have right patient at the right ward, which is most important regarding patient safety. The second purpose is to use the hospital beds efficiently. Both coordinators are nurses with mandate to distribute patients to different wards with available beds within the area (surgery or medicine). About 33 percent of the patients, arriving from the ED, goes through KAVA or MAVA while the rest are directly transferred to other wards at the hospital, see figure 6 below.

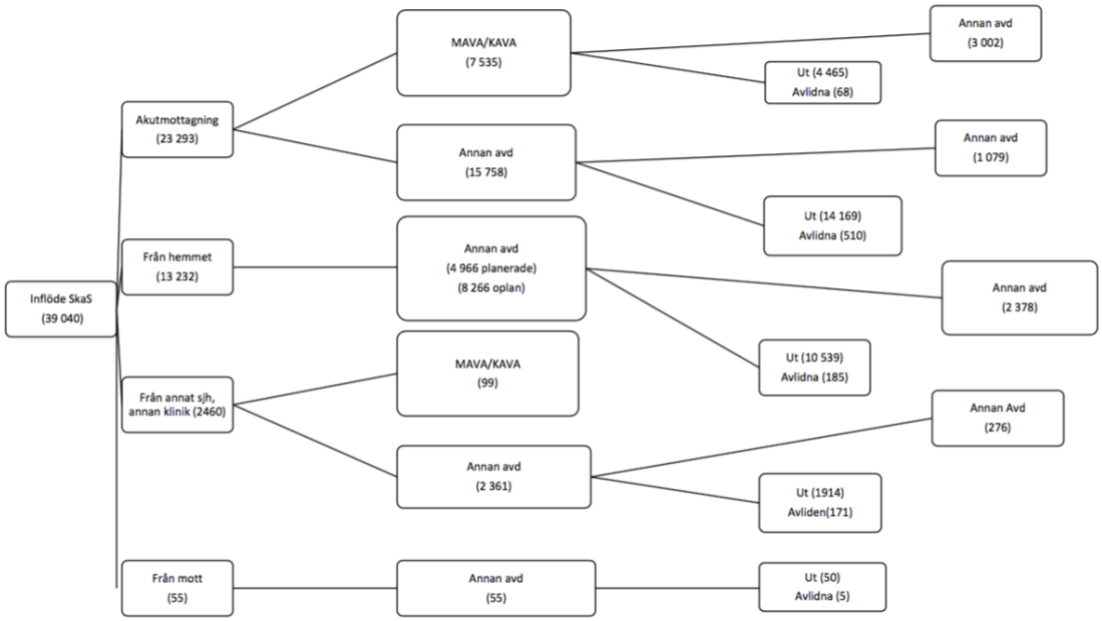

Figure 6 Compilation of the larger patient flows at SSS during 2015

Collaboration among the wards concerning distribution of patients is managed by having, as mentioned above, a coordinator located at KAVA and MAVA, who is in charge for distribution of patients every hour of the day. The hospital uses a computer system called Belport, for status of available beds and have a daily meeting called KAVA-meeting/MAVA-meeting were distribution of patients is made face-to-face with representatives from each ward.

The Belport-system register the current number of patients at the ward and should be updated several times each day. According to routines written in the system, it should be updated four times a day, (at 8:am, 11:am, 2:pm and 7:pm), by each ward. Other routines have other times for updates and different times when talking to respondents. These number is valuable for the coordinators at KAVA and MAVA who distribute the patients both from the ED´s but also from other hospitals and need to know if beds are available at certain wards. The numbers are poorly updated at certain times by several wards, which force the coordinator to contact the ward and ask for their actual numbers. According to conversations with nurse's, registration of available beds in the system is sometimes forgotten or not updated due to heavy workload. In several (the most) of the wards conducted in this study were no one responsible for update the system. Figure 7 below, shows how many of the wards (wards that should update the system) that has updated the available beds into Belport according to the four set times, within one hour before the predetermined time and 20 minutes after. Figure 8 show how many of the wards that had updated the system according to the routines in the Medical and Surgical operation areas.

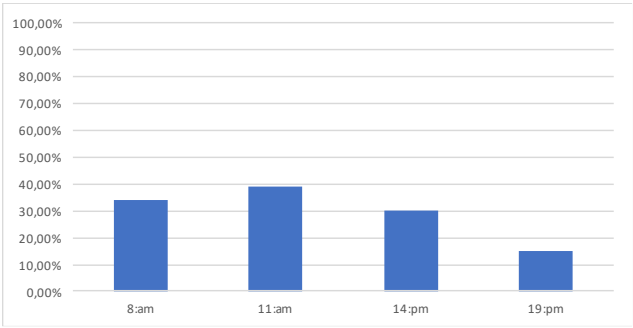

Figure 7 Percentage of wards updated according to routines in Belport.

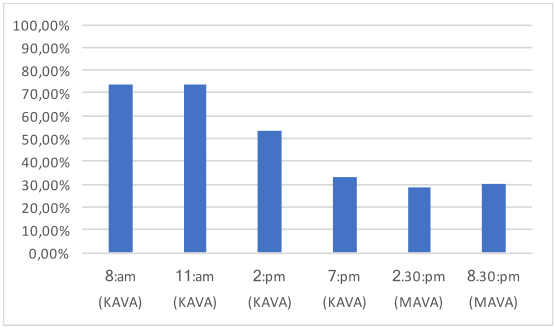

Figure 8 Percentage of wards updated according to routines in Medical and Surgical operation areas.

The way of working differs between the two patient flows, medical and surgical. MAVA have a coordinator who focus on distribution of patients and constantly keep him or herself updated with information regarding available beds by phone, computer systems and by attending to the MAVA-meeting. An administrator is responsible for all phone calls except those regarding distribution of patients. The administrator is a support for the coordinator when needed, which makes it possible for the coordinator to attend at the MAVA-meeting and get the information soonest possible. The coordinator at KAVA on the other hand, is responsible for all incoming phone calls in addition to distribution of patients. An administrative employment is currently not appointed, which prevent attendance at the KAVA-meeting since no one support the coordinator in the meantime. Differences between the medical and surgical operation areas way of working occurs today, further will only the surgical area be in focus.

Cooperation between wards

There is a developed cooperation regarding patient flow between MAVA, KAVA and the ED at SSS. Representatives from the different wards get together on regular basis to work on improvements of the flow between them. This has led to a better flow between these wards. The work with other wards is not that developed as the one between MAVA, KAVA and ED. The information flow between ED and KAVA, MAVA is transparent and they have a close relationship but the communication between them, in the beginning, and the succeeding wards is in some case problematic.

4.3 Patient flow within the Surgical operation area

Communication and transportation

Communication about incoming patients between the ED and KAVA is made by phone. The coordinator does also get information about current patients at the ED through the Elvis-system and can therefore estimate if any patients will shortly be transferred to KAVA, before getting a phone call. When ED ask to transfer a patient to KAVA does staff at KAVA have to pick up the patient within 30 minutes, to ensure continuous outflow from the ED. Communication between the ED as well as KAVA and urology ward is also made by phone, but routines for pick up isn't determined in advance. Transportation of patients is arranged every time they call, decisions about who will transport the patient and what time is decided upon during the call. Transportation can be made either by staff at the urology ward or by staff at the ED or KAVA depending on workload. Common reasons for late pick up is heavy workload or no available bed to transfer the patient in. Due to late pick up from ED is patients often transferred to other wards then the patients belong to since patients cannot stay at the ED to long time.

KAVA-meeting

The KAVA-meeting is held by the unit manager of KAVA at 11:am every weekday were the unit managers from each ward within the surgical operation area are supposed to attend.

Absence of unit managers is replaced by a nurse. The meeting was held in a room at the ED but was during the autumn moved to a room at the surgeon ward to have less people moving around in the ED. Purpose of the KAVA-meeting is to face-to-face update the current numbers of available beds at the hospital, and commonly distribute patients at KAVA and other hospitals to the most suitable ward at the hospital. The meeting starts with an oral review of available hospital beds at each ward which is written down on a piece of paper by the unit manager of KAVA. Which patients to transfer and where to are discussed, the prioritization is to place each patient at the ward they belong to, if not possible are the patient placed at another ward until there is an available hospital bed at the correct one. The meeting takes approximately 15 minutes. After the meeting does the unit manager update the coordinator about decisions taken at the meeting.

Zebra-meeting
If the situation of available beds is not stable after the KAVA-meeting, the operational managers for each operation within the surgical operation area are having a meeting at 11:30:am, called Zebra-meeting, convened by the unit manager of KAVA. The operational managers are informed that there will be a meeting by a text message from one or both unit-managers responsible for the KAVA/MAVA-meeting. The operational managers respond to the message if they will attend or not. Purpose of the Zebra-meeting is making a decision of actions to handle the situation. Common actions in this situation is: cancelled operations, since acute patients are prioritized before planned, transfer patients to other hospitals or start a buffer. Start a buffer means open up extra beds in one or several wards and staff these by call for extra personnel or use available staff. Responsibility for adding extra staff to the buffer is organized by a schedule. These kinds of decisions are the unit managers not mandated to take, which is the reason for having the Zebra-meeting. According to an operational manager is the decisions taken at the Zebra-meeting, in 99 percent proposed by the unit managers.

4.4 Urology ward

The urology ward 63-64 is a ward for inpatient care whose patients commonly have diagnoses as prostate cancer and benign prostatic hyperplasia. Patients treated at the urology is those who will or just have had a surgery. The ward has 28 physical hospital beds whereof 24 are open and available for incoming patients during the weekdays, and 20 are open at the weekend. Patients at the ward 63-64 are mostly urology patients but the ward also takes care of patients from other wards if the ward themselves do not have enough beds or staff. The urology ward prioritizes to help out with surgery patients, whereas up to six hospital beds is available for surgical patients. If patients from other areas have to be placed at the urology ward is patient within the surgical operation area preferable before the medical patients. Since there are 28 physical beds at the ward but only 24 of them open at the weekdays, means that 4 of them are extra. Today those are used as buffer, to handle the high inflow of patients at noon (See section 4.5.3).

4.4.1 Daily operations with focus on patient flow decisions at urology ward

The dayshift starts at 7:am with a 25-30-minute reporting about the patients' medical condition and whether the patient is, or possibly is, ready to leave the hospital during the day. Every weekday morning at 7:30:am does the unit manger have a daily meeting, approximately 5-10 minutes, where any information regarding the day or week is brought up. Nurses update the unit manager regarding number of patients at the ward and a prognosis of how many patients that will be or possible will be sent home during the day as well as information about planned incoming patients. Most of the information associated with the patient flow is orally reported at the round in the afternoon the day before. After the meetings does morning activities starts,

which are waking patients, serve them breakfast, distribute medicine and remove catheter etc. The round starts at about 8:45:am every day and is executed by four physicians in total, two per corridor which includes two teams each and is finished in approximately 30 minutes. Which team to start with depends on whom of the nurses that is ready. The round starts in the medical office where the two physicians together with the nurse discuss each patient without prioritization. Afterwards, the physician and nurse is jointly seeing the patients in person and update about remedial actions. When the round is finished or as soon as possible, the physician is writing additional notes about the patients and create referrals to other wards, or samples needed to be taken. The evening shift starts at 2:45:pm, followed by an oral report of the patients from the dayshift staff at 2:50:pm, which is written down on paper. The afternoon round starts at 3:30:pm, in comparison to the round in the morning is not the physician seeing the patients. A visualization of a normal day at the urology ward is shown in figure 9 below.

The Belport system is updated by the unit manager at 8:am, while the nurses are responsible for updates the rest of the day. Updates at 7:pm is mentioned to be forgotten sometimes due to heavy workload with patients, which is prioritized before updating the system.

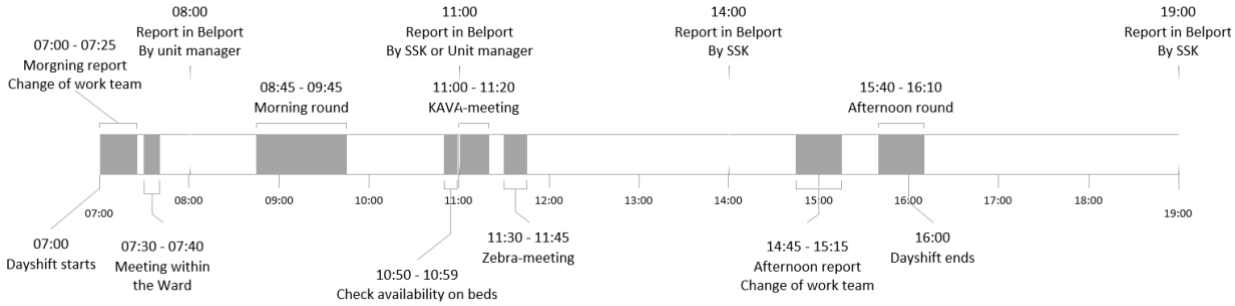

Figure 9 A normal day at Urology ward

4.4.2 Elective patient flow

Once decision about surgery is made is the patient registered on a waiting list. The medical secretary is responsible for planning the surgery's, which is made once a week together with the physicians. Planning of surgery is based on available surgery room, available nurses, the schedule of physicians and their competence as well as what kind of surgery that will be made. Kind of surgery made each day differs from week to week since it depends on possibility of matching available staff with surgeries at the waiting list. The average amount of time is set to each of the surgery's as help for planning the surgery rooms as efficient as possible. Patients planned for surgery has an appointment for an examination with a nurse (often the extra resource nurse) and a physician from the urology ward, an anesthetist and sometimes also other professions depending on the surgery. This examination takes place one week before the planned surgery. It is often a junior physician responsible for the examination, who also makes the discharges. This means that prioritization between examinations and discharges is constantly made. At the appointment is the patient investigated, and informed about the coming surgery and preparations needed for it. The examinations take place between 9:30 and 11:00 am at Tuesdays and Thursdays, if that is not enough or possible to manage for the patient is Mondays and Wednesdays available. Each appointment takes 30 minutes, which result in 8 admissions per week. The following week at the day the surgery will be done is the patient hospitalized.

4.4.3 Internal communication

The information flow within the ward is mostly made verbally. There are four teams altogether who verbally communicate with each other about the patients. Information regarding patients

is continuously written down on notepads or on separate papers kept in the pocket. The team have two boards where they sometimes write information about some patients, for example the time a patient will go home today and if there are any surgeries scheduled for the day.

Each corridor at the ward have two offices, one for nurses and assistant nurses and one for physicians. Formal communication between nurse and physician appear at the rounds. During the two rounds is patient's medical condition in focus, nurses report how patient´s feels and how their condition has changed. There is a discussion between nurses and physicians about how treatment will continue, as well as when it is time to start work with care-planning if needed.

When the shift change takes place, the leaving nurse is reporting by reading from her/his notes and the new nurse write these notes in an own notepad. Depending if the nurse was working the day before or not does this report goes quick or takes a bit longer, since when the nurse worked the day before is only o short report with changed conditions required to report. The staff at the urology ward witnesses of longer report now than before. Unit manager is kept updated by getting information from the staff connected to the meetings. To prepare information before the KAVA-meeting, does the unit manager ask the coordinator about available beds, if the coordinator isn't available the unit manager talking to the nurses instead.

4.4.4 Schedule of human resources

The human resources in the urology ward are physicians, nurses, assistant nurses, secretary, coordinator and unit manager. The ward is staffed differently at different shift and also differently between weekdays and weekends. During the weekdays is the ward staffed with four physicians (two full time and two during rounds). The ward is divided into two corridors; each corridor is split in two teams which results in four separate teams altogether. Lunchbreaks is overlapping each other, which means that the nurses are responsible for double as many patients at this time. Nurses and assistant nurses have one kind of schedule system while the physicians have another system. The physicians are scheduled by one of the physicians. The nurses and assistant nurses schedule is organized as, every eight weeks do they plan their own schedule. Required shifts is available on a time table, were the nurses choose what shifts to have. There are certain conditions to satisfy, for example do they need to work certain number of evening shifts per months. They are all working the three different shifts per month, which some respondents describe as a source to lack of continuity since they work differently and the physicians work together with different staff from day to day. The unit manager is the one responsible for the daily operations at the ward and for the schedule of nurses and assistant nurses. The physicians on the other hand are not organized by the same unit manager, it's the chief of physicians who is responsible for that recourse, which create a problem in running the daily operations the most optimal way. At days with heavy workload a buffer is sometimes started, which means that the unit manager contacts available nurses and ask them to work extra. It does also mean that the urology staff sometimes have to work at other wards which is not appreciated from the staff since poor knowledge about where to find things at other wards and not confident in what to do.

4.4.5 Continuous improvement and measurement

The ability for continuous improvement work at the hospital is that every ward conducts their own improvement work that can be carried out by themselves based on their mandate for making decisions. The hospital strives to work according to the PDSA-methodology, which stands for plan, do, study and act. An improvement board exists at the expedition as a tool for the improvement work. The meetings at 7:30:am held by the unit manager does sometimes takes place by this board, but the staff do not work actively with it as they should according to

the unit manager. The ward works sporadically with improvement work. However, there are no follow-ups of the made changes. Due to week follow-up, it becomes difficult to see if the improvements have given improved results. The measurements made at the ward today are few, the latest update was made in 2016, which is over a year ago. The only measurement currently available at the board is occupancy rate.

4.5 Data of the patient flow

This subchapter shows in more detail, the inflow of patients to the Urology ward and the acute flow of patients through the ED in numbers. It will enhance to understand the discussion made in the analysis.

4.5.1 Inflow of acute patients to SSS

As shown in figure 12 in section 4.5.2.1, the largest inflow of acute patients to inpatient care comes through ED and the second is from home. The inflow to the ED at SSS in 2015 and 2016, distributed throughout the day, can be seen in figure 10 below. It shows that the inflow starts to increase in the early morning and are growing almost the rest of the day. Figure 10 do also show there is a delay of 2-3 hours between incoming patients and discharge of the same. The discharge from the ED is admission to another ward at SkaS, for example KAVA or the urology ward. The growing inflow of patient throughout the day makes the "system" more sensitive in the afternoons and the evening, when bottlenecks becomes visible.

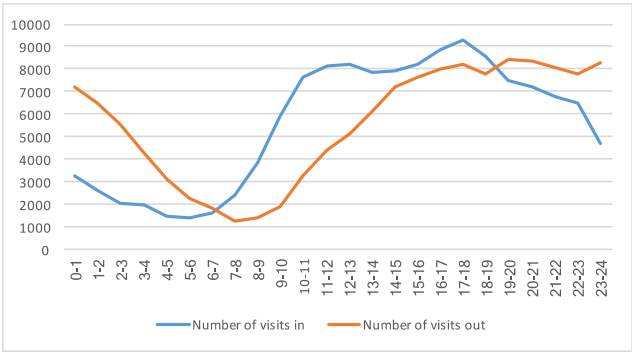

Figure 10 Inflow and outflow of patients at the Emergency Department SSS

4.5.2 Patient flow to Urology ward

Approximately 70 percent of the incoming patients are acute and 30 percent are patients that have been waiting for surgery and are planned in advance, the elective, see table 3 below. Table 3 also shows how many patients that have a diagnosis within the urology area and also how many that belongs to other specialties but have been relocated to the urology ward due to lack of beds. If the ward only would have taking care of patients within "their" specialties the distribution would have been 35 percent elective and 65 percent acute.

Table 3 Number of stays at the urology ward

	Elective		Acute		Total on Ward	Total on Ward
Year	*Urology patients*	*Other patients*	*Urology patients*	*Other patients*	*Elective*	*Acute*
2015	*496*	*99*	*864*	*322*	*595 (33,4%)*	*1186 (66,5%)*
2016	*424*	*17*	*886*	*178*	*441 (29,3%)*	*1064 (70,7%)*
Total	*920*	*116*	*1750*	*500*	*1036*	*2250*
	1036		*2250*		*3286*	

4.5.2.1 Planned patients

Figure 11 below shows the flow of elective patients at the ward. The elective inflow is mainly from four places, patients on the waiting lists coming from home, patients from IVC (interventionscentrum) and those going through SVF (standardiserat vårdförlopp) which is a fast track for patients diagnosed with cancer. When treated and medical ready to leave the ward are there four possibilities, going home, to a special accommodation with help of the municipality (retirement home), transferred to another ward or patients that are deceased. The largest outflow of patients returns to their home, which stands for 94,5 percent. The second is to an accommodation in the municipality, which stand for 4 percent of the outflow.

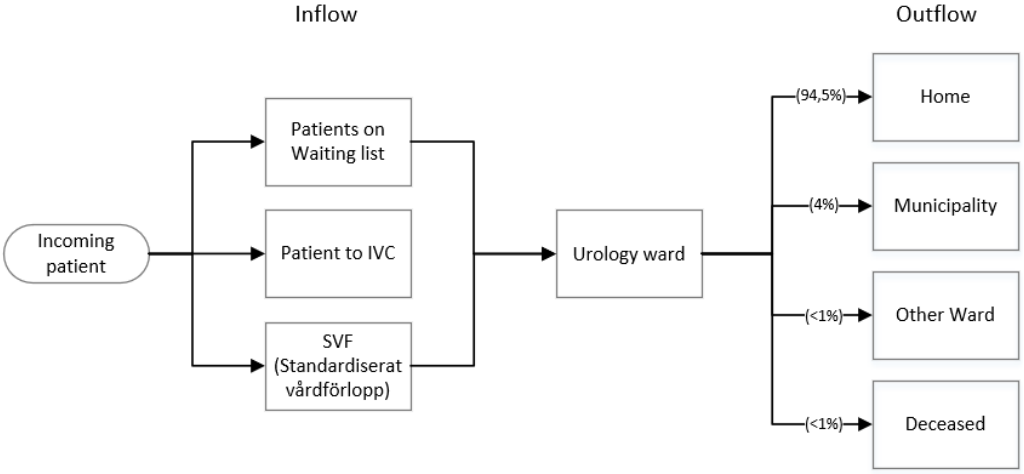

Figure 11 The elective flow for urology patients

4.5.2.2 Acute patients

Acute patients arrive from different instances at SkaS. As figure 11 below shows the largest inflow to urology ward is from the ED in Skövde, which is about 70 percent of the acute patients and the second is patients coming acute direct to the ward which is 16 percent. The third is from KAVA (small part also from other wards) in Skövde, which is 13 percent. The largest outflow of patients is the same as for the elective flow, patients return to home, which stands for almost 80 percent. The second is also the same as elective, accommodation in the municipality, which is 12 percent and the rest is to other wards or deceased, see figure 12. Altogether the two largest inflow of patients are coming from the ED and from home, while the two largest outflows are to home or to accommodation at municipality.

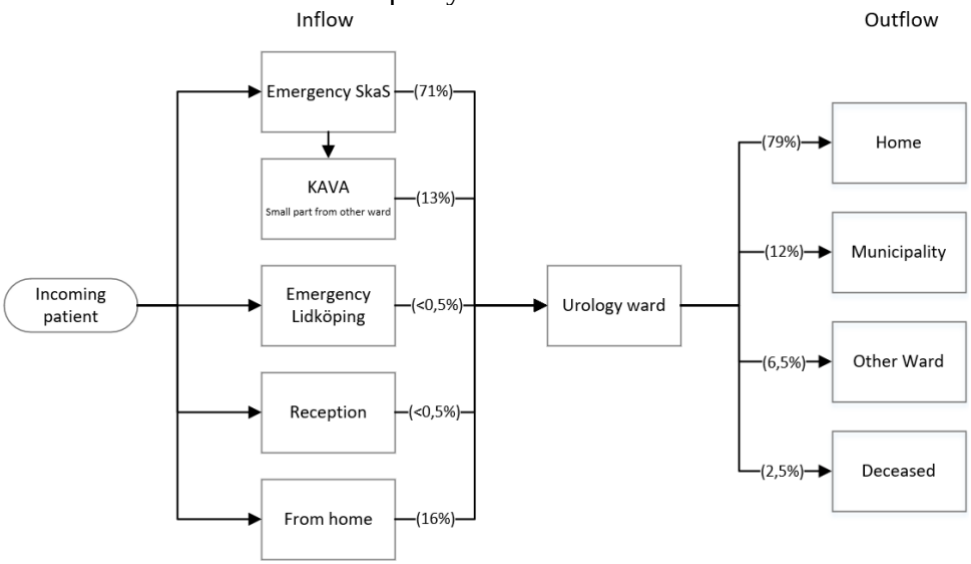

Figure 12 The acute flow for urology patient

4.5.2.3 Distribution of inflow throughout a day

Figure 13 below show patients arrive to the urology ward throughout the whole day but the inflow is highest in the mornings. This is due to the fact that most patients coming for planned surgery will arrive during this time. The acute flow however is not predetermined as the elective, but comes quite evenly spread throughout the day but the incoming frequency are higher during the day and evening as shown in figure 14. The graph in figure 14 for acute patients can also be compared to figure 10, the inflow and outflow of patients to ED. The discharge time from ED is inflow time of the acute flow in urology ward.

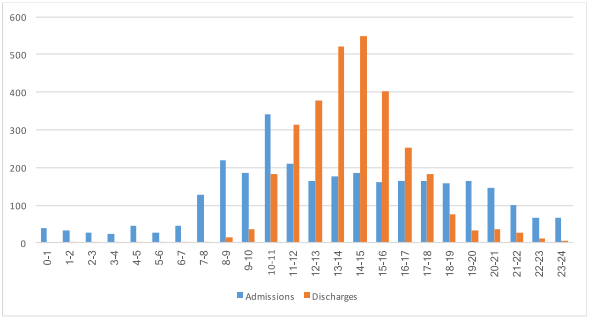

Figure 13 Admissions and discharges throughout the day both elective and acute; 2015-2016

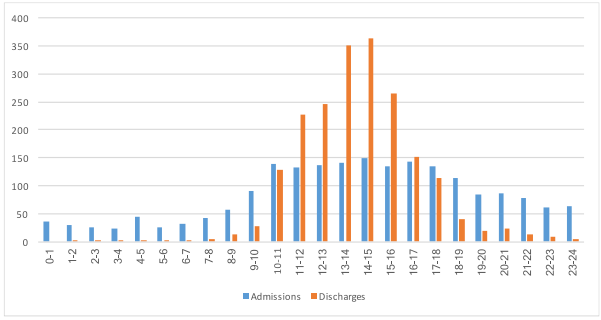

Figure 14 Admissions and discharges throughout the day only acute; 2015-2016

4.5.2.4 Length of stay

During 2015 and 2016 the elective urology patients stood for 41 percent of the total care time and the acute for 59 percent. Depending on the diagnose, kind of surgery and individual aspects does LoS varies. During the same period the LoS vary between 1 and 77 days. During 2015 and 2016 the urology ward treated 256 different diagnoses. The 10 most common diagnoses stand for over 60 percent of the LoS. In figure 15 below the portion of LoS is shown. The average care time for elective patients during 2015 and 2016 were 3,4 days and median of 2 days, but about 71 percent of the patients were in the ward less than 3 days. The LoS for the acute patients during 2015 and 2016 can be seen in figure 16 which in comparison to the elective patients' show a larger variation in care time and the average LoS were 5,8 days and a median of 4 days. 51 percent were in the ward less than 3 days for acute patients. It is important to know that the LoS is counted only on care episodes which is counted from when a patient is registered in inpatient care until discharged from the hospital.

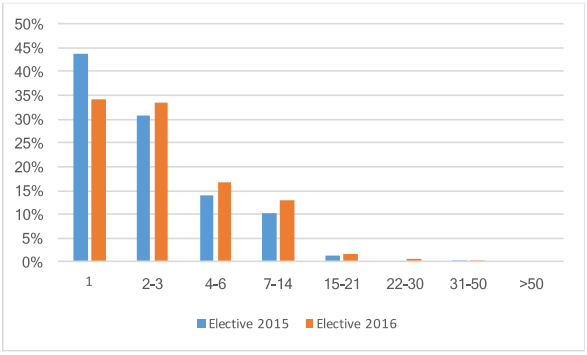

Figure 15 Length of stay in days for elective patients

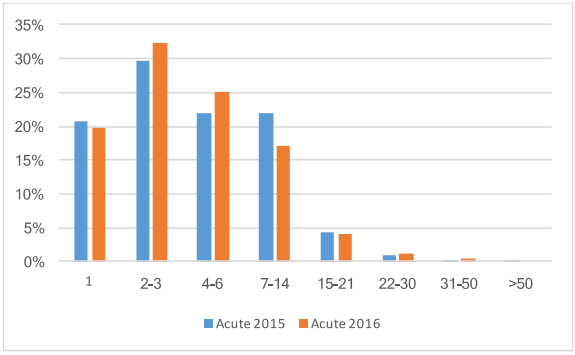

Figure 16 Length of stay in days for acute patients

4.5.3 Occupancy rate

SkaS has a goal of 90 percent occupancy at each ward, which is decided to be measured at 6:00 am. The urology ward is performing well in comparison to other wards at the hospital, but the goal is not met and stable over the year. The staff at the urology ward are as the rest of the

hospital struggling with too few number of available hospital beds. The urology ward hade year 2015 and 2016 an average occupancy of 95 percent at 7:am, 98 percent at 12:am and 91 percent at 4: pm. The accumulated variability of occupancy during the weeks in 2015 and 2016 is shown in figure 17 below. However, if only taking into consideration urology patients treated at the urology ward during 2015 and 2016 the occupancy rate at 7:am was 81 percent, 84 percent at 12:am and 78 percent at 4: pm.

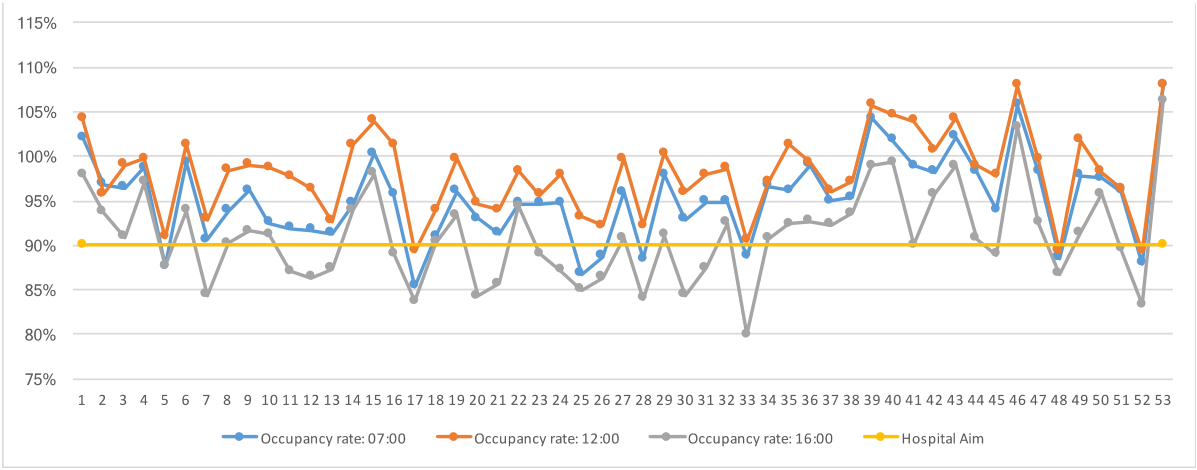

Figure 17 Occupancy rate at Urology ward at 7:am, 12:am and 16:pm

The occupancy rate at 12:am is, in the gathered data, always higher than the one at 7:am and 4: pm. By looking at the inflow and outflow of patients to urology ward, as shown in figure 12 and 13, the high occupancy rate at 12:am is because most of the inflow is in the before non, while discharges are higher in the afternoon.

In figure 18 is the distribution of patients admitted before and after 12:am shown. The proportion of admissions is 45 percent before and 55 percent after 12: am. Figure 19 shows the distribution of how many of the patients that are discharged before and after 12: am. Only 16 percent are discharged before 12: am and 81 percent afterwards. In worst case this lead to patients need to wait until a bed is available. In the urology ward, this is usually not problem but solved by using the four extra beds available at the ward, even though this leads to overcrowding.

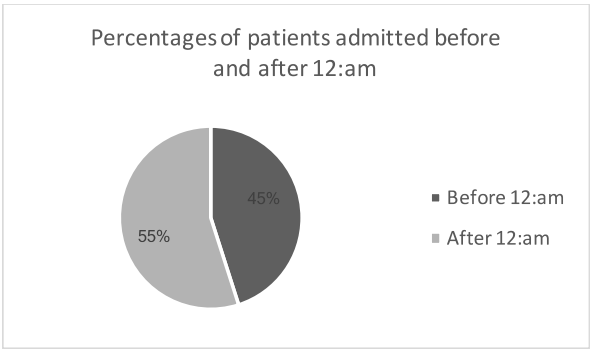

Figure 18 Admitted patients during 2016, before and after 12:am

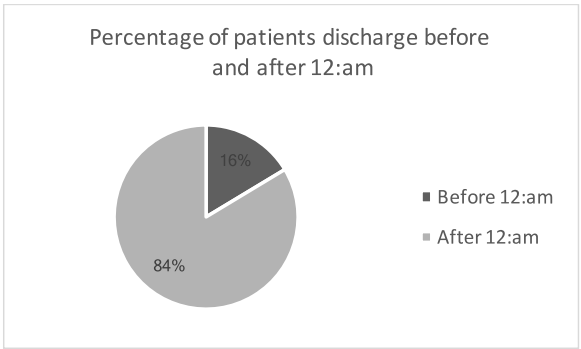

Figure 19 Discharged patients during 2016, before and after 12:am

4.6 Urology discharge process

The urology ward has an ongoing work about the discharge process with the municipality. A plan to facilitate the discharge of patients has been developed. The urology ward is one of three

pilot wards at the hospital that are testing a new way of working concerning the discharge processes. The urology ward has as mentioned two main outflows, to the home and to the municipality. When a patient is ready for discharge is often decided during the round in the morning when the different professions discuss the patient's condition based on their professional knowledge. If a patient is decided to leave during the day is verbally communicated with the nurse. After the morning round the different professions starts their work with the discharge process for the leaving patients. In some cases, this work starts before the round or the day before if the staff are aware of when the discharge will happen, but this is also connected to whom is working at the moment. Routines for the discharges process doesn't exist, except a checklist with things that have to be done before the patient leave the hospital, when certain activities should have happened is not mentioned.

The nurses work regarding discharge is to type "finishing notes" of the patient, type nursing empiricism and have a discharge conversation with the patient. However, the discharge conversation is not always done according to some respondents. The nurse or coordinator book transfer or contact relatives for pick up. Most of these things happen close to when the patient is discharged.

The physicians work, connected to the discharge process, is not specified nor have a certain order for when to happen. Depending on things as the patients diagnose and where to leave after he or she is discharged, the things that need to be done happens at different times but often when the patient is supposed to leave the hospital or straight after. If a patient is going to residence in municipality, it is more important to get everything done before the patient leaves. Things that should be done before discharge are e.g. typing a list of medication, provide discharge message, sending referral if needed, type empiricism and set time for revisit if necessary. One thing that always is done just before the patient can leave is a discharge conversation between a physician and the patient where the patient is able to ask questions and get the final information from the physician.

The discharge process for patients going to the municipality is administratively handled through a system called SAMSA. SAMSA is a IT-system in "västragötalandsregionen" used in order to create a safe and secure discharge process between hospitals and municipality. The system builds on a collaboration between the healthcare staff, both from the hospital and the municipality, together with the patient and in some cases also relatives. It follows a structured way to make a plan for what will happen with the patient after the discharge from the hospital. SAMSA is a care planning system divided into five steps, used to arrange the assistant help needed for the patient.

1. Registration in SAMSA, date and name only.
2. Ask for care planning. Depending on if the patient currently stays at a municipality is the planning made at the ward. If the patient is in need of a municipality the first time is the hospitals planning team handling it. The municipality get back with a date for planning.
3. Care plan is produced, which usually takes place at the ward but sometimes via skype.
4. Register date when patient is medically finished.
5. When the patient is discharged is documentation made of what has happened during the hospital stay and the current condition of the patient etc.

4.7 Organizational resistance

There are some misunderstanding or lack of understanding of the overall picture of how the patient flow shall work and also about the coordinators tasks. This misunderstanding can lead to concealment of information between the wards. E.g., this is sometimes done when reporting the number of available beds through Belport but also at the KAVA and MAVA meetings. As one respondent expressed itself, it can be seen as some form of territorial thinking. This is not only on ward level but also between the different operation areas. According to another study conducted at the same hospital (Lidköping), the same thing was noted between the physicians. They are specialist in limited areas of the flow but at the same time can create resistance to cooperation and then the overall picture.

5 Analysis

In this chapter, the problem found from the empirical data are discussed. Initially is an overall reflection about areas affecting the patient flow is discussed. The second part is discussing the problems based on the first and second research questions. The third research question will be presented in chapter 6.

5.1 Introduction

The overall problem connected to the patient flow at SkaS is the lack of availability on several wards. According to Haraden and Resar (2004) a hospital has problem with patient flow if; the available beds at midnight is higher than 90 percent in more than 50 percent of the total time. The hospital does not measure occupancy rate at midnight but the closest is the measure at 6:am which was 91 percent during 2016. Green and Nguyen (2001) state that 90 percent occupancy rate can be handled in a unit for planned patients only and that 85 percent occupancy rate can result in delays and other problems. Brandt and Palmgren (2015) states that an overcapacity is necessary to avoid bottlenecks in a system and Modig and Åhlström (2015) stresses that bottleneck often is more expensive than overcapacity. If only focus on the number of patients diagnosed with that specific diagnose belonging to the urology ward, it becomes clear that the occupancy rate was 88 percent in 38 percent of the time during 2016 and 75 percent in 19 percent of the time during 2015. This means that the availability problem at urology ward is an effect of taking care of patients from other wards. Figure 20 shows the difference between only urology patients and all patient treated at the urology ward in more detail. The figure also shows the number of planned beds, where it appears that the occupancy rate increases with a reduced number of planned beds. Based on this it is assumed that focus at the hospital is resource utilization and not flow efficiency. However, it should be noted that difficulty with recruitment of staff experienced at the ward is not shown. Number of available beds are determined for an entire year, taking no account of seasonal variations. However, changes can be made but often just in conjunction with a problem. To place patients at wards where they should not be, is often connected to higher risk of issues and to worsen quality of care (Green and Nguyen 2001).

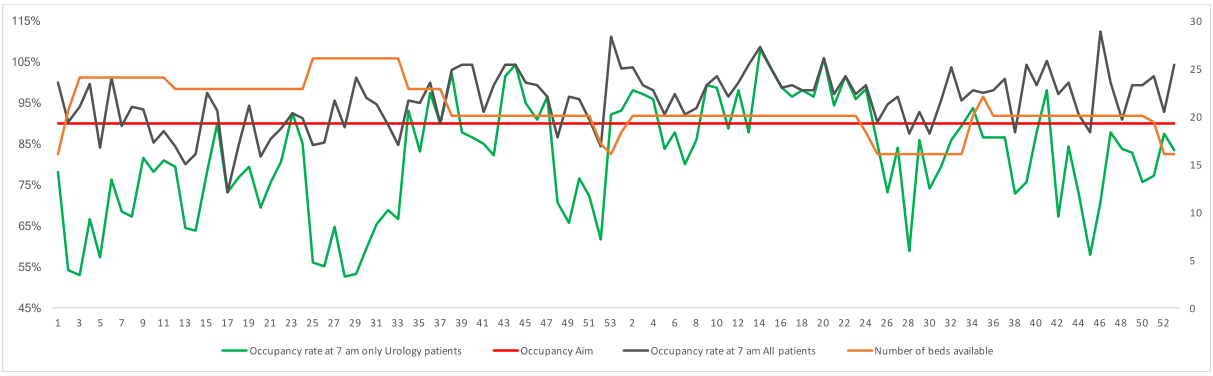

Figure 20 Occupancy rate at 7, both for all patients and only for urology patients stayed at the urology ward; 2015-2016

RQ 1: In what way has patient flow been reflected in the hospitals organization?

The identified areas that affect the efficiency of handling the patient flow were, organizational structure, ability to make decisions, and information systems and planning.

5.2 Organizational structure

There are differences in the routines for the reporting procedure of the occupancy status at the hospital. The routines differ both between the surgical and medical operation areas, but there were also different routines in different document within the surgical area which tend to confuse the staff about what is expected and prioritized. The information of occupancy status at the hospital are gathered at different times in the two areas which does not contribute to see the whole picture of the current situation at the hospital, a system view of the entire hospital is problematic to capture as it is organized today.

Furthermore, differences in the workload for the coordinators were identified which affect the performance of distribution of patients. MAVA has been working with development of routines longer that the KAVA. As a result, administrative tasks are kept focused at a specific employee. The MAVA-coordinator is supported by an administrator who's enabling that he or she solely keep focus at the current occupancy, the prediction of the coming situation and related activities that requires coordination, such as being present at the MAVA-meeting. The KAVA-coordinator on the other hand is not supported by an administrator which result in additional tasks besides the coordination. That means that the coordinating activities get disrupted by other activities such as, phone calls from relatives, radiology etc. Hence, the KAVA-coordinator cannot attend at the coordinating meeting, therefore an handover is needed to process the information instead, which according to Ljungberg and Larsson (2012) tend to increase the use of resources. The differences in working routines can be seen as absence of a best working approach which is advocated within Lean (Liker et al. 2009). That areas differ in how they work may be due to lack of control of the flow at an overall level. Each area only sees parts of the total flow. To see the whole picture of the flow is mentioned by Aronsson et al. (2011) as an important factor to create a more flow oriented organization and not create sub optimizations.

The coordination meetings are currently not done in the most efficient way due to all information is given verbally. Although the verbal communication is good and should not be eliminated completely but the meeting can be more effective in some parts. The managers specify the status at their ward ones at the time which is written down by the one responsible of the meeting. This is time-consuming and therefore waste in terms of waiting (Modig and Åhlström 2015), time that could have been used for value-adding activities instead. The information given has to be kept in mind by the members of the meeting while discussing, hence an overview of the situation is hard to capture. To visualize the information instead, would give an overview of what is discussed and make it easier to talk about as well as the time spend at the meeting would have been shorten since reduction of communication (Liker et al. 2009).

5.3 Ability to make decisions

As mentioned in the previous section there are differences in the reporting procedure of occupancy status at the hospital. Information of occupancy status at the hospital are gathered at different times in the two operation areas. This does not contribute to see the whole picture of the current situation at the hospital, a system view of the entire hospital is problematic to capture as the hospital is organized today. Because of this, decisions are made on inadequate

information, which can affect the decisions not to be the most optimal in the current situation. According to Endsley (1995) situation awareness is a base for decision making to find the best course of action in complex and dynamic systems, such as the hospital organization. Situation awareness means high degree of knowledge with respect to inputs and outputs of a system (Endsley 1995). As the information of inputs is the base for decisions it is of high relevance to have it accurate and complete, to decide upon the best course of action.

Since patients are coming and leaving during the day the current state is continuously changing, hence continuous updates in Belport of available beds is necessary to have reliable numbers for the coordination of patients. A lot of the time Belport is not updated, which means unreliable numbers and impossibility to base decisions on the system. Instead the coordinators are forced to contact the ward by phone and ask for it. These many phone calls are referred as waste according to Bergman and Klefsjö (2012) since it was not the primary need and means extra work which could have been avoided. Endsley (1995) highlight the importance of current assessment of the changing situation, which continuously requires accurate and complete information about relevant parameters, otherwise they are unable to effectively perform their function. The coordination meeting, called KAVA and MAVA-meeting, where decisions regarding distribution of patients takes place is not ongoing simultaneously. Decision within the medical area is made regardless of decisions made within the surgical area. That the meetings are organized like today is motivated by that they are dependent on when the round is finished since information about which patient actually can get discharge in the near hours are more trustable by then. Consequences of not making the right decision is that patients are moved to a ward where they do not belong and therefore do not get staff with the most suitable competence which usually increases the LoS. This also means that transportation has to be made to a temporary ward, while waiting for an available bed at the belonging ward and therefore a second transportation is needed. The unnecessary transport and misplaced patients also lead to lower quality of care (Green and Nguyen 2001).

Another identified activity about how the patient flow is reflected in the hospital which can be problematic is the second coordinating meeting called Zebra-meeting. In situations when the availability of hospital beds is critical and urgent, sometimes actions beyond distribution of patients within the hospital are needed. Examples of these actions are, increased capacity by adding extra staff, cancellation of a planned surgery to prioritize acute ones or to transfer patients to other hospitals within the region. To handle this kind of situation, the hospital is organized to have a second coordinating meeting, since the unit managers present at the first coordinating meeting do not have mandate to make such decisions. In situations with high demand relative the capacity the decisions of action are lagging due to the current way the coordination meetings are organized. The ability to make decisions in an efficient manner is limited, due to that the manager with the mandate for making required decisions is absent. This is motivated by the hospital since these kind of decisions is not necessary every day, only in critical situations, when an extra meeting is performed, which was observed to happen frequently during the study. The separation of these meetings also require an extra handover which according to Womack and Jones (1996) should be kept as few as possible for efficient handling of information. Having the right manager with the required mandate to make decisions is a necessity for efficient decision making, to prevent unnecessary handovers. According to Liker and Meier (2006) it is the people on" the floor" who know the system best and should come with ideas of how to precede, since they usually have the best solution.

Having the coordinating meetings separated affect the time needed to make decisions of actions. Delayed decisions results in delayed actions and the pace in the patient flow is lagging, as a

consequence hospital beds are used inefficient. This is directly connected to waste in terms of waiting (Liker and Meier 2006). Due to not be able to make decisions when needed, this meeting can be seen as a bottle neck in the information- and decision flow about patient distribution. Since unit managers work dayshift it is urgent to start to call for extra staff early to ensure the forthcoming required capacity. Furthermore, managing transportations in due time since the receiving ward has to be ready for reception is essential. If the receiving ward has no available beds, the transfers cannot be made.

Another consequence of the organization of coordinating meetings is the disruption of operational managers´ workflow. The operational managers, which are the ones present at the Zebra-meeting since they have mandate to make decisions, do frequently get disrupted due to the need of being standby for a possible meeting. The operational managers in the medical operation area get noticed approximately 40 minutes prior to the meeting, while operational managers in the surgical operation area get noticed approximately 10 minutes prior to the meeting. The short notice and uncertainty as to whether there will be a meeting provides interruption in ongoing activities and difficulties in planning activities for the operational managers. Which operational managers that are present at the Zebra-meeting differs from time to time, due to that it is difficult to plan for a meeting that is done sporadically. This, however, is something the unit managers understands. The variation of meeting performance, waste in contacting each and every affected manager, causes a lot of communication and waiting time for the unit managers. Another aspect explaining the current structure of meetings, where all operational managers are present, is the existing territory thinking at the hospital. The perception from some respondents was that since the operational managers are in charge of one area each they are keener about good decisions being made about their own area and to ensure this, they want to be present at the meetings.

5.4 Information system and planning

Different computer systems are used to organize different kinds of patient data. For the patient flow, two systems are used for keeping track of number of patients and available beds. The registration system, Elvis, is used at MAVA and KAVA to keep track of incoming patients from the ED. The occupancy portal, Belport, keeps track of the occupancy at separate wards and is sometimes complemented by expected discharges in a message column. The two systems are not connected, instead the coordinators have to keep track of each of them separately. According to Stiernstedt et al. (2016) IT-systems that are well adapted can release resources. According to Endsley (1995) information regarding current state as well as predicted future state is necessary to assess the situation and choose the best course of action. Current system has scarce information to capture the situation and to make a good prediction of the future state. According to Silfver (2015) relevant parameters for prediction and coordination are date of discharge, both confirmed and estimated, resources and inflow from the ED. Excluding prediction of the future state might result in an unnecessary increase of capacity.

RQ 2: What present routines and practices affect patient flows within a ward?

5.5 Communication and information

The current structure of communicating and spread of information at the ward makes it important that all staff are available for meetings at certain times. It is also important that the person with the necessary information is available for questions when the information is needed. Poor communication can also be a reason why things are done twice or more or that information between different professions is not clear enough. In the long run this can also lead to longer stays than needed for patients. Having information visible to increase the possibility to take quick actions if there is a problem, is one of the ground stones within the lean philosophy. Within the urology ward there were not that many visual communication tools but instead information was written down continuously in the staff's own notepads. During the shift changes, the information is then communicated verbally to the next shift staff who writes the same information in their notepads. This documentation is typical waste in a healthcare organization (Manos et al. 2006). Even information about patient's future plan is only communicated to those taking over, while the rest of the staff in the ward are not aware of it without asking. Hence unnecessary questions and disruptions can arise due to that there is no good communication tool. According to Graban (2012) this is something that can be decreased by visualizing the answers to some common questions. Slack et al. (2016) stresses that visualization also can facilitate collaboration between the staff. The ward is using a few boards for some information today but they are not used by all staff. What information to add on the boards are not standardized and thereby differ depending on who is working. To standardize the information on the boards can be valuable for everyone working together and reduce the variation of what is written (Liker 2004). By having the boards standardized with right and useful information a calmer work environment can be created (Seddon 2010) since the staff know where to find the information they are looking for. For example, the unit manager knows where information about how many patients are present at the ward as well as how many that are expected to leave during the day and in the coming days, can be found.

Furthermore, the nurses and assistant nurses have individual schedules which contributes to a lot of rotations of staff. This is according to several respondents, within both the urology ward and other wards, considered to be a major communication problem and also a huge waste in terms of time. A lot of unnecessary time due to comprehensive reports during the shift changes is required to debrief the staff that have not worked for a couple of days about new patients received by the ward. Handovers should be kept as few as possible not to increase the workload (Ljungberg and Larsson 2012). The irregular working hours increases the information transmission made each day. The staff scheduling is an assignable variation affecting the efficiency which can and should be minimized (Shewhart 1931). The fact that the current schedule system causes extra work was something most of the participants agreed upon and were also in favor of change. It is not only the time consumed during shift changes that is a waste of time due to the current schedule. The time and communication needed by both the unit manager and the staff for making adjustments in the schedule is also extra work and waste of time. Time spent on communication due to current scheduling is waste according to a lean philosophy and should be minimized or eliminated if possible (Liker and Meier 2006). The time saved can instead be used for value-adding activities for the patients or to do improvement work. For example, proactive work to spread the discharge activities which they, as mentioned by respondents, do not always have time to do.

During the observations, attention was drawn to the fact that various professions lack insight in each other's duties. Most information between staff at the ward and the physicians were

communicated during the rounds. The rounds did not follow a standardized structure and according to respondents the duration, the performance and which information that was shared are dependent on the persons present. By standardizing work tasks, errors can be reduced (Spear 2005) as well as the time and resources needed (Graban 2012).

Occupancy status at the ward is communicated via Belport. Who is responsible for updating the system differ depending on what time it is, and how well the system is updated depends on various factors. To have persons responsible to a greater extent lead to tasks being completed.

5.6 Discharge process

How the discharge process is performed is directly affecting the patient flow. How much extra time a patient will stay at the hospital depends on how the discharge process is performed. Most of the discharges at the urology ward are made after 12: am which depends on both the treatment of the patient, but also on the process itself. The discharge of patients after 12: am has a major impact on the lack of beds at the ward that occurs in the middle of the days. This is also seen in the high occupancy rate at 12: am. To have patients leaving the hospital before midday should be prioritized and is a key factor according to (Martínez-Ramos et al. 2016). One reason for late discharges is prioritization of it. The admission of elective patients, which takes place before noon, are handled by the same physicians that are doing the discharges. Because of this the admissions are prioritized prior to the discharges. Hence the discharges are moved to later in the day when the physician has time.

The discharge process for both physicians and nurses usually starts when a decision of time of discharge has been made. Most decisions about discharges take place during the morning round, which increases the workload immediately after. At present, the discharge process takes different amount of time for different patients, one reason can be derived from the variation of preparation of the discharge process. The ward is using a standardized checklist for the discharge process but when the different tasks should be done are not mentioned. By having more discharge activities made earlier, and not at the same time as the patient will leave, might result in more discharges during or directly after the rounds. Standardizing the discharge process and planning the discharge in an earlier phase will decrease the LoS for patients (Ortiga et al. 2012). By planning the discharge date and a patient's treatment plan already in the admission phase would make the process more predictable and also possible to evaluate (Walley et al. 2006). Furthermore, by having information about when a patient is planned to leave will increase the planning for optimal bed availability and also increase earlier discharges, which is better for the patients (Black and Pearson 2002). Better planning of discharge processes makes the patient prepared for leaving, this might decrease the need of letting a patient stay after medically finished only because of kindness due to that the patient was not mentally ready.

Moreover, the ward does not have any routines or practices describing in which order the patients should be prioritized during the rounds. This affect the work with the discharge process and the time before a decision regarding medically finished patients can be communicated to people concerned. Henke et al. (2017) shows that better planning of discharge decreased the readmissions within 30-days, which for SkaS also would decrease the number of admissions to the hospital. Furthermore, better information to relatives or residents of the municipality can also decrease the stay for a patient since they can be more prepared to receive the patient. However, Utley and Worthington (2012) and Ortiga et al. (2012) mean that it is also important to create a better collaboration with the municipality. This was done at SkaS during the summer

of 2017, which according to respondents made patients who were medically finished able to leave the hospital earlier than before the collaboration.

An overview of the current situation but also of the future state, for example tomorrow, is according to the respondents hard to get. This makes planning of activities in a near future even harder since information about the coming situation is unknown and the current system is not made for a longer perspective. Lack of access to continuous updates of information regarding the patients plan prevents the staff to commit and involve in the proactive work with the discharge process. Monden (1983) says that visualization creates a better understanding of how the process is performed at the moment and gives an overview of the situation. By having a date for a likely discharge on a board where everyone can see it, already from the admission, increases the proactive work of the discharge process earlier and thereby levels their work tasks. This would enable discharges earlier in the day.

5.7 Planning and separation of flows

There are two major flows of patients at the ward, acute and elective. Planning of elective admissions is made two weeks before patients arrive to the ward for a treatment. The check-up of elective patients made one week before the admission is in a way separated from the regular work with the patients that are hospitalized. The patients are meeting a nurse who only handle the elective patients which makes the check-up not affected by the status of the acute flow. However, this part of the admissions, is the only separation of flows done at the ward. The physicians and nurses, as mentioned in previous sections, are still working in both flows and are therefore affected by the status of the acute flow. When patients arrive for admission, no separation occurs and the elective and acute flow are mixed. The arrival time is more predictable in an elective flow than in the acute flow hence the ability to plan the arrival time in advance. According to Green and Nguyen (2001) it is possible to have higher occupancy level on the elective flow than on unpredictable ones, such as the acute. The acute flow contains variations in both treatments and arrival times, which causes disturbances within the entire ward when for example, operations have to be displaced. Brandt and Palmgren (2015) stresses that it should be a clearer separation between patient flows. This should also enable different strategies in each flow to match recourses against beds (Olsson and Aronsson 2012) and a higher occupancy rate can be achieved in the elective flow than in the acute flow (Green and Nguyen 2001). By separating the elective and the acute flow, including staff and hospital beds, higher utilization of the resources can be accomplished due to that the staff can focus on similar tasks (Jacobsson 2010). Staff working only with a specific flow will facilitate the planning of the work and simplify the coordination of activities (Liker 2004). The acute patients require overcapacity due to high variation, while the planned flow can use the capacity in a greater extent due to less variation. Patient flow with high variation and high capacity utilization will acquire longer patient throughput time, see for example discussion in (Silvester et al. 2004).

The ward uses individual scheduling to control the production. Scheduling should instead be planned based on the actual demand to create efficient flows (Brandt and Palmgren 2015; Stiernstedt et al. 2016). To predict the actual demand can be difficult due to variations in the acute flow and should therefore be planned with overcapacity to avoid bottlenecks. By using historical data, the ward should be able to calculate how many beds that should be needed for both the acute and the elective flow. For example, by calculating how many beds that are needed for the actual demand. Below in figure 20 is an example of a calculation made of how many beds that are needed, taking into consideration the number of planned and acute patients, the average length of stay as well as the 85 and 90 percent occupancy rates at the ward. This is a further developed model of one used at SkaS where they do not separate the acute and the

elective flow when calculating the number of beds needed. When using data to calculate it is important to know what kind of data there is and how to analyze it (George 2005). For example, this example shows the difference between using an average or a median value when calculating, which makes the results remarkably distinguished.

	Number of elective patinets per week	Forcast of number of acute patients per week	LoS elective	LoS acute	Extra beds for hanlde the variations	Elective Calculated number of beds needed with 90% occypancy rate	Acute Calculated number of beds needed with 85% occypancy rate	Total number of beds (rounded up)	Total number of beds with the extra beds
LoS Average	8	16,3	3,4	5,8	5	6,0	16,9	23,00	28,0
LoS Median	8	16,3	2	4	5	3,6	11,6	16,00	21,0
LoS Mix	8	16,3	3,4	5	5	6,0	14,6	21,00	26,0

Figure 21 Difference in results for calculating beds using average, median and a mix between them of LoS

By separating the flows, a better levelling of the workload can be accomplished. For example, if only considering elective patients the inflow is higher in the beginning of the week. If schedulers of the surgeries consider how many days a recovery for a particular diagnose, in combination with age range, usually takes they might be able to plan recoveries during the weekends that are able to be discharged in the beginning of the week. This would help to balance the inflow compared to the discharges, and thereby result in lower occupancy. Historical data can also be used to determine which days are the most optimal days for check-up. For example, if only locking at the admissions and discharges, the days for check-up should be concentrated to Mondays and Thursdays to level the work load at the urology ward. This is visualized in figure 22 below. This would level the workload for the junior physicians which would make earlier the discharges possible.

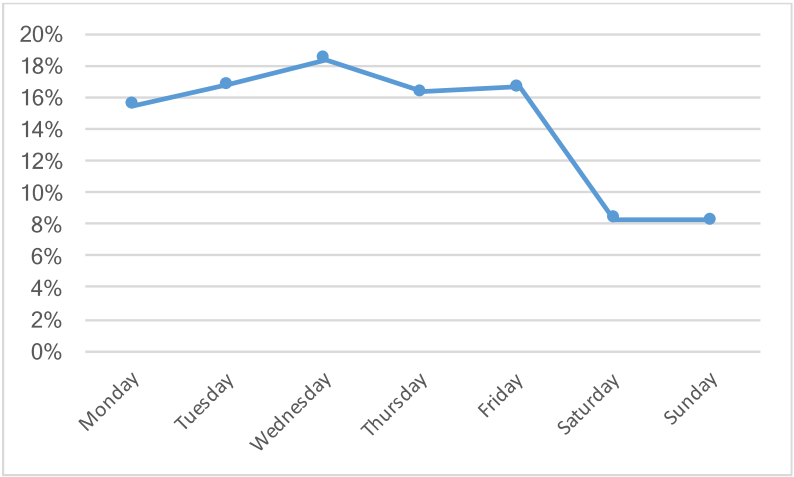

Figure 22 Percentage distribution of total number admissions and discharged in a week

6 Discussion

This chapter will reflect upon previous research made in the studied area as well as analysis the third research question. The third question addresses solutions aimed at the organization, and therefore it is reflected in the discussion instead of in the analysis.

The purpose with this master thesis was to give practical suggestions for a more efficient work with patient flow. This purpose was addressed by investigating how a specific ward works with patient flow, both the acute and the elective, at a medium sized hospital. Furthermore, the study also examined the coordination of the acute flow on an overall level and how it was affected of the work in the specific ward. This thesis will not only give a set of improvements for the organization in the study but also give a general understanding of how other healthcare organizations with similar problems can improve their efficiency of patient flow.

There have been several researchers that have investigated and suggested improvements for a more efficient work with patient flow in a ward (Ortiga et al. 2012) and towards the ED (Vermeulen et al. 2014). However, no one has been found investigating the work with the whole patient flow on an operational level and how decisions, planning and work in one ward affects the efficiency of the whole flow. Several studies have been made on specific parts, while this study aims to affect the overall patient flow without sub optimization. There were no new improvement areas identified, but highlighting the connection hopes to increase the understanding of what effects specific activities in a ward have on the overall patient flow at a hospital. The initiative of this study was not to use any specific framework or management philosophy from the beginning but instead understanding the problem by observations and conversations, then see what methods that are best suited for solving the problems. However, the area that was found most connected to enhance the flow efficiency and the problems at SkaS was closely connected to lean philosophy, which has been identified by several other researchers (Jacobsson 2010; Tay et al. 2017). This was also considered appropriate for this study. SkaS has worked with lean during several years but as this study identified, they have not been able to fully implement the philosophy on an overall level. E.g. the organization works with improvement work in small units but has problem to connect it to a system view. Our study confirms what other researchers have discussed regarding lean adaptation in only small parts and not including the whole organization, which contributes to lost effect (Mazzocato et al. 2010; Young and McClean 2008). Our findings also concur with Haraden and Resar (2004) regarding that the problems of the flow often are connected to the downstream ward and the discharge process. The findings of the importance of starting the discharge process in an early stage, already in the admission phase, also concur with the article from Ortiga et al. (2012).

For SkaS and the urology ward, the aim of this study is to suggest areas in need of improvements to be able to better evolve the acute flow. The study also highlights the importance of a system view to create a better connection between wards. Thus, better understanding the importance of doing the work according to routines from the beginning. After discussions and a workshop along the research the staff at the ward have started to examine some ideas generated in collaboration with the researchers. In this way, it was beneficial that the researchers were present at the organization and interacted with the employees. This makes not only the result of the study important for the organization but also the interaction between the researchers and the employees itself.

This case study, as many other qualitative studies, suffer from lack of generalizability due to that only one ward was studied at the hospital. Some of our findings, e.g. lack of standardization

and unnecessary time for handovers are however in line with findings from Stiernstedt et al. (2016)´s report, who made a larger investigation in Sweden. This study´s quantitative data of e.g. the inflow can also be compared with data from research done on other hospitals (see e.g. Walley et al. 2006) which strengthens the transferability of our finding to other hospitals.

Even though there were no new findings of practical improvements in this research, the understanding this thesis hope to create is of importance to describe the whole picture of a health care organization. To see the connection between different levels of the organization and how they affect each other hopefully creates an interest for further investigations of the system view of hospital operations. Additionally, how a system view can contribute to improving hospital operations. Moreover, suggestion of future research is to further investigate the effect of the suggested improvements as well as the effect of these on flexibility of the system in the healthcare context.

RQ 3A: What improvement areas exist in the individual wards that in themselves can contribute to improved patient flow between wards? RQ 3B: What improvements in the hospital organization will contribute to a more efficient acute patient flow?

Several areas of improvement within a specific ward have been identified which could create a more efficient patient flow at a meso level in a hospital organization. There is inadequate standardization in the wards, including both how processes are implemented as well as standardization of information transmission that affect the overall patient flow. In addition, a single ward´s planning of discharges has shown to contribute to increase availability at the ward as well as contribute to coordination of patients, hence enabling prediction of the future state. The following is a discussion of how the different areas within a ward affect the acute flow at a meso level at a hospital, furthermore improvements at meso level are discussed which contribute to managing the patient flow at an overall level.

6.1 Planning and separation of patient flows

To achieve an efficient patient flow, the LoS for patients should be shortened, this since a decreased number of patients in the system contribute to a more efficient process which improves the patient flow (Modig and Åhlström 2015). This in turn increase the availability of hospital beds at the ward. Further improvements to acquire an efficient patient flow and to decrease the number of delocalized patients is to enable good coordination of patients at an overall level of the hospital. In this way patients acquire care by staff with the right competence relative the diagnoses which increase patient safety and less transfers of patients are required. In order to enable coordination, relevant information regarding patients is needed to make good decisions.

In order to achieve the improvements mentioned above, planning the discharge process in a greater extent is shown to be valuable. Planning discharges at admission will, as mentioned, shorten the LoS for patients. (Ortiga et al. 2012). Patients predicted plan of care and estimated date of discharge made at a ward can help planning the distribution of patients earlier. Hence, the coordinator at the meso level can make better decisions about the distribution of patients in an earlier stage, which leads to less transfers of patients within the hospital and secures that patients are given care by staff with the right competence. Because the biggest inflow to the ED occurs during the days, starting in the morning, it is important to have updated numbers of availability, both the current state and the predicted future state, as early in the mornings as possible. This makes the coordinators prepared for what will happen and they can be able to prepare, if necessary, an action plan earlier than today. The study by Ortiga et al. (2012) shows

that less than 10 percent of the estimated discharges were changed from the plan, which means that the discharge plan was quite reliable. By focusing on the whole flow instead of parts of it, a more efficient flow can be created (Haraden et al. 2003). However, the hospital organization concern human beings and not products. This means that the complexity of the process is quite high in comparison to a process with products, since the time for recovery vary depending on several aspects such as age and previous condition. Individual variation exists in a large extent, and adjustment of discharge date can of course occur. Even if the ward is planning for discharges the problem with lack of information transmission can still occur if the information still does not reach the distribution coordinators (see section, 5.5).

Furthermore, separation of flows will create more effective processes that highlights the existing wastes (Ljungberg and Larsson 2012), which should be eliminated (Liker 2004). If wastes are eliminated at a ward, clearer flows can be created against the meso level which make the acute flow more efficient. By separating flows, the work with production and capacity planning will be manageable and implemented easier. The scheduling at the ward should be managed by matching resources against the actual demand, rather than having individual schedules managed by the staff themselves as it is today. To be able to match resources against the actual demand more focus should be on taking variations, e.g. seasonal variations, into account when scheduling. By matching the resources and the demand in a better way the efficiency of the flow will be improved and more beds available at the "right" wards. The matching of resources and the demand is facilitated by separated flows (Olsson and Aronsson 2012).

6.2 Standardization and visualization

Creating situation awareness among staff at a single ward will increase the effectiveness of managing a patient flow at an overall level. Moreover, enhancing the information transmission within a ward will affect the information transmission to the overall level. Variation in communication and variation in available information is the case at the ward today. This contributes to that information sometimes gets lost and this makes it hard for the staff to get an overview of the patient's care process. Furthermore, with uncertain information it is hard to predict the coming situation concerning available beds at the ward. Standardization and visualization of the provided information within a ward as well as on a meso level, will according to (Liker 2004) reduce the variation and thereby make the communication more effective. Furthermore, standardization and visualization of information will create an overview of the care process. This creates situation awareness among the staff at the ward, which according to Endsley (1995) is necessary to enable a prediction of the future state. This also makes it easier to communicate the information to the meso level, such as to the coordinators at the hospital or to the radiology, to contribute with information for making good decisions regarding the patient flow. Wright and Endsley (2008) addresses the importance to share this situation awareness at the ward to coordinating staff for a better collaboration. It is not always known that other teams do not have the information that they require or do not even know that they are in need of certain information, and thus not attempts to communicate it. The information communicated to coordinators at the meso level is at the moment poor and only communicated occasionally, which prevent the coordinators from making optimal decisions, this due to lack of situation awareness.

Incomplete information also creates a secondary need (Bergman and Klefsjö 2012) in terms of contacting staff at different wards asking for data, who themselves have to ask colleagues for accurate information. This could have been prevented by continuous updates of the system and thus providing correct data for those needing it. The less effort the coordinators have to apply

to seeking information to be fully updated about the situation the more time they can spend on the actual planning of the coordination. This also releases additional staff currently needed to support the coordinators. Moreover, same questions are asked repeatedly by different staff, which according to Graban (2012) can be decreased by visualizing the answers to common questions. Time saved by standardizing what information is needed as well as visualizing it will decrease waste at the ward which in turn enable staff to have time to update the system with accurate numbers. This is not made properly today because of the heavy workload. Situation awareness on a meso level, both current and future state, will contribute to good decision making regarding the distribution of patients. Furthermore, the ability of making required decisions as early as possible would increase the possibility to eliminate waiting time.

The execution of different activities at the ward, e.g. the discharge process and the rounds, is at the moment differing depending on who is working. Standardizing and visualizing a lot of the information regarding patients care processes will ensure that the staff have the information needed and that they are able to see what information that is missing, or what activities that is not finished (Monden 1983). Standardization of the processes will level the workload which results in more efficient work, hence proactive activities are executed earlier in the process (Haraden and Resar 2004) and patients can get discharged earlier in the day which will release beds for new patients. However, it is important to standardize processes that are suitable for standardization and that can help the staff and not use it for command-and-control (Seddon 2010). If suitable processes within a ward are standardized there will be less waste and more value-adding activities that can be used for care of patients to satisfy customer needs. If for example the rounds are performed in a standardized way they will be more efficient, thereby finished earlier. Since the rounds are a bottleneck for decisions regarding patients discharge it is of great importance to make them as effective as possible. A more accurate status of available beds at the ward can then be given to the coordination of acute flow at the meso level. The uncertainty that currently exists when the rounds are not finished on time causes some patients to be transferred to a temporary ward for relocation later on. If the round is standardized and patients prioritized, the information regarding if a patient is ready for discharge can be found in time for coordination meetings, which allows the patients to be placed in the right place from the beginning.

6.3 Continuous improvement

The improvement work is one of the most important principles in lean to achieve an effective organization (Åhlström 1997) and the work within a ward has an indirect effect on the overall patient flow. Enabling continuous improvement by highlighting the current problems in the organization is a way to evaluate the processes and practices but also a way to eliminate wastes and variations which makes them better (Bergman and Klefsjö 2012). According to Jekiel (2011) it is of great importance that the staff is engaged and encouraged to share their ideas and thoughts with the goal of achieving better results. It is therefore important to continuously spend time on improvement work but also to have a standardized way of working with it. The urology ward is working with improvements and has historically implemented some process improvements. However, the present work with improvements is done sporadic and is lagging due to lack of time but also because no one is asking for it. Moreover, the current way of working with process improvements and implementation of a new solution takes a long time, which can be deduced from the fact that a process has to be completely finished before it is introduced at the ward. Liker (2004) instead advocates trying new things in small steps allowing improvements in processes earlier but also so that one can easily go back, if the change was a mistake.

The ward does not have any measurements connected to the improvements. According to Elg (2013) it is important to measure the current situation to evaluate if there was any change after the improvement was implemented. Elg (2013) states that measurements need to be a part of the daily work to be able to analyze deviances. The ward does not have regular follow-up meetings by the management to see how the improvement work is progressing. Eriksson et al. (2011) stresses the importance to have encouraging and interested managers to be able to create long-term solutions. The improvement teams used in the improvement work are usually lead by a physician. The physicians are the ones with the most influence in an healthcare organization and they do not consider the administrative hierarchy as important as the medical one (Glouberman and Mintzberg 2001). This can be a problem since they do not have the same manager as the staff at the ward and have the possibility to prioritize other work task instead of working with continuous improvement work. Glouberman and Mintzberg (2001) also stresses that physicians often feel a closer connection to the patients than to the ward itself. By having measurements the organizations goals can be clarified and also become an incentive for all professions to work against (Elg 2013).

Improving the processes at a ward in the end of the care chain, will shorten the patients LoS and thereby decrease the number of patients in the system, which affect the overall flow at the hospital. The improvements made at a ward should also be evaluated according to how it affects the overall flow of patients, so that sub optimizations are eliminated or minimized. The hospital has a developed method of working with continuous improvement, but in which way and how much time that is spent working with it differs between wards within the hospital. The connection between wards are lacking today and there is no structured way to communicate and follow up improvements regarding other wards. The released time due to more effective coordination meetings can instead be used to improve the flow between wards to avoid sub optimizations. By continuously working with improvements, an understanding of the flows will arise as well as a better understanding of the work at other wards can be created. In this way, the trust in the coordinators decisions can hopefully increase and create a better collaboration.

7 Conclusion and managerial implications

In this chapter, the conclusion drawn from the analysis and discussion are presented and answers to the formulated research questions are given. Lastly, a prioritizing of the suggested improvements is also presented.

RQ 1: In what way has patient flow been reflected in the hospitals organization?

The hospital is in some areas organized to be able to manage patients flow, but not in the most effective manner. Deficiencies have been found in the match between admissions and discharges at the hospital which leads to the increased occupancy in the middle of the day. This can be an effect of lack in coordination between the wards upstream and the ones downstream. There are coordinators located at the KAVA and MAVA wards for distributing incoming acute patients, coordinating meetings and a computer system to manage available beds at each operation area. However, the work with the patient flows and availability of hospital beds is varying in the different operation areas which creates wastes as well as incompatibility in development of the processes. This also creates lack of system view and contributes to that decisions are made on inadequate information. Furthermore, the coordination meetings are performed without full mandate for the required decisions. This causes delays in the decision making which is negative in a rapidly changing organization. Lastly, the organization has systems to follow and distribute patients but these systems are not synchronized. The computer system, Belport, is poorly updated and is not providing predictions of future state, which would serve as a base to effectively managing the patient flows.

RQ 2: What present routines and practices affect patient flows within a ward?

There are several routines and practices within a ward, found in the study, affecting the patient flows. Some affect directly, e.g. discharges process, and others indirectly by unnecessary waste, e.g. long meetings or the need to search for information. The current work with the discharge process makes patients stay longer than needed which creates more patients in the system, resulting in longer throughput time. Furthermore, there are no set date for discharge at the ward which leads to longer stays. To be able to accomplish earlier discharges, when a patient is medically finished, more planning and proactive work with the process is needed. How the rounds are performed are closely connected to the discharges. The ward does not have any routines or practices describing in which order the patients will be prioritized during the rounds. This affects the time passing before a decision, regarding medically finished patients, can be communicated to the persons whom it concerns and in this way also when a patient can leave the hospital.

Furthermore, how a ward works with information and communication transmission is important to create an efficient patient flow. A lot of waste was connected to the information and communication transmission. Except long meetings and the search for information, does individual scheduling lead to unnecessary time to communicate. This time could instead have been used to work with value-adding activities. Poor communication between the professions is also a problem due to misunderstandings and delayed decisions which also affects the patient flows. There is also lack in how the ward currently work with the planning of elective patients. The planning occurs without synchronization to the acute flow and patients from both flows are mixed in the ward, thus there are no physical separation of the flows which leads to longer stays.

RQ 3A: What improvement areas exist in the individual wards that in themselves can contribute to improved patient flow between wards?

This master thesis presents three areas within a ward that needs to be improved to contribute to a better flow between wards. The three areas are: i; Planning and separation of patient flows, ii; Standardization and visualization, iii; Continuous improvement. In each area, concrete proposals for improvement are also presented.

Planning and separation of patient flows
To make the discharge process as effective as possible prerequisites for planning and leveled workload is important. This requires an estimation of expected date of discharge as well as working proactively with the discharge process. When a patient is ready for discharge only activities that could not have been done in advance should be executed. All other activities should have been prepared and done in advance to shorten the discharge process. Since the LoS is predictable to a great extent a date for expected discharge should be set to work towards. Since variations in treatment occur the date can get changed, however the outcome of predicted discharge dates is quite stable over time and therefore possible to work towards. To achieve proactive work with activities connected to the discharge process standards for when these activities should be made are required. A suggestion for this is to create a standardized document which is given to the patient at admission. It should be updated along the patients stay with, e.g. relevant information about the patient and information relevant for the discharge process. Relevant information that affect the discharge process is e.g. what kind of transportation that will be needed, contacts to relatives and list of medications. The document can also contain a paper where the patient can write down questions to remember until they meet someone who can answer these. If more questions are answered during the stay, this will result in less phone calls to the ward after the discharge.

The acute flow contains variations in both diagnoses and arrival times, which causes disturbances within the entire ward when, for example, operations have to be displaced. To handle the situation separation of the two flows is suggested, were both staff and available beds should be separated. This should facilitate planning of work and simplify the coordination of activities. By using historical data regarding the acute flow and how many patients that are planned for a week in the elective flow, in combination with the information from the average length of stay (or median or other relevant data) for a treatment, the number of beds in each flow can be calculated. The capacity that is needed is also differing between the flows since the variation in the elective flow is less than the variation in the acute flow. The acute patient flow requires overcapacity due to high variation, while the capacity in the elective flow can be used to a greater extent since less variation occurs. High capacity utilization in a flow with high variations means that the patient's throughput time will be longer than required seen from a medical point of view.

To change into a more focus–based approach by separating processes and flows as well as planning the discharge earlier, the LoS can be shortened and more efficient flows can be created. This will make more beds available for other patients, e.g. acute patients. The separation of flows will also create conditions for better utilization of staff and therefor better ability to match recourses against the actual demand. Furthermore, a separation of the flows within a ward will enhance the accurate information communicated to the coordinators which creates better conditions for better planning and managing of the acute flow.

Standardization and visualization
In order to use resources as efficient as possible elimination of wastes connected to information transmission is important. Double documentation, lack of overview of the information and missing information can be avoided by standardization and visualization of information and meetings. An overview of all patients in the ward should be visualized on a board, were also the care process of each patient is presented. To visualize where the patient is in the care process the suggestion is to have information about estimated date of discharge, confirmed date of discharge, transportation and other valuable information to the staff at the ward but also to the physicians. This makes information available for everyone by just looking at the board and unnecessary communication about current status is eliminated.

The round is also an important meeting were decisions affecting the discharge process is taken, which should be standardized and organized. In order to ensure that patients planned for discharges can leave the ward as soon as possible, a standardized way of prioritizing which team to start with should be developed. E.g. start with the team having the most patients scheduled for discharge. The round should have some form of agenda so the information communicated, is valuable for the meeting and does not vary depending on who is working. However, it is important not to use standardization for command-and-control, but use it as a way to help the staff to create a calmer working environment. Immediately after the round decisions about discharges should be written on the board, in order to spread the information to everyone so that the work with these or other activities can start immediately. By writing decisions about the discharges on the board before the entire round is complete, the unit manager can see the information and earlier communicate it to the distribution coordinators. If accurate information about the present and the future state of available beds is given earlier to the coordinator meeting, the meeting could, in the long term, be moved earlier in the day without rounds being completed. Furthermore, standardization of rounds will reduce the duration, thus information about taken decisions can be given to other wards earlier, enabling more patients to get placed at the right ward from the beginning.

To ensure that information about the current bed situation is delivered, a suggestion is to ensure that routines of Belport is made by having clearer responsibility of the process of updating Belport at the ward. Updating these numbers takes maximum one minute, if the information is present on the overview board mentioned above. Therefore, proper updates are a small effort which effect the work of coordinating patients and will save the coordinator a lot of time. Furthermore, clearer routines, better follow-ups and more information about why updates of the available beds are important are suggested to get the system updated every time and thus ensuring correct information at all times.

To increase continuity in the workflow and the possibility that the same staff are having the same patients in a greater extent so lesser handovers is necessary, the staff´s schedules are recommended to change from individual schedule to a fixed schedule. The expected outcome is that handover reports will be less extensive and instead more time can be spent on the treatment of patients. This is an indirect effect that leads to smaller wastes in several areas. For example, the morning meeting needed every morning to give information to all staff could be reduced and also be moved to the shift change to include more people. This would have reduced a lot of unnecessary time.

Continuous improvement
To continually improve the processes and the work at the ward, staff are recommended to carry out improvement work. The people working within an organization have knowledge of the processes and thus also insight into the problems that arise, why it is important they are engaged in the continuous improvement work. At present, there is a model for continuous improvement work at the ward but it is lacking in execution due to lack of time and commitment. There are small groups working with different improvements but it is not performed continuously. To engage the staff and find motivation to keep focus on improvement work measurements is important. What outcome the improvement work has resulted in and what way of working made the organization perform better? The continuous improvement board, should include statistics and diagrams of the ward's results, which should be continuously updated. Results, such as the number of patients discharged before 12 o'clock and the number of patients treated in the last months can be reported to see how the improvements have developed the ward. Through the visualization of results, the awareness among staff is expected to increase as well as increase motivation for participation in improvement work. By having regular meetings in close connection to the improvement board and discuss status of the various enhancements shows interest from the leaders.

Working with continuous improvement is important to be able to evaluate and improve the processes. If improvements only are made in the beginning of the patient flow and not in the wards where the patients are discharged, the number of patients in the system will increase and thus create longer throughput times which affect the flow efficiency.

RQ 3B: What improvements in the hospital organization will contribute to a more efficient acute patient flow?

Situation awareness
On an overall level, improvement areas are identified that will contribute to a more efficient patient flow. To create a system view of the organization on the overall level it should be ensured that the two operation areas have the same purpose and routines to be able to enhance the patient flow. E.g. simultaneous updates of the occupancy status at each ward would help capture a system view of the organization, thereby enable managing the patient flow efficiently. Further, the computer system should be expanded to ensure that required information regarding current and future state is provided within the system. The situation awareness captured while having complete and accurate information about the situation, both the current and future situation, enable coordinating staff to make good decisions regarding distribution of patients. Hence, improved coordination will decrease number of delocalized patients, which increase patient safety and reduce transfer of patients within the hospital.

Decisions regarding distribution of patients and other related actions required regarding available hospital beds, should be made as early and as effective as possible to find the best solutions. This makes the use of resources as efficient as possible and non-value-adding activities are eliminated. Hence, managers with mandate to make decisions should participate at the coordination meeting in order to make immediate action decisions, which will minimize the number of extra-meetings, such as the Zebra-meeting. Thereby enabling the coordination of patients earlier in the day and ensuring that the available human resources are sufficient the following hours or days, or if more human resources are required. Furthermore, if only two of the operational managers, per week, need to attend the coordination meetings, the rest can then focus on other work tasks and avoid being disturbed.

Structuring the coordination meeting
The structure and performance of the coordination meeting can be improved to decrease waste and moreover increase confidence. The meeting should exclusively be led by the coordinator who is continuously working with the acute flow and is the one who needs the information. Having the coordinator responsible for the meeting will eliminate waste, due to that handovers among staff will decrease. A second advantage of having the coordinator in charge for the meeting is that this might create confidence in its role among other wards, which is inadequate today. To achieve this, the coordinator needs a pure coordinating role with support from the operational managers. Further, structuring the coordination meeting by having a visual board centralized in the meeting room were information about available beds is updated by the respective ward prior to the meeting instead of verbally communicated during the meeting. Hence, a better overview of the situation will be gathered and non-value adding activates will decrease and thereby shorten the time spent on the meeting.

Continuous improvement
Currently, improvement work is expected to be done in the separate departments, but there is no standardized way of working with this between the wards. Since the coordination meetings is a forum where managers from different wards interact with each other, they are also able to affect the work across the interfaces. Saved time at the meeting can be used to work with continuous improvements among the present unit managers. This can, for example, be done once a week to enhance the collaboration between the wards. By enhancing the interaction between each other the improvement work across the interfaces would contribute to identify problems affecting the overall patient flow in the hospital, which may also reduce sub optimizations. Common development of the coordinating process can be discussed and jointly evaluated. A joint evaluation of the coordination process is expected to have an effect of less territory thinking.

7.1 Prioritization of the suggested improvements

The suggested improvements have been divided into the categories short and long term. Short term includes improvements that can be managed by the ward themselves and that can be completed within a rather short perspective. Long term suggestions include improvements that need more extensive actions by the organization. Table 4 below summaries the suggested improvements at the micro-level. Initially the arrangement of a visual board can help the staff to communicate and to overview the patients and their care process. A discharge date can then be written on the board and thereby enabling proactive work. A patient document is also manageable by the ward themselves as well as standardization and prioritization of the rounds. Extend the work with continuous improvement is also manageable in short perspective. Separation of patient flows though require further organizational actions to manage, it is therefore suggested in a longer perspective. Furthermore, a change of schedule does also require extensive changes in the organization and agreement by the staff and therefore expected to be manageable in a long perspective.

Table 4 Short- and long-term prioritization at Micro level

Micro level	
Short-term	**Long-term**
Board at ward	Separation of flows
Set discharge date	Change schedule
Patient document	
Round (standardize & prioritize)	
Continuous improvement	

The suggested improvements at the meso level are summarized in table 5 below. The ability to make decision as early as possible is manageable by having an operational manager present at the coordination meeting. This is an improvement that is not requiring extensive adjustments in the organization and therefore manageable in a short perspective. Continuous improvement is also a short-term improvement, but requires priority from unit managers. Improvements that require further organizational actions is to have coordinators responsible for the coordination meeting. To be able to accomplish this, it is necessary to relieve the KAVA-coordinator with certain tasks and it might require recruitment of additional staff and is therefore seen as a long-term improvement. Furthermore, long-term improvements are development of Belport and organizing the operations areas to have the same routines. Those implementations are more complex to accomplish since they involve all wards and that several people have to adjust their routines. They are therefore seen as long-term improvements.

Table 5 Short- and long-term prioritization at Meso level

Meso level	
Short-term	**Long-term**
Manager present at KAVA meeting	Coordinator responsible at meeting
Continuous improvement	Improve Belport
	Same routines

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APPENDIX 1

General questions

1. What patient flows is managed at this ward?
2. How is inflow of patients managed?
    a. From where are they coming?
3. How is outflow of patients managed?
    a. Where to are they leaving?
4. What information is experienced missing regarding patient flow both in and out?
    a. How does staff get aware of usage of hospital beds?
    b. Is it possible to know the situation of tomorrow?
    c. How is number of available bed prognosed?
5. Who decides upon were a patient shall be placed?
6. How is information to the coordination meeting prepared?
7. When does the discharge process starts and how is it managed?
8. How is staff aware of what will happen about discharges, transfers etc?
9. What prerequisites does the staff have to contribute to a efficient patient flow?
10. How is variation in the patient flow managed?
11. How are delocalized patients treated?
    a. Who is in charge of the care process?
12. How is the acute patient flow followed up?
13. What challenges exist regarding patient flow?
14. How is communication between healthcare staff and management?
    a. What is problematic in this collaboration?
15. What is the average length of stay at this department?