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Understanding patient transfer coordination at an acute care ward

Master's thesis in Quality and Operations Management

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SUMMARY

Background: The current healthcare situation in Sweden is experiencing delayed and late provision of care. Inefficient patient flow has been shown to lead to longer waiting times in healthcare and as such becomes an area of interest for healthcare organizations to improve. At Skaraborg hospital group's hospital in Skövde an acute medical and surgical ward, AVA, coordinates the overall acute patient flow for the whole hospital and hold great power of it.

Literature review: The literature review of this thesis included screening 1925 articles related to patient flow, and coordination. Both problems identified in literature and possible solutions to those problems were identified.

Method: The understanding of the coordinating process was captured using semi-structured interviews conducted with the coordinating staff at AVA, as well as with other staff members at the hospital. Quantitative data came from excerpts from hospital patient systems pertaining to patient visits and was used to identify the spread of discharges and admissions throughout the hospital.

Results: The interviews resulted in a description of the current process, how it looks and what the coordinators need with regards to information. How that information is obtained is also described. Furthermore, the problems experienced by the coordinators in relation to overcrowding at the hospital is illustrated in text and in a fishbone diagram.

Discussion: There is animosity between AVA and the wards receiving patients as a result of their coordinating process which align with other literature on the matter. The discharge is mostly centered to the afternoon, which results in overcrowded mornings and aligns with previous literature on the matter.

Conclusion: The coordinating process at AVA has been shown to rely on information obtained from other staff members at the hospital in various forms, often relying on the accuracy of that persons reporting. Delays in discharge and admissions follows from this, and is further affected by the overcrowding present in many hours of the day and night. Higher reliability in the information which is critical to the coordination, and discharge that is timed as to alleviate overcrowding are areas where the hospital needs to put their effort in order to achieve a better patient flow.

Keywords: Patient flow management, System-wide, Hospital, Coordinators, Continuous improvement, Acute ward

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1 Background

The evolution of science and technology is one main reason that life expectancy and population have increased. This fact has led healthcare organizations to face a greater and increasing demand for their services (Bacelar-Silva et al., 2022; Deveraj et al., 2013). According to Haraden and Resar (2004), unsolved increased demand can cause problems in healthcare and especially in hospitals, such as long waits, delays, and cancellations. Delayed or late provision of care to patients can worsen their health status, but it can also create additional financial costs for the organizations, as more care funds will be required (Bacelar-Silva et al., 2022). Therefore, organizations will need to enhance their existing capacity in order to avoid these issues (Haraden and Resar, 2004), however their resources are limited (Gualandi et al., 2020). This rising demand for healthcare services gives the opportunity to the hospitals to manage their limited resources more efficiently (Koushan et al., 2021).

Especially, when looking at the current situation of healthcare in Sweden there are reasons to believe that the system in Sweden needs to reduce delayed or late provision of care. In a report published by the Official reports of the Swedish Government (SOU, 2021) it is presented that the proportion of patients that do not get care according to the statutory Vårdgarantin, a national guaranteed access to care, is increasing. The guarantee is supposed to provide patients with their first visit to specialized care, or their planned surgery, within 90 days. However, in January of 2012, the proportion of patients who got their planned surgery or other specialized care in less than 90 days was around 85%, while in January of 2020 it was down to around 71% to then decrease to around 54% in January of 2021 (SOU, 2021). There is a clear negative trend towards longer waiting times for patients in need of specialized care and thus there is a strong need for Swedish healthcare to enhance their existing capabilities in order to dampen the negative trend, and hopefully turn it into a positive development.

Sweden is also experiencing an increase in the elderly population. With mortality rates going down, the percentage of the population who are 80 years or older is increasing (Statistics Sweden [SCB], 2018). This puts an extra strain on the healthcare system, and thus Swedish healthcare needs to be more diligent in how it uses its capabilities.

1.1 Patient flow

Health care organizations should improve their overall patient flow efficiency (Haraden and Resar, 2004; Deveraj et al., 2013). These organizations must save unnecessary costs and expand their services without negotiating the care quality for the patients, which should remain as high as possible (Gualandi et al., 2020). A proper and smooth patient flow provides timely treatment of patients, without incurring additional costs (Haraden and Resar, 2004). Hendrich et al. (2004, p.36) define patient flow as “how hospitals

transfer patients between nursing units, and it is influenced by the levels of care required and the severity of patients' conditions".

Patient flow has a big impact on healthcare decisions and its improvement depends on successful patient flow management. In accordance with Benjamin and Jacelon (2021), patient flow management reflects the implementation of holistic viewpoints, dynamic data, and complex concerns of numerous priorities with the purpose to make the patient care to be well-timed, efficient, and high-quality. Patient flow management has an immense impact on the patients, the healthcare staff, as well as the hospital system (Benjamin & Jacelon, 2021). It is a critical aspect for hospitals, but it is also a very complex problem since their units need to be available for a number of patients, a number which can fluctuate (Winasti et. al, 2018). Gualandi et al. (2020) explain that patient flow is highly variable, as every patient has different needs and responses to treatment, while the state of medical knowledge differs in each case. Therefore, it is crucial that the patients' needs, the care processes and the staff responsibilities be identified (Benjamin & Jacelon, 2021).

Inefficient patient flow, in addition to the long waiting times and the additional costs, can cause other issues, such as healthcare staff dissatisfaction (Winasti et. al, 2018). Common indicators of patient flow are the patients' waiting times and length of stay (LOS) (Deveraj et al., 2013). There are various ways to improve flow efficiency. The main solutions are by dealing with unwanted patient variability, insufficient resources in designated units, poor communication in the workplace and delays due to non-medical reasons (Winasti et. al, 2018).

1.2 The hospital

The Skaraborg hospital group (SHG) is a healthcare organization that currently faces the same challenges. The hospital group consists of four hospitals in different cities. This thesis is focused on the hospital located in Skövde and its acute patient flow. The beginning of the acute patient flow is located at the emergency department (ED) where the vast majority of patients with acute symptoms have their first contact with the hospital. From there on, the patients are moved to different departments in the hospital or discharged.

Where patients end up depends on both the medical or surgical needs of the patients, as well as where there are care spaces available. The coordination of these patients moves are performed by dedicated staff members of the merged acute medical and surgical ward (AVA). AVA themselves are a receiver of patients from the ED, but there are also several more wards where patients could be moved. Thus, the coordinating process by these staff members at AVA have a given impact on the overall acute flow of the hospital.

Given the previously stated trend of increased wait times in specialty care and the increasing proportion of elderly people in the population, it is important to look at coordinating process of the AVA ward. The ward's role in the acute patient flow means that the efficiency in the ward itself also has an impact on the ED as well as ward that receive patients from AVA.

1.3 Aim

The aim of this thesis is to describe the coordinating process of acute patient flow and the problems in decision-making the coordinating staffs experience at AVA ward. The project will explore the current state of the acute patient flow in the AVA area, detect causes that have a negative impact on its flow efficiency, and find potential ways for improvement.

1.4 Research questions

Having focused on improving the overall acute patient flow at Skaraborg Hospital in Skövde, we specify a set of research questions. As previously stated, the report will be focused on the AVA ward, and thus it is their strategic coordinating process that will be analyzed.

To understand how the ward currently coordinates the patient flow the following questions are formulated:

- **What does the patient coordinating process at AVA look like?**

Understanding how the staff collects their bases for making decisions and how those decisions are prioritized are important for understanding how the process could be improved in the future. The second research question will therefore be:

- **What factors are considered when making coordinating decisions at AVA?**

Finally, the using the extensive knowledge of the staff to determine the most prevalent problems will aid any future improvements to the process. For this reason, the third research question is:

- **What problems do the coordinators face in managing the patient flow?**

1.5 Delimitations

The project is limited to acute flow management processes and practices at AVA in Skövde. As such, the interviews conducted will be kept to the staff of the ward in question. The same approach will be taken to observations of the process in action.

Some interviews and observations are from organizational spaces outside of AVA but are limited in their use throughout this thesis and more designed to broaden the authors understanding of the hospitals structure.

2 Literature review

The main problems and solutions found during the literature are listed in the following tables, see Tables 1, 2, 3, 4, 5, 6, and 7. Along with what problems or solutions that were discussed in the corresponding literature is also information of where the literature was conducted geographically as well as in what part of a healthcare organization.

Tables 1, 2, 3, and 4 collectively show problems areas identified in the literature during the literature review.

Tables 4, 5, 6, and 7 illustrate the possible solutions to problems identified in the literature during the literature review.

Article	Area	Increased workload	Conflicting Roles	Staff Dissatisfaction	Patient Dissatisfaction	Overcrowding of patients	Bed unavailability	Patient Transport Problems
Nicosia et. al. (2018)	Private Hospital, United States	√	√	√	√			
Wise et. al. (2022)	ED, Australia		√	√				
McHugh et. al. (2018)	ED, United States	√			√			
Liu et. al. (2003)	ED, United States					√	√	
Winasti et. al (2018)	Inpatient unit wards, International					√	√	
Diefenbach & Kozan (2011)	ED, Australia					√	√	
Davis & Fard (2020)	Community hospital, United States					√	√	
Austin et. al. (2021)	ED, Australia					√	√	

Thomas et. al. (2013)	Medical Center, United States					√	√	
Bai et. al. (2018)	ICU, International					√	√	
Waring & Alexander (2015)	Acute care hospital, United Kingdom					√	√	
Goldwasser et. al. (2016)	ICU, Brazil					√	√	
DeAnda (2018)	ED, United States					√		
Hanne et. al. (2009)	General hospital, Germany							√
Lee et. al. (2020)	ED, United States	√				√	√	√

Table 1 Table of identified problems in the literature.

Article	Area	Delayed discharge	Lack of beds	Bad planning of discharge process	Discharge in the afternoon	Variation in discharge
Chen et. al. (2019)	General medicine ward, United States	√			√	
Kreindler et. al. (2022)	Regional health system, Canada			√		
Barnes et. al. (2016)	Medicine ward, United States	√				
Ortiga et. al. (2012)	Whole hospital, Spain			√		√
Destino et. al. (2019)	Acute care wards, United States	√	√		√	
Williams et. al. (2010)	ICU, Australia	√	√			

Table 2 Table of identified problems in the literature.

Article	Area	Bad intra-hospital transfer communication	Lack of teamwork and respect in intra-hospital transfer	Units not aligned with regards to patient flow	Intergroup tensions	Non-effective work routines	Weak patient flow infrastructure
Germack et. al. (2020)	Whole hospital, United States	√	√				
Drupsteen et. al. (2013)	Whole hospitals, The Netherlands,			√			
Kreindler et. al. (2022b)	Whole health systems, Canada				√		
Boiko et. al. (2021)	Acute trauma center, United Kingdom		√				
Kreindler (2017)	Regional health system, Canada						√
Athlin et. al. (2013)	ED, Sweden					√	

Table 3 Table of identified problems in the literature.

Article	Area	Increased workload	Conflicting Roles	Staff Dissatisfaction	Patient Dissatisfaction	Overcrowding of patients	Bed unavailability	Patient Transportation Problems
Wise et. al. (2022)	ED, Australia		√	√				
Austin et. al. (2021)	ED, Australia					√	√	
Lee et. al. (2020)	ED, United States	√				√	√	√
Davis & Fard (2020)	Community hospital, United States					√	√	
Bai et. al. (2018)	ICU, International					√	√	
DeAnda (2018)	ED, United States					√		
McHugh et. al. (2018)	ED, United States	√			√			
Winasti et. al (2018)	Inpatient unit wards, International					√	√	
Goldwasser et. al. (2016)	ICU, Brazil					√	√	
Waring & Alexander (2015)	Acute care hospital, United Kingdom					√	√	

Table 4 Table identifying possible solutions in the literature.

Article	Field	Capacity Increasing	Flow Redesign	Better Defined Roles	Staff Education and Motivation	Changes in Admission or Discharge Processes	Process Improvement and Innovation
Nicosia et. al. (2018)	Private Hospital, United States	√	√				
Wise et. al. (2022)	ED, Australia			√			
McHugh et. al. (2018)	ED, United States				√		
Winasti et. al (2018)	Inpatient unit wards, International	√	√			√	
Austin et. al. (2021)	ED, Australia	√	√				√
Thomas et. al. (2013)	Medical Center, United States		√				√
Bai et. al. (2018)	ICU, International	√	√			√	√
Waring & Alexander (2015)	Acute care hospital, United Kingdom	√	√				√
DeAnda (2018)	ED, United States			√	√	√	
Hanne et. al. (2009)	General hospital, Germany		√				√

Table 5 Table identifying possible solutions in the literature.

Article	Area	Machine learning for discharge predictions	Better planning of discharge	More, earlier rounds	Discharge identification the evening before	Acknowledgement/rewards for wards with earlier discharge	Improvements with the whole hospital's patient flow
Kreindler et. al. (2022)	Regional health system, Canada		√				
Barnes et. al. (2016)	Medicine ward, United States	√					
Ortiga et. al. (2012)	Whole hospital, Spain		√				
Destino et. al. (2019)	Acute care wards, United States			√	√	√	
Williams et. al. (2010)	ICU, Australia						√

Table 6 Table identifying possible solutions in the literature.

Article	Area	Tools developed by all parties in the transfer staff.	Goal-setting across departments	Sharing waiting list information	Sharing planning information	Cross-departmental planning	Creating combined appointments
Germack et. al. (2020)	Whole hospital, United States	√	√				
Drupsteen et. al. (2013)	Whole hospitals, The Netherlands,			√	√	√	√
Kreindler et. al. (2022b)	Whole health systems, Canada		√				
Boiko et. al. (2021)	Acute trauma center, United Kingdom						
Kreindler (2017)	Regional health system, Canada		√				

Table 7 Table identifying possible solutions in the literature.

2.1 Patient flow

Overcrowding in hospital wards is a growing problem, which affects the health care of the entire world (Oredsson et al., 2011). To face the consequences of overcrowding, health care organizations have as a priority to improve their patient flow efficiency (Haraden and Resar, 2004; Deveraj et al., 2013). The patient flow in most cases is considered as the process throughput and it is a critical measure of how to evaluate the competence in hospital operations (Deveraj et al., 2013). Hendrich et al. (2004) define patient flow as “how hospitals transfer patients between nursing units, and it is influenced by the levels of care required and the severity of patients’ conditions”.

Until now the most articles emphasize patient flow in ED. However, EDs are not isolated departments, and health care managers need to focus on the necessity for a wider approach to increase the overall patient flow efficiency (Gualandi et al., 2020). Except for the emergency units, there are also patients, which pass through multiple hospital units, like intensive care units and medical or surgical inpatient units (Winasti et. al, 2018). Including operating theaters and other support services, it is clear that a lot of patient factors and issues need to be considered. However, the flow of the patients is

constant and when the subsequent wards and units are overcrowded, it will also affect the patient flow in EDs. So, in order overall patient flow improvement to be achieved at operational level, solutions must be found for many processes, which are evolving in parallel (Gualandi et al., 2020).

Within the whole of a hospital organization, overall patient flow is a particularly complicated concept (Olsson & Aronsson, 2015). Patients have different needs and respond differently to their treatment, making their length of stay often difficult to predict (Gualandi et al., 2020). Likewise, numerous actors are participating at every single level of the processes. Physicians, nurses, and coordinating staff need to have a high-level collaboration to provide proper treatment to the patients (Gualandi et al., 2020).

Poor patient flow has a big impact on the care quality as it can lead to longer waiting times for the patients (Benjamin & Jacelon, 2021). Congestion of patients causes the appearance of process bottlenecks and as a result bottlenecks in clinical and administrative tasks can decelerate the pace of the patient discharges and increase the treatment costs (Deveraj et al., 2013). Inefficient patient flow, in addition to the long waiting times and the additional costs, can cause more indirect issues, such as healthcare staff and patient dissatisfaction (Winasti et. al, 2018). Patients' rights to their privacy can often be put in danger (Oredsson et al., 2011). There is the danger of discharging patients before the completion of their treatment too (Burström et. al., 2011).

On the contrary, a proper and smooth patient flow provides timely treatment of patients and secures the financial viability of healthcare organizations (Haraden & Resar, 2004). Patient flow has a great influence on healthcare decisions and its improvement depends on successful patient flow management. Hospital managers have tried a variety of techniques on how they can manage patient flow. Their early endeavors involved lean management practices inspired by the production methods of Toyota Motors Co., and other evidence-based techniques aimed at optimizing patient flow (Deveraj et al., 2013).

In recent years, patient flow has been investigated extensively in the literature, and a significant amount of them have the scope of “lean thinking” (Tlapa et. al., 2020). This fact has created a discussion and questions among the academics and research community regarding the prospect of lean thinking in health care as theory and as a toolbox (Olsson & Aronsson, 2015). Additionally, several models have been proposed to suggest how to optimally solve health care scheduling problems, for example patient admission scheduling, patient to bed assignment, and nurse scheduling (Abdalkareem et. al., 2021). Nevertheless, despite all of these improving proposals, it is not obvious what initiatives are successful and what health care managers can expect with their implementation. Unfortunately, health care organizations repeatedly evolve, their performance is based on numerous factors, and they receive impacts from professional

regulations and ethical responsibilities, so their progress cannot be investigated and measured easily.

In accordance with Benjamin and Jacelon (2021), patient flow management reflects the implementation of holistic viewpoints, dynamic data, and complex concerns of numerous priorities with the purpose to make the patient care to be well-timed, efficient, and high-quality. Patient flow management has an immense impact on the patients, the healthcare staff, as well as the hospital system (Benjamin & Jacelon, 2021). Tlapa et. al. (2020) explain that efficient patient flows require the management of medical care, physical resources, and internal systems.

Patient flow management is a critical aspect for hospitals, but it is also a very complex problem since their units need to be available for several patients (Winasti et. al, 2018). Gualandi et al. (2020) claim that patient flow management is quite composite, and it is influenced by both internal and external key factors, like patient acuity, bed management, communication, and new technological improvements. The problem with overall patient flow is highly variable too, as every patient has different needs and responses to treatment, while the state of medical knowledge differs in each case (Gualandi et al., 2020).

Common indicators of patient flow are the patient throughput time and length of stay (LOS) (Deveraj et al., 2013; Tlapa et. al., 2020). Patient throughput time is defined as the total amount of time needed to provide a patient treatment and it is measured from the time the patients arrive at the hospital to the time they discharge (DeAnda, 2018). It can also be considered as the sum of the LOS along with the patient's waiting time. Therefore, the factors that negatively affect patient flow and contribute to the formation of bottlenecks are directly related to the increase in LOS and patient's waiting time.

Capacity of a hospital or a clinic is estimated by calculating the hospital or clinic time of day capacity. There are also efficiency indicators for health care processes like admission and discharge processes (Gualandi et al., 2020). They are assessed with measurements of how many surgery admissions there are in a same day or how many patients there are, which need to be moved in a second or higher-grade choice unit (Gualandi et al., 2020).

However, these indicators only have to do with patient flow efficiency. There are other indicators that highlight the financial performance of patient flow (Bacelar-Silva et. al., 2022). Market impact, cost of labor and cost of saved labor time are some that have been used in previous research (Gualandi et al., 2020). It should be taken into consideration that there are cases where efficiency indicators come into conflict with financial indicators (Crawford et. al., 2014). For instance, if the number of nurses increases, the efficiency will increase, at the expense of the total budget. Although many articles refer to measures of patient flow effectiveness and financial indicators, a small

number of researchers have pointed out the need to include indicators from the clinical outcomes, patient satisfaction and quality-of-care outcomes (Gualandi et al., 2020; Deveraj et al., 2013; Bacelar-Silva et al., 2022).

2.2 Resources issues

Staffing of hospitals has been studied by many researchers due to the multiple effects it has on safety, the provision of quality care to the patient and the burden of health costs (Nicosia et. al., 2018). Nurses can have a number of different roles in patient flow management, such as flow nurses, navigator nurses, site managers, bed management nurses, and discharge planners (Benjamin & Jacelon, 2021). High patient-to-nurse ratios not only have a negative impact on patient outcomes, but also affect nurses who are at greater risk of emotional fatigue, stress, job dissatisfaction, and burnout (Wise et. al., 2022). Safe and adequate staffing is the key to quality and safety in the provision of health care (Nicosia et. al., 2018). Determining the right staffing is important and requires rational planning and accurate classification of human resources, which guarantees the right and appropriate number of staff and the necessary specialties in the necessary place and time (McHugh et. al., 2018).

Overcrowding can also be an outcome when the specified inpatient units' beds are occupied (Liu et. al., 2003). The times that there are not enough resources in the specified inpatient units, the patients, who have received the appropriate treatment and are ready to be discharged from the ED and be placed in another unit, are obliged to wait until a bed is accessible (Winasti et. al, 2018). So, one of the main reasons for the increased LOS is the unavailability of inpatient beds (Diefenbach & Kozan, 2011). Additionally, it is observed that it is an often phenomenon that patients, who occupy beds in inpatient units, are ready to be discharged (Winasti et. al, 2018).

Davis and Fard (2020) say that except for the waiting time, considerable cost and safety issues arise when the demand for hospital resources is higher from the current healthcare resources. When demand exceeds capacity, the health of the patients is in danger because of this lack of resources, which can cause higher rates of mortality medical errors in a healthcare organization (Davis & Fard, 2020). Liu et. al. (2003) in their research in the ED environment observed that the majority of patients encounter their most of their waiting time when they are waiting for an available bed and after that there were not statistically considerable differences between time periods in ED.

Moreover, health care staff occasionally try to cope with their resource capacity without including the holistic view and the system-oriented nature of a healthcare organization (Austin et. al., 2021). Thus, in order to achieve optimal bed management, a hospital-wide approach needs to be adopted (Winasti et. al, 2018). Bed assignment is a stressful task for the staff which is responsible for this, and research has shown that human instinctive decisions can be away from the optimal ones (Thomas et. al., 2013). For this

reason, there is an effort to create tools and build models with the assistance of operations research theoretical background to facilitate staff in decision-making regarding the most correct bed allocation (Bai et. al., 2018). Until now most of these tools cannot be applied to real life situations when a wide-system approach is required.

There is also the scenario that a bed can be found for a patient, but this bed is not on the proper ward (Waring & Alexander, 2015). As Waring and Alexander (2015) explain, patients in different wards have an additional health risk, since they could be overlooked or receive incorrect treatment in the other ward. DeAnda (2018) points out that bed management strategies are a temporary solution and health care organizations need to prioritize how to minimize the time a patient stays in the hospital in order to make space for the new patients. Goldwasser et. al. (2016) led to the same conclusion when they examined intensive care units in the state of Rio de Janeiro. This solution can have indirect benefits too, such as the enhancement of staff satisfaction (DeAnda, 2018).

Hospital top management frequently ignores the effect that the role of logistics has on quality of care and also on staff satisfaction (DeAnda, 2018). A factor that has a special role in the efficiency of patient flow is the transportation of the patients and the resources related to it. According to Hanne et. al. (2009), the day-to-day logistics actions operated in a hospital contain processes, such as coordinating and delivering to acute patients intrahospital transportation, resources, and medical equipment and even they look easy and uncomplicated. These health care logistics have an effect on the quality and the cost of the health care services (Lee et. al., 2020). The shortest distance movements are mostly made by qualified nurses, who generally go with the acute patients with restricted mobility problems from one unit or ward to the other using gurneys, beds, or wheelchairs (Hanne et. al., 2009). However, when a patient has to be transported to or from a hospital or clinic, specially designed vehicles are used, which two or more patients can share for their movement or ambulances as the case may be (Lee et. al., 2020).

Several issues related to patients' transport have been reported in the literature so far. Hanne et. al. (2009) have found in their research on hospitals in Germany that transport bookings are often scheduled a few minutes earlier or even later than the requested hour to pick up patients. Likewise, telephone calls are mainly not applicable for urgencies (Hanne et. al., 2009). An online real time platform, which provides all the necessary data can be an effective solution in order for the transport staff to have access to as much information as possible in order to improve the coordination of the transport provision for the acute patients (Lee et. al., 2020).

Another barrier that has to do with communication is that carriers do not accept orders about which sequence patients should pick up, so they make the decision, preventing a proper estimate of how long their route will last (Hanne et. al., 2009). Furthermore, transports can be a complex process and are often delayed, as a consequence increasing

the waiting times for patients (Lee et. al., 2020), but also the idle times of the EDs and the specialized wards (Hanne et. al., 2009).

Hospital wards also face barriers since they have limited access to the information about the condition of their requests to the transporting team. This knowledge is also essential when special equipment is needed and should be brought with the transport means (Hanne et. al., 2009). Most of the transport requests are planned on the same day and the uncertainty can grow since transportations can need more time than expected because of unplanned events, like a potential damage to the ambulance, or even the transport orders to be withdrawn (Hanne et. al., 2019). In their research, Hanne et. al. (2009) found out that the bookings to diagnostic and treatment units increases significantly when physicians complete the morning ward rounds. Thus, it is valuable when the health care coordinators decide to assign transporters to also think about both the currently and the potentially admitted patients (Lee et. al., 2020). Lee et. al. (2020) explain that advance inpatient bed request signals can assist the transporter dispatcher to decision-making process and as a result to increase the patient flow efficiency.

2.3 The Discharge Process

Optimal bed management is an operational goal in health care organizations (Chen et. al., 2019). Bed management also affects the performance of the other hospital specialized departments concerning the bed availability (Kreindler et. al., 2022a). Therefore, it is important to have proper bed management in order to secure that the quality of care is satisfactory (Barnes et. al., 2016). Bed occupancy is described as a problem with high variation and attempts to reduce variation should begin with the discharge processes (Ortiga et. al., 2012). Redesigning patients' pathways gives the opportunity to health care managers to improve patient flow aspects, such as bed management and hospital throughput, increasing the safeness of patient care (Kreindler et. al., 2022a).

According to Ortiga et. al. (2012) having necessary information about scheduled discharges at least one day in advance would enable better planning regarding bed assignment. Furthermore, the discharge process should begin at the same time with the admission process, estimating the LOS in cases when the absence of medical complications is guaranteed (Ortiga et. al., 2012). Discharge planning permits an easier and faster bed assignment in hospitals reducing the workload from the nurses and other staff working in discharge coordinator roles (Barnes et. al., 2016). Thus, multidisciplinary teams can lead to an improvement of the existing health care services (Kreindler et. al., 2022a).

Ortiga et. al. (2012) noticed that the increase in planned discharges helped the health care staff to communicate faster and effectively necessary information to each other and improve their teamwork. Kreindler et. al. (2022a) found that discharge interventions,

encouraging continuous discharges, with the support from the leadership and the management teams have better results in patient flow efficiency. Improvisation from the staff is less with planned discharges too (Ortiga et. al., 2012).

Moreover, it is often a difficult task for hospital units when the overall demand is frequently higher than the bed capacity. According to Destino et. al. (2019) health care leaders also identified early discharges before 11 o'clock as one initiative to contribute to improved patient flow as a continuation of other initiatives that existed, such as discharges before noon. However, regardless of the discharge process, reducing discharge delays demands a collaborative approach from physicians and flow coordinators otherwise it is difficult to be implemented (Williams et. al., 2010).

2.4 Internal communication

Aside from the resources, another factor that affects the performance of patient flow is the cooperation among the different roles in the healthcare environment. The status of professionals has changed in comparison with the last century. New professions are arising which receive analogous importance to doctors at the same time as other established professions, as nurses are claiming status (Villa et. al., 2009). Thus, internal reorganizations are currently guided and influenced by the degree of inflexibility of such professional barriers (Villa et. al., 2009). Health care quality improvement efforts may perhaps focus on a teamwork encouraging attempt to decrease unintended power imbalances and improve communicative interactions among the different wards (Germack et. al., 2020).

Clinics is still a concept under continuing development in medical sciences and the development of cross-specialization leads that the borders of medical specialties should be redefined in order to avoid conflicts derived from driven by different but overlapping specialized proficiencies (Villa et. al., 2009). Health care administrators, as well as medical professionals need to try to stop their silo mindset and begin integrating approaches (Drupsteen et. al., 2013). According to Kreindler et. al. (2022b) narrowly structured groups establish strong characteristics more effortlessly, but larger groups enable coordination of care by lessening the quantity of limitations patients need to pass through.

Hospitals nowadays with this increased demand are not in position to maintain extreme specialization of staff or staff incompetence as a consequence of the narrow functional areas (Villa et. al., 2009). Research from Drupsteen et. al. (2013) shows that patient flow efficiency increased from the existence of beneficial collaboration between the various actors of the patient flow. Boiko et. al. (2021) explained that lack of teamwork and collaboration can cause flow-related types of interprofessional barriers. In their research in an acute tertiary trauma center hospital in England, they identified three interprofessional barriers: teamwork barriers, performance-driven coordination barriers,

and referral-related collaborative barriers (Boiko et. al., 2021). Furthermore, low-level communication among the different departments can increase the rate of patient delays, clinical procedures postponements or cancellations, and waste of resources (Villa et. al., 2009).

Drupsteen et. al. (2013) singled out four integrative practices, which are sharing waiting list information, sharing planning information, cross-departmental planning, and combining appointments. These integrative practices can reduce non-value-added activities in the patient flow process, so the planners will not wait the previous steps to be finalized before the next step to be planned and also the length of the queues is expected to be reduced (Drupsteen et. al., 2013). However, Kreindler (2017) explains that initiatives can improve parts of the organization but also can fail to provide a solution for the primary system limitations.

Moreover, improving some wards can create barriers to the others of the same hospital since all of them share the same resources increasing the antagonism between the different parts of the organization (Kreindler, 2017). Therefore, it needs to be developed in a collaborative environment where all departments will be allies for a common purpose and not competitors. Athlin et. al. (2013) claim that teamwork can make a positive impact to the quality improvement of care and to guarantee a secure and reliable care for the patients. However, it requires a consistent, and wide oriented hospital ecosystem which is described from clear roles and liability (Kreindler, 2017).

2.5 Coordination in hospitals

Coordination between hospital departments has a major impact on patient flow efficiency, as it can significantly expand improvements in the use of hospital resources, performance indicators such as LOS, and the quality of patient treatment (Izumi et. al. 2018; Sanner & Ovrelid, 2020). Swan et. al. (2020) claim that coordinating care is so important as it ensures health care, contributes to the better functioning of the treatment of patients with chronic diseases, as well as in the reduction of patients who die. It has been observed that healthcare organizations in their effort for continuous improvement have given great importance to how to develop procedures, which are applicable within a hospital department, such as those of ED, surgical, and medical department, but still lag behind in improving processes about how to have better collaboration among these departments (Hoyem et. al., 2018; Luther et. al., 2017; Sanner & Ovrelid, 2020).

Despite the wide research of cooperative effort within various clinical teams in single departments, there are not many studies on interdepartmental road map coordination (Sanner & Ovrelid, 2020). According to Hoyem et. al. (2018) the role of health policies is also essential. They found in their research that in Norway the policies lack comprehensible ways and lack of established responsible professionals (Hoyem et. al., 2018). In most hospitals the people in charge of interdepartmental coordination are part

of the health care staff with extended personal responsibility called coordinators (Izumi et. al. 2018; Hoyem et. al., 2018; Luther et. al., 2017; Sanner & Ovrelid, 2020).

The job description and the responsibilities of coordinators are still quite recent, and they progress day by day (Hajewski & Shirey, 2014; Izumi et. al. 2018). In accordance with Izumi et. al. (2018), there is not enough information about the distinctions of care coordination process, the role of coordinators and what skills they need to have as all of these are authorized within the context of health care teams. However, Wise et. al. (2022) explain that they need experience, communication, and negotiation skills. The fact that coordinators work inside teams may cause them to face issues such as conflicting roles, lack of recognition and the perception that coordination is not always necessary (vanAchterberg et. al., 1995). Performance indicators for the work of coordinators are scarcely addressed (Hoyem et. al., 2018; Izumi et. al. 2018).

Lack of coordination among hospital departments is intensified by the use of information systems that emphasize on medical procedures in comparison with those that focus on communication between different hospital roles (Sanner & Ovrelid, 2020). Hospitals have resorted to the use of workflow-oriented IT solutions in order to restore problems related to the efficiency and speed of patient-oriented coordination further than single departments and hospital documents and reports (Sanner & Ovrelid, 2020). Furthermore, physicians should often have very good communication with coordinators and an active role in coordination day (Hajewski & Shirey, 2014).

Sanner and Ovrelid (2020) in their research described the way coordinators work in a Norwegian hospital regarding emergency unit admission to patient transfer and discharge. They found out that the work content of the coordinators is characterized by great variability, as there is a wide variety of patients with different problems (Sanner & Ovrelid, 2020). Furthermore, units that would receive patients were often reluctant to accept new patients claiming different reasons and excuses, giving priority to their own internal capacity, creating barriers to coordinators (Sanner & Ovrelid, 2020). Finally, the coordinators were very skeptical about the online platform and felt that it was not often up to date (Sanner & Ovrelid, 2020).

Wise et. al. (2022) in their research found that in the EDs of Australian hospitals mostly the coordinator was the only team member, who was supervising the electronic waiting list, inspecting the evolution against the time-based performance objectives, and negotiating the paths of the patients through the ED and on to the next step of their patient journey. In brief, their job is very complex and constantly under time pressure (Wise et. al., 2022).

2.6 Lean in healthcare

In an attempt to increase productivity and decrease wait times many hospitals around the world have tried to organize their operations using methods that have gained fame outside of hospital settings (Lot et al., 2018). Hospitals have needed a method for dealing with cost issues and quality issues (Zepeda-Lugo et al., 2020). One such method has been lean management (Lot et al., 2018; Al Owad et al., 2018; Al Owad et al., 2020; Breen et al., 2020).

Lean has its roots in the car manufacturer Toyota as a means for process efficiency (Zepeda-Lugo et al., 2020). Lean methods and lean six sigma have been utilized in healthcare since the early 2000s, partly in order to combat limited financial and personnel resources and the ever-growing aging population (Daly et al., 2021; Zepeda-Lugo et al., 2020). It serves to be a strategy for lowering the costs of operations by way of increasing the efficiency of hospital processes. According to Al Owad et. al. (2018) lean strategies can help healthcare in eliminating wastes in the processes and in reducing control costs.

In a systematic review by Zepeda-Lugo et al. (2020), the implementation of lean in healthcare is not without difficulties. Applying learnings in one field and then trying to move those over to a new one has been an occurring problem. In addition, the research field, and the effect that lean has on patient flow efficiency is still in its early stages (Zepeda-Lugo et al., 2020).

Indeed, health systems are clearly more complex than other organizations such as the manufacturing industries, but also like other service providers (Sanchez et. al., 2018). Among service providers, in health systems, the human factor, human health and safety, and in general the desired positive outcome of each patient are paramount, surpassing the importance of other parameters such as operating costs and performance (Olsson & Aronsson, 2015). However, as the above important factors affecting patients' health make up the quality of health systems, quality improvement is also a key issue (Elamir, 2018).

2.7 Lean tools

In an article by Lot et al. (2018), the application of tools associated with Lean methodologies was done at a liver transplantation clinic in order to reduce patient waiting times. They found success in using tools such as an A3 Report, Gemba walk, value stream mapping, and five Whys (5W). Daly et al. (2021) also apply lean tools in a healthcare setting; their aim was to improve the availability and access to data within an emergency department. Tools used include, but are not limited to, Gemba walk, Process mapping, Fishbone diagrams, and the concept of voice of customer (Daly et al., 2021).

The A3 report is made to communicate progress and results on different improvement projects and is used in problem-solving to integrate the individual knowledge of the staff members, so that it can be used to identify ways to improve (Lot et al., 2018). With the term Gemba walk Lot et al. (2018) describe making sure to observe and live the patients journey through the hospital, with the goal of gaining further understanding of the inner workings of the processes.

Daly et al. (2021) observed the patient journey through the emergency department with the intent of understanding how the work was done, and where. The value stream map (VSM) is a visualization method for structuring the flow of work and the resources needed in the flow. The goal of this method is to make an improved flow, with less non-value-added steps which in turn will reduce process time (Lot et al., 2018; Breen et al., 2020). The tool of process mapping is used to ease the understanding of very complex processes or systems of processes (Daly et al., 2021). Furthermore, it can be useful in identifying and understanding bottlenecks.

The 5W method is aimed at understanding problems and finding the underlying cause, the root cause. The question of why something is occurring is asked repeatedly, and it is through this act of digging deeper repeatedly that the root cause is supposed to appear (Lot et al., 2018). Another tool for finding the root causes of problems is with Fishbone diagrams. They can be used to analyze cause and effect with the intent of finding areas of improvement (Daly et al., 2021). The concept of voice of the customer is the expectations or needs of the customer of any process (Daly et al., 2021). In a healthcare setting it might be difficult to specify who the customer is. The patient as the customer, the staff as the customer, or any other participant in the care as the customer has been used as perspectives in literature (Al Owad et al., 2018, 2020; Daly et al., 2021).

3 Method

The thesis explores the current design of the patient-coordinating process conducted by staff at the AVA ward. As such, the methods used need to effectively capture the organizational understanding the process, as well as factors affecting it.

Since the hospital current understanding of the coordinating process is limited, the thesis has the foundational goal of increasing the understanding by using the staff's descriptions and experiences collected through semi-structured interviews. This qualitative data is then used to answer the stated research questions of the thesis. Since root causes can be hard to identify, especially when the understanding of the process itself is low, the qualitative data will be analyzed in with use of a fishbone diagram. It is from this collective view that identification, and priority, of root causes will be drawn.

The approach of this thesis could be described as inductive, in such a way that theory is to be drawn from the observations and findings gathered: the experiences and descriptions derived directly from the staff is then used to develop a theoretical understanding of what factors influence the decision making of the coordinators and the potential root causes to identified issues with the process.

3.1 Literature review

At the initial phases of this thesis literature reviews were conducted on topics related to the initial presentation of the AVA ward, and their felt problems. This was done to create a base of understanding of what had been done in the domain before, and how previous literature looked on issues within this domain.

This structured literature review was done using the scientific database called Web of Science. Keywords such as “patient flow” and “coordination AND hospital AND coordinators” were used for an initial search which resulted in 1925 results. From there on a screening was performed on the titles of each article where papers deemed unrelated to this thesis were excluded based on the authors' judgements. After that, another screening was performed on the resulting articles using the abstracts of each article. Again, exclusion was made as per the authors' judgements. A diagram of the screening process with all its steps can be seen in Figure 1. Two articles were also included based on recommendation from supervisors. The full result of the screening resulted in a total of 62 articles.

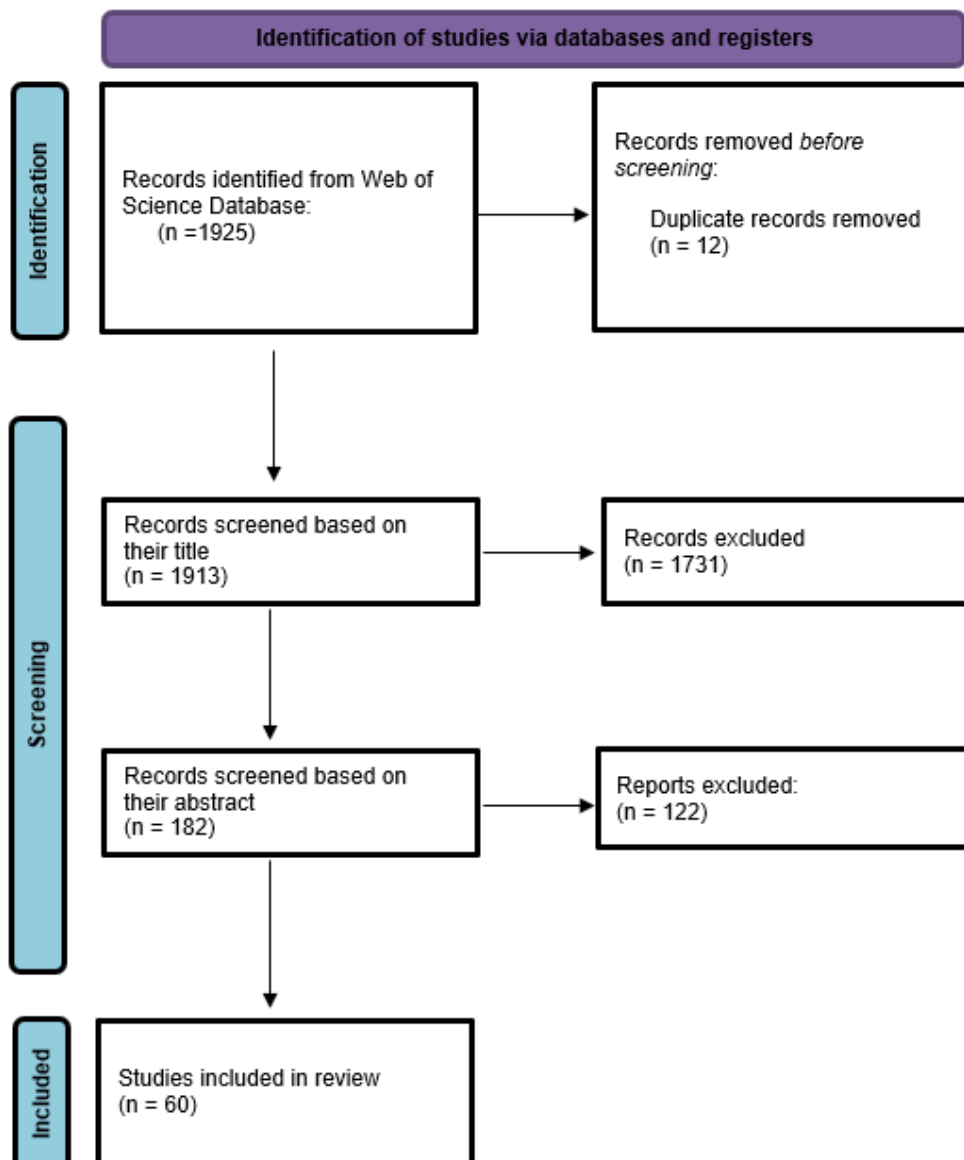


Figure 1 Screening process of the literature review.

3.2 Interviews

As per previous explanation, the use of semi-structured interviews was performed to gather qualitative data relating to the patient-coordinating process. The interviewees themselves consisted mostly of nurses working directly as the role of coordinators at AVA but also included unit managers at both AVA and other wards at the hospital. Two coordinators of a medical ward and a surgical ward respectively were also interviewed during the work of this thesis. This selection was done first and foremost to get as many interviewees as close to the coordinating process as possible. The coordinating nurses were not chosen according to any specific sampling structure, instead the number of interviewed coordinators were bound solely by how many of the coordinators that

wanted to be subject to interviewing. Interviews outside of AVA were conducted with the intent of broadening the understanding of how the coordinating process was viewed by the people who were direct recipients of said process outcome. These interviews were conducted with staff members of other wards.

The interviews followed a semi-structure format in which questions were determined beforehand but designed to be open ended, as to elicit responses regarding the process that we were not aware of before. After each interview the questions were reviewed and possibly changed for the next-coming interviewee based on what had been learned previously. As such, the interviews were able to gather qualitative data related to the research questions of the thesis without the authors having previous understanding of the coordinating process.

Interviews were conducted both in person, at the hospitals in Skövde and Lidköping, or over video call using the software Microsoft Teams. All interviews were recorded, except three interviews conducted at hospital in Lidköping. In the case where recordings were not made, extensive note taking was conducted instead. All recordings were transcribed. An automatic transcription service as part of Microsoft Word was used on the audio files to generate a transcription. However, due to the quality of said automatic transcription being rather poor each interview had to be manually looked through as well.

In order to make the interviewees as comfortable as possible they were all asked the question of whether the interview be conducted in Swedish or English. Most interviewees chose Swedish. As this report is written in English, most quotes found in the text are translations of what was originally said by the interviewees. The quotes were translated back to Swedish using a translation program to make sure that the resulting translation was equating to the original quote. This provides further strength to the English translations found in this thesis.

All conducted interviews, along with the role of the interviewee, location and date can be found in Table 8.

Role	Location	Date
Unit manager at a surgical ward A	Teams - Lidköping	02/28
Group meeting – AVA staff members	Skövde hospital	03/02
Coordinator at a surgical ward	Lidköping hospital	03/11
Coordinator at a medical ward	Lidköping hospital	03/11
Unit manager at a surgical ward B	Lidköping hospital	03/11
Two managerial staff members	Skövde hospital	03/18
AVA Coordinator A	Skövde hospital	03/18
AVA Coordinator B	Teams - Skövde	04/01
AVA Coordinator C	Teams - Skövde	04/04
AVA Coordinator D	Teams - Skövde	04/06
AVA Coordinator E	Teams - Skövde	04/14
Fishbone diagram workshop	Teams - Skövde	05/03

Table 8 Table of the performed interviews.

In addition to a more structured data collection from interviews, meetings with hospital staff were participated in by the authors. Meetings about a potential new software solution for the coordinators and other hospital staff were deemed to give additional understanding of the way the hospital as an organization viewed the coordinating process. The attendance by the authors on these meetings were almost in its entirety made with as little obstruction as possible to the staff members; the authors were quiet observers. One of these meetings was done at the hospital with plenty of the nurses who work as coordinators as attendees. It was from this meeting that the foundation of the semi structured interview questions was made, as it was the first exposition towards the staff's perception of the coordination process.

Observations were also made on site during visits to the hospital in both the Skövde and Lidköping facilities. The work of both coordinators and unit managers were observed both during interviews and after. Note boards and other material used by staff were photographed in order to serve as reference for the authors later on. These observations did not result in any specific findings related to the research questions, but instead functioned in helping the making of interview questions.

3.3 Patient system data

In addition to qualitative data from interviews, quantitative data from the system called Elvis was also gathered. This data consisted of database entries regarding patient stays at the hospital. Information such as patient demographics, time of admission, housing ward, and time of discharge were included for all hospital stays for 2019 to 2021. A separate file with aggregated admission and discharge for each hospital ward, and for different time spans per day for the whole hospital was also gathered as part of the qualitative data collection.

These sets of data were used to support certain claims made by staff members during the interviews. Mainly, regarding the discharge process and the timing of discharge depending on time of day, or day of the week. Information regarding the distribution of patients located outside of the ward in charge of their care was also extracted from the quantitative data. The presented data in the result section of this thesis were generated through Microsoft Excel, making simple calculations on the data gathered from the hospital in order to structure it for presentation.

3.4 Data analysis

From the transcribed interviews, both the design of the coordinating process as well as the staff's perception of it needed to be extracted. In this endeavor, a map of the process was designed as a basis for further description of the process and the barriers described by staff and then put into larger groups.

The description of the process was further broken down into different types of patient moves, and how the coordinating role of AVA played into the larger hospital-wide system. Critical points in the process were also identified and expanded upon such as: how the staff got their information, and where it was from, and where decisions were made in the process.

The experienced difficulties expressed in quotes by interviewed staff was as previously mentioned grouped together in accordance with what sort of problem they described. From this a large number of quotes were gathered and grouped, but in order to determine what could be considered root causes and what were merely symptoms a Fishbone diagram was created. The Fishbone diagram structured the gathered concerns into cause and effect, and was shown to members of the coordinating team in a workshop where they could add anything that the authors might have missed as well express their opinion on how these found causes could be prioritized. The revised Fishbone diagram later led the foundation for discussion on the potential root causes of problems within the coordinating process.

4 Results

In this chapter of the thesis results from the data collection will be presented. The results are further divided into seven sub-chapters: The patient's journey, The role of AVA, Managing the flow, Information, Decision-making, The patient flow process, and lastly The overcrowding problem in the hospital. The results are drawn from the qualitative data gathered during the interviews, while Decision-making also presents quantitative data from the patient systems.

4.1 The patient's journey

The first stage of an acute patient journey is the ED. The ED of Skaraborg hospital is a set of organized departments responsible for the reception and treatment of patients characterized as emergencies and accidents with a wide range and variety of clinical cases extending to all health disciplines, i.e. the full range of diseases, injuries, and behavioral disorders as well as the management of the patients until the moment of their admission to a more specialized clinic or department. The concept of emergency has different meanings for the patients, their environment, as well as for the doctors and the nursing staff.

The EDs purpose is to provide immediate and specialized care to patients when the need for acute or urgent treatment arises on a 24-hour basis. It is responsible for the reception and triage of any incident that occurs but also for the rapid and effective treatment of emergencies with procedures for immediate diagnosis of life-threatening situations of immediate resuscitation, support of organic systems, stabilization, and further promotion for definitive and treatment, performing minor surgeries and orthopedic surgeries. It is practically the connecting link between pre-patient and inpatient care. In addition, it acts as a filter as it protects the hospital from unnecessary admissions.

Patients arrive at the ED reception area, with or without the help of an ambulance, and report their symptoms to a competent nurse or triage doctor. The doctor or the nurse (triage team) characterizes the severity of the cases and after being examined by the doctor, the patients are provided with the necessary care. If the examining doctors deem it necessary, they prepare an admission report, and patients are transferred to a bed located inside the ED. However, the efficiency of ED processes depends on the number of the incidents.

Patients can be transferred from the ED to the AVA or to a specialized ward, such as a medical or a surgical one. AVA is a ward, which evaluates, beyond ED, the health of acute patients and provides them with appropriate care and continuous monitoring. The main reason for the existence of AVA is to avoid overcrowding of patients in ED. The existence of this ward also reduces the waiting time of patients in ED. AVA patients are either sent for further medical or surgical care in a more specialized department or

require only short-term admission and are later discharged from the hospital. The role of AVA is described in detail in the next section.

Patients after receiving care from ED or AVA can visit the medical and surgical wards of Skaraborg hospital if they need more extensive treatment. The medical department provides nursing care to non-surgical patients mostly with complex and multi-system disease. The patients, who are accommodated, require additional medical investigation, treatment, and cure under the spectrum of the medical specialties. The patients, who need surgery, are transferred to a ward in the surgical department. It should be noted that medical and surgical departments also receive elective patients too. These different streams can cause all available beds in the surgical and medical department to be covered. Therefore, there are cases where patients can be transferred to a specialized department immediately after the ED or AVA which is located within the Skaraborg organization but in another city if there are not available beds in Skövde. The most common route is for patients from Skövde to be transferred to Lidköping. Figure 10 below illustrates how the patient's journey to Skövde Hospital is formed.

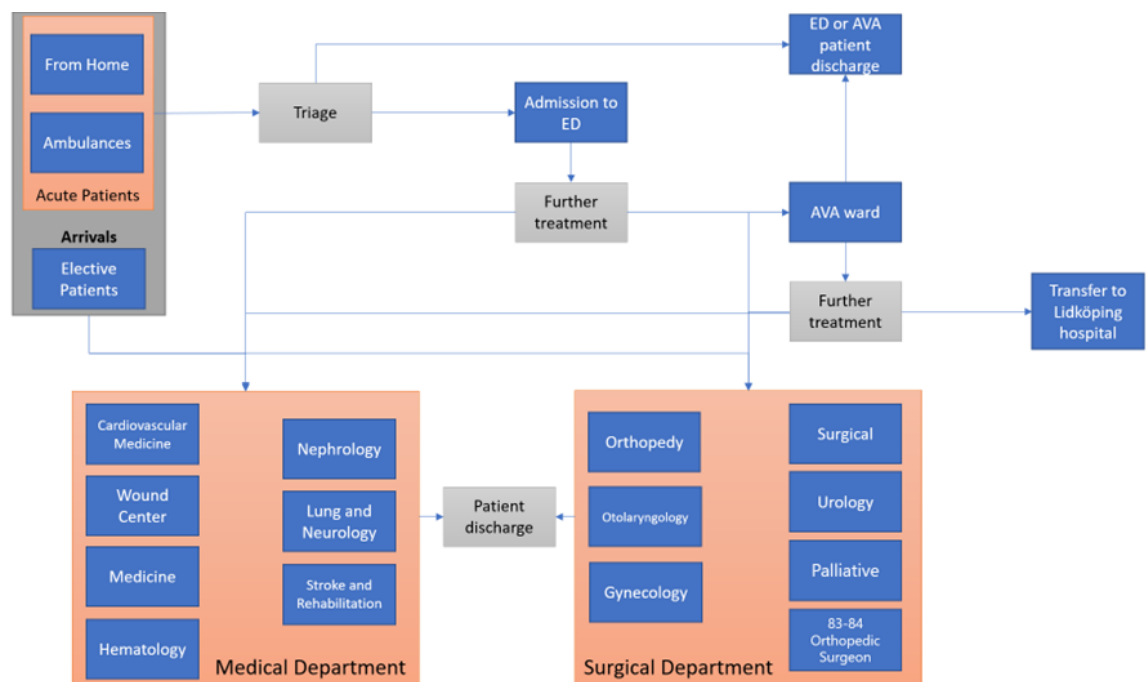


Figure 2 Patient's journey in Skövde hospital.

4.2 The role of AVA

AVA is a ward at Skaraborg hospital in Skövde. The hospital is built up of many different wards, with most of the patients with acute needs coming in through the emergency department (ED). One could think AVA as being the ward after the ED in the patient flow; they take patients in need of acute care directly from the ED to make

space for new patients coming with acute needs. However, when trying to understand the patient flow of the hospital it is important to note that not all patients go from the ED to AVA.

“The problem when we have to take these other patients who are not acute is that they mix up with very demanding patients and complicated medical patients, and the ones from emergency. It is just too much to do with all of them.” (Staff Manager)

The hospital has guidelines for where each patient is supposed to go following the ED and these guidelines divide patients into two groups per ward that could best be translated to: need-to-patients and should-patients. These groups have special conditions that are supposed to determine if a patient needs to go to a specific ward or if they should but could go to another ward instead. Regarding the guidelines, patients with need of acute care with a high level of surveillance, but without need for intensive care, need to go to the AVA ward. As do patients with acute confusion, diabetic patients in need of insulin infusion, patients with intoxication, patients with cramps in need of surveillance, and patients with disturbance in their electrolyte levels who need surveillance of their heart rhythm. Patients that should go to AVA but could go to other wards include patients with acute medical conditions that are expected to stay at the hospital for one or two days, patients with acute conditions with unclear diagnosis, patients with gastroenterological conditions until a move to the specialized gastroenterological ward is feasible.

Each ward also has its own set of guidelines like the ones at AVA. This means that some patients could be said to have a “home unit” where they need to go, while other patients do not. Since the patients that do not have a “home unit” could go to many different units, there is the need to have some sort of coordination or planning related to their flow. At the hospital, this coordinating role has been given to AVA, at least for patients going from the ED.

4.3 Managing the flow

The coordinating role of AVA begins when a patient is set to leave the ED. One staff member at a time has the role of the coordinator and has information on the patients at the ED, the occupancy at AVA, and the occupancy at the other wards. A doctor from the ED calls the coordinator and delivers information that a patient or more are in need of moving and presents the condition of these patients along with a recommendation of where they need to be moved. The coordinator then tries to look for an available spot for the patient, examining the information of occupancy at the other wards. If the patient has a clear need-to home according to the guidelines, then that is the ward where the patient is going to be moved. However, if the patient falls under the should-category the situation becomes more complicated and a destination needs to be decided depending on the occupancy of the other wards. If a ward other than AVA is decided on, the

coordinator's part in the process is concluded. The doctor takes contact with the decided ward and facilitates the move. If the patient needs to be moved to AVA, then the coordinator will receive more information about the patient's condition and the patient journal will subsequently be moved. This process, in which a patient is moved from the ED, can be seen illustrated in Figure 3.

“When patients are ready to move, a doctor from the ED calls me. They already have an opinion of where the patient should go, and in cooperation with the coordinator they decide where to put the patient. This could be to AVA, or it could be to the other wards.” (AVA Coordinator A)

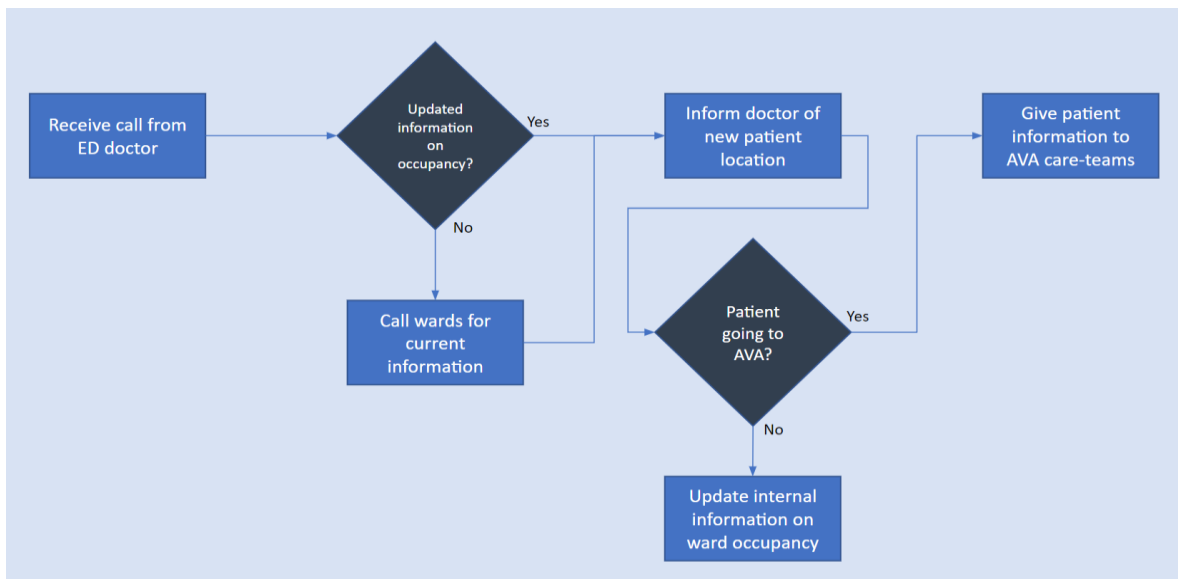


Figure 3 Process of patient being moved from the ED.

The coordinators also need to facilitate the movement of patients from AVA to the other wards. When patients are deemed to be in need of a move by the doctors, the coordinators get delivered this information along with a recommendation of where they should be moved. The coordinator then looks at the occupancy of the other wards and decides where they will be moved. This decision is again made with the guidelines in mind. The process can be seen illustrated in Figure 4. Other factors that need to be considered are regarding the needs of the patient and the specialization of every ward. For example, the hematological ward cannot receive patients with wounds or certain infections due to the reduced immune system of the patients there.

This all requires the coordinators to have information regarding the occupancy of the other wards so that they can make informed decisions of where a patient could be moved. They also require the medical information of the patient that is about to be moved so that the coordinator can, in accordance with guidelines, find a suitable location for the patient. At this point, it should be noted that the COVID-19 pandemic

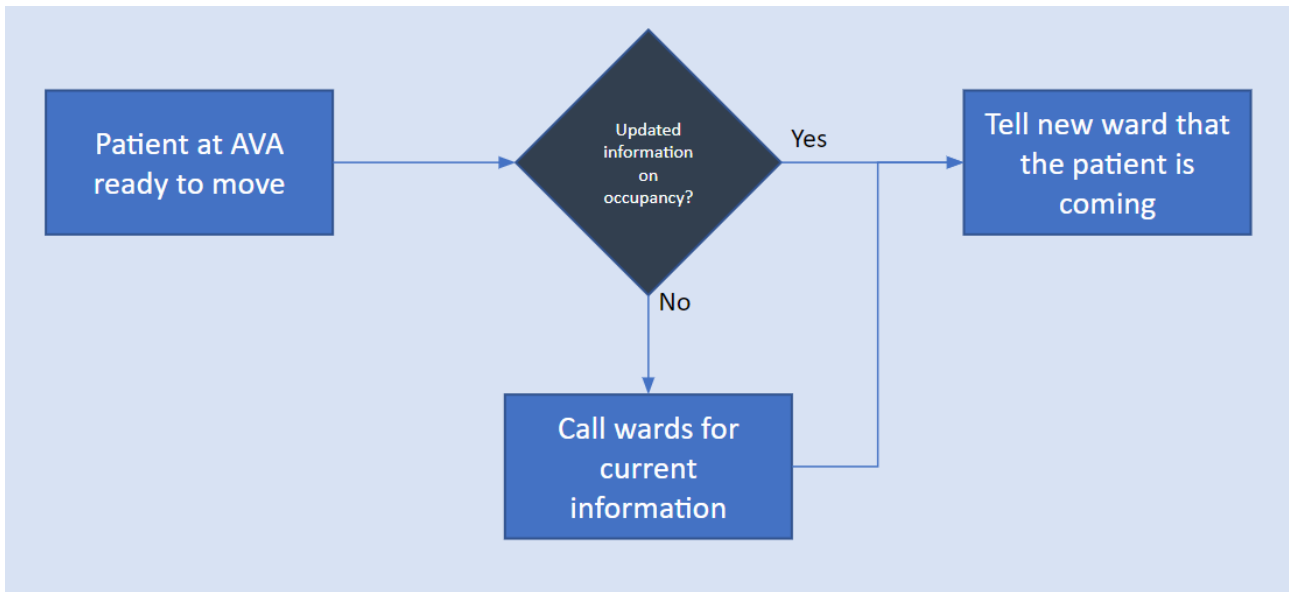


Figure 4 . Coordinating process for patients being moved from AVA.

has not significantly affected the current condition of the patient flow. Pandemic patients have their own flow which is independent of that controlled by coordinators.

4.4 Information

The day-to-day task of AVA management is to always know how many patients are being treated in each ward at Skaraborg hospital in Skövde. For this reason, the organization uses the online platform Belport, where each ward reports the number of patients who have a bed inside the units and the available number of beds. At the same time, information about patients and the condition of the hospital is also obtained from the Elvis care management system. Having this data makes it easier for the hospital staff to estimate the potential demand in the different wards in the coming hours or days.

“I have a list in Elvis that shows all patients at the ED. I can see notes on the patients to get a picture of where they might need to go later.” (AVA Coordinator A)

However, not every patient who visits the hospital needs a bed. This decision belongs exclusively to the doctors who will diagnose their problem and decide what their treatment will be. In addition, it is very difficult to determine the exact number of patients who will be discharged, as a lot of patients suffer from complex problems and doctors need to confirm until the last minute that their health is at an appropriate level so that they can be discharged from the hospital or move to another ward or unit.

To address this ambiguity, it has been decided that all wards will update their status at Belport every three hours from 08:00 to 20:00 (at 08:00, 11:00, 14:00, 17:00, and 20:00). So, their information at Belport will be more accurate. In case AVA ward wants

to know more details for a specific moment, it calls the staff of the wards and is informed in more detail. However, the decision wards to update their status every three hours is not always beneficial for AVA. Patient flow is continuous, so the available information and data are supposed to be constantly updated. Moreover, there are times that the Belport data is not accurate due to delays by the different wards. Also, there are no standardized procedures regarding how the staff should use Belport to describe all this necessary information, even though there are some routines. These are the main reasons why telephone calls to all wards have significantly replaced Belport.

“There is a mistrust for the numbers in Belport. 50% to 90% of the wards report their numbers in Belport in time. It varies who updates in time, it is not always by the same wards.” (AVA Coordinator A)

Each ward, additionally with the digital systems to which the other wards have access, uses other methods and practices to store their data. It has been observed that the coordinators have at their disposal whiteboards where there is the necessary information for each patient located in one of the units under their jurisdiction, excel sheets and files, as well as notebooks. This fact has created a small degree of dissatisfaction among the coordinators as they will have to record the same information in several places, and they feel that there is a lack of automation too. So, the flow of information moves with a slow pace to its receivers.

“In Belport there are always humans behind it. It would be better if it was automatic.” (AVA Coordinator A)

“I think we have a lot of meetings, documents etc., but there are always people behind it. It really needs to be straight from the hospital.” (Staff Manager)

Most patient health information comes from nurses. During their shift, nurses are in constant contact with patients and inform coordinators and unit managers about the progress of their health. They take care of the treatment and medication prescribed by the doctors for each patient, monitor and record their temperature, blood pressure and pulse, and provide medicines. However, the most critical information comes from doctors. They make diagnoses, write patient health reports, and make suggestions about which decisions would be best for patients' health, for instance which ward would be most helpful to move to.

AVA management starts from 11:00 every day to gather all the information about the bed availability of each ward, first from the hospital in Skövde and then from the hospital in Lidköping. So, it gathers all the necessary information it needs before 11:45. This is because AVA coordinators should have access to as much information as possible, as it is the next ward after emergencies.

“The AVA collects all the information until 11:45, because the (AVA) coordinator should have the whole full picture.” (AVA coordinator B)

Finally, at 11:45 there is an established meeting between the unit managers of the hospital. All the unit managers make sure before this meeting to know how many beds are available in their units and how many patients may be treated in them in the upcoming hours. These meetings are mostly conducted through online business communication platforms. During the meetings, there are discussions about the occupancy rate that each unit has and depending on the available bed positions they have. Afterwards, they discuss how many patients they can receive from the other wards.

4.5 Decision-making

In general, it was observed that decision-making in patient flow is a rather complex process, and a large number of factors affect the final result. The judgment and diagnosis of the doctors have the greatest importance in terms of decision-making. This means that the decisions about whether a patient should be admitted or be discharged are always up to the doctors. The other decisions about in which ward the patients should be transferred to are, however, mostly made by the coordinators.

It is very important, the doctors, especially of the patients who come from the ED to be involved with the whole process, otherwise the coordinators may not feel so confident regarding the unit they need to place the patients. The work of the coordinators involves a degree of complexity in their decisions, as if there are several patients with different symptoms waiting for a bed, they will have to sort out which patients best fit the specific units.

“The doctors should be involved from the emergency ward... and communicate where the patient fits. Otherwise, the coordinators have that feeling that ‘I need to make that decision’.” (Managerial staff)

Decisions can be divided into three categories. The first category concerns decisions in which one ward must receive a patient, the second concerns the decisions when a patient remains for treatment in a particular ward, and the third concerns the decisions that must be made in order for the patient to leave the ward, either to be discharged or to be transferred to another ward for additional treatment. A ward can pick up patients, not only from the AVA ward, but from the emergency rooms, directly from the patients' home or from another clinic or hospital. In every hospital, there is obligation for each patient to receive the necessary help. If a patient comes from the ED, then the AVA coordinator in consultation with the doctor from the ED finds the most suitable option for the patient. There are also patients, which arrive directly at a ward. Then each ward is responsible for handling the issue on its own. So, as soon as all the patients are

admitted to a ward, they will either occupy a bed in the appropriate unit, or in case there are no beds available, they will need to temporarily stay in another unit.

From the excerpts from Elvis regarding patients' visits to the hospital, the number of patients housed at a different ward than the ward in charge for their care was discovered. By checking for discrepancies in the listed ward in charge and the listed housing ward the numbers presented in Table 9 were gathered.

Right ward		Located outside ward		Percentage located outside ward
2019	Sum	2019	Sum	
Q1	11114	Q1	1282	10,34%
Q2	11109	Q2	1437	11,45%
Q3	10201	Q3	1439	12,36%
Q4	11164	Q4	1464	11,59%
Total	43588	Total	5622	11,24%
2020	Sum	2020	Sum	
Q1	10622	Q1	1378	11,48%
Q2	9864	Q2	1086	9,92%
Q3	10333	Q3	1612	13,50%
Q4	10739	Q4	1458	11,95%
Total	41558	Total	5534	11,75%
2021	Sum	2021	Sum	
Q1	9995	Q1	1299	11,50%
Q2	10114	Q2	1352	11,79%
Q3	9381	Q3	1669	15,10%
Q4	10300	Q4	1454	12,37%
Total	39790	Total	5774	12,67%

Table 9 Patients located inside and outside their responsible ward, broken down per year and quarter.

As per Table 9, it is made evident that there has been a slight increase in the proportion of patients housed at a ward different than the one in charge of their care when comparing 2019 to 2021. It is also shown that the number of patients at the correct ward has decreased while the number of patients at another ward has remained almost the same when comparing 2019 to 2021.

When a patient has to move from the AVA ward to another ward, then the situation may become more complicated. On days when there are enough beds available the situation is quite easy, but when there are no or only a few beds available it takes more time for the unit managers to analyze the situation and then make the final decision about how many patients they can receive. In essence, AVA's physicians know which ward will be best for patients. They write the patient health reports in order to deliver the necessary health care information to the next ward of the patients. AVA ward explained that physicians are trying to get more involved in the process. Furthermore, priority is given to avoid moving patients between hospitals, i.e. as much as possible Skövde patients stays in Skövde and Lidköping patients stays in Lidköping. Transportation can have a negative impact on the health of patients, and transportation might also take a lot of time due to a potential unavailability of ambulances or other means of transport. Transfers of patients from the AVA or another ward to another municipality elderly homes are also performed. According to the interviewees other clinics seem to have the same problems, since many times the municipality elderly homes cannot accept patients due to unavailability of beds and there may be issues with the schedule of the vehicle that will transport the patients.

This complexity manifests itself in the variability observed regarding at what time patients are moved. In case there are empty beds available, the decisions that allow the movements are made before the daily meeting with the unit managers which is conducted at 11:45. Otherwise, if the units are above 100% occupancy rate, then there is a time gap of waiting until 11:45 to check whether the units can receive new patients. If there are no available spaces, it is decided during the meeting of unit managers and the final decision is estimated to be made after 12:00. In several cases, it is observed that the patients have been moved in the evening, as some available beds needed to be vacated, but the usual time is in the afternoon.

“It depends on how many places there are. If there are vacant regular places before 11:45, they can get that decision before 11:45... and then it will be after 12 o’ clock. Sometimes we move patients in the evening because we have to free up spaces. But most of the time they are moved in the afternoon.” (Staff Manager)

The portion of patient discharges in relation to the number of admitted patients per time span was calculated and is presented in Figure 5, 6, 7, and 8. The time spans are 06:00-11:59 for *Before noon*, 12:00-17:59 for *Afternoon*, 18:00-23:59 for *Evening*, and 00:00-05:59 for *Night*. As can be observed from the graphs, the proportion of discharge compared to admission changes drastically depending on the time of day. It can be observed to be at its lowest at night, with discharge being almost 28% the size of admissions, then increasing before noon to about 77% the size of admissions. During the afternoon hours the nature of the proportion changes, showing that more patient discharges than admission occur; The size of patient discharges is 154% of that of patient admission, meaning that the discharges were 50% larger than admissions.

Following that, the size of the patient discharges shrinks to 51% of admissions during the evening.

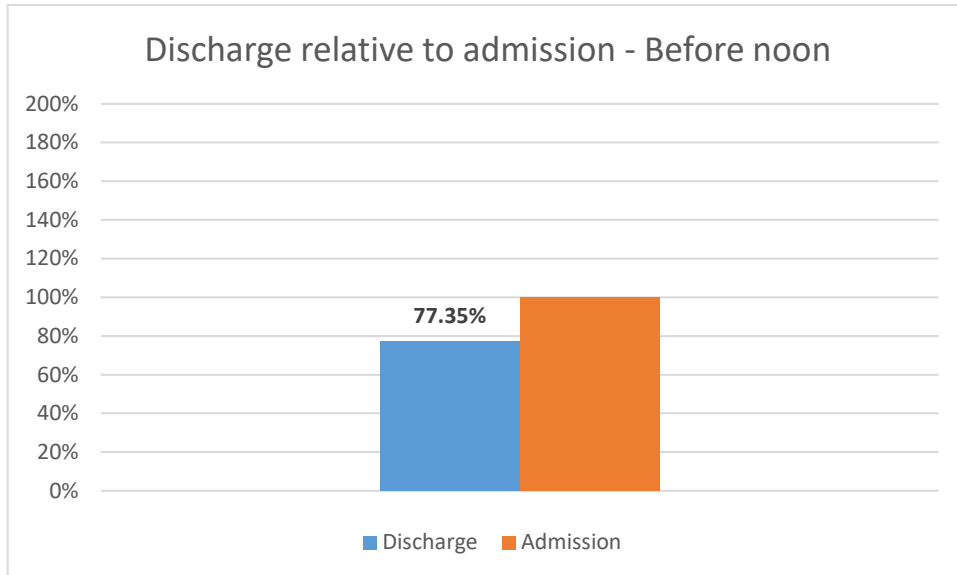


Figure 5 Discharge relative to admission - Before noon.

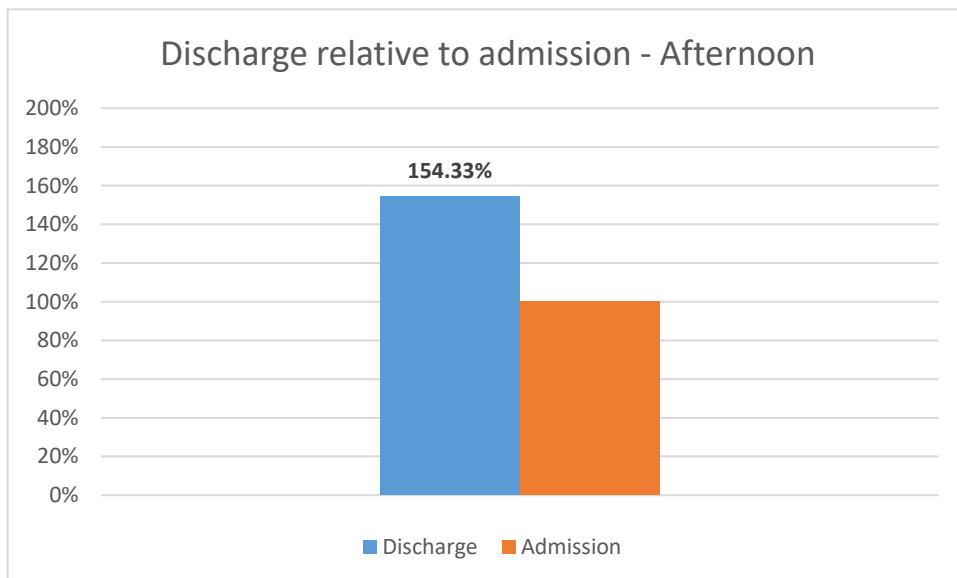


Figure 6 Discharge relative to admission – Afternoon.

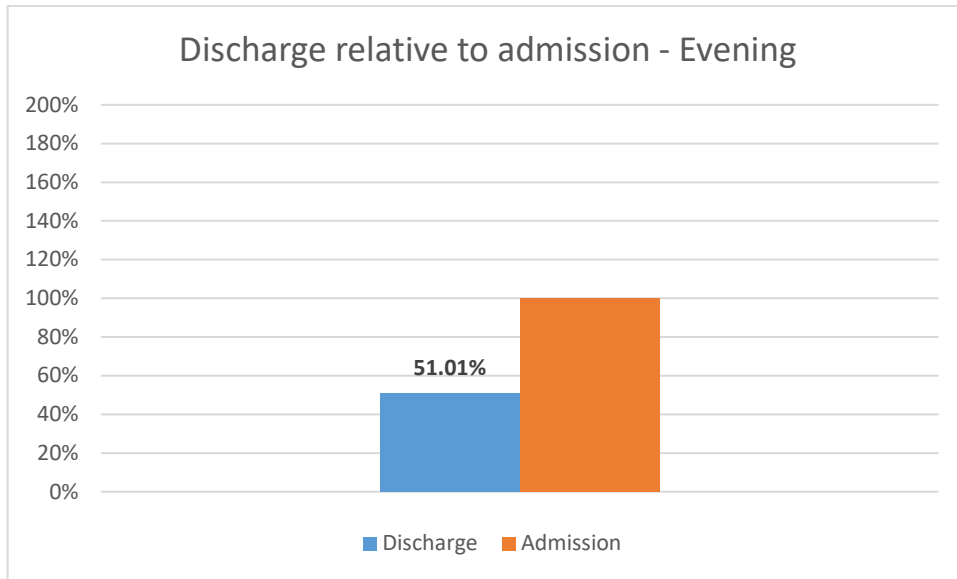


Figure 7 Discharge relative to admission – Evening.

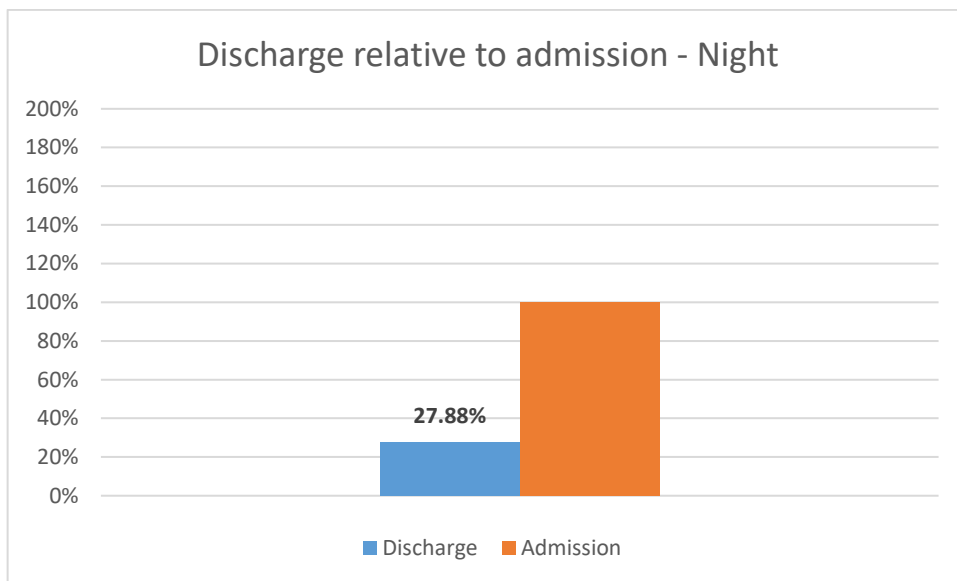


Figure 8 Discharge relative to admission – Night.

The admission and discharge also change form depending on if it is a weekday or the weekend. From the data on admission and discharge was on a per day basis with information regarding the date it was possible to calculate the different averages in discharge and admission depending on if it's a weekday or a weekend. The calculation was done using data from the whole hospital, as well as with data from just the AVA ward. This data is presented in Figure 9 and 10. As can be observed, the average hospital admissions are higher during the weekdays compared to the weekends. The same can be said of the patient discharges; they also show a decline during the weekends. When comparing the size of discharges in comparison to admissions however, the data shows that the average number of patient discharges are higher than

the average admissions during weekdays. During the weekends this relation is flipped, instead the average admissions are higher than the average patient discharges. Both the pattern of higher averages during weekdays, and the relation of discharges compared to admissions are reflected in the data concerning only the AVA ward.

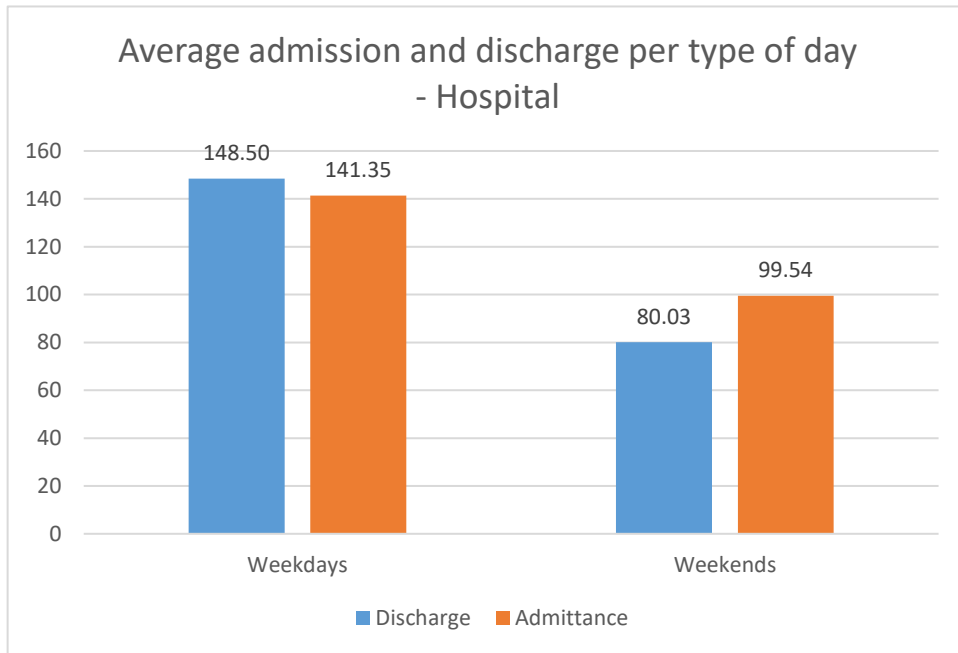


Figure 9 Average admission and discharge per type of day – Hospital.

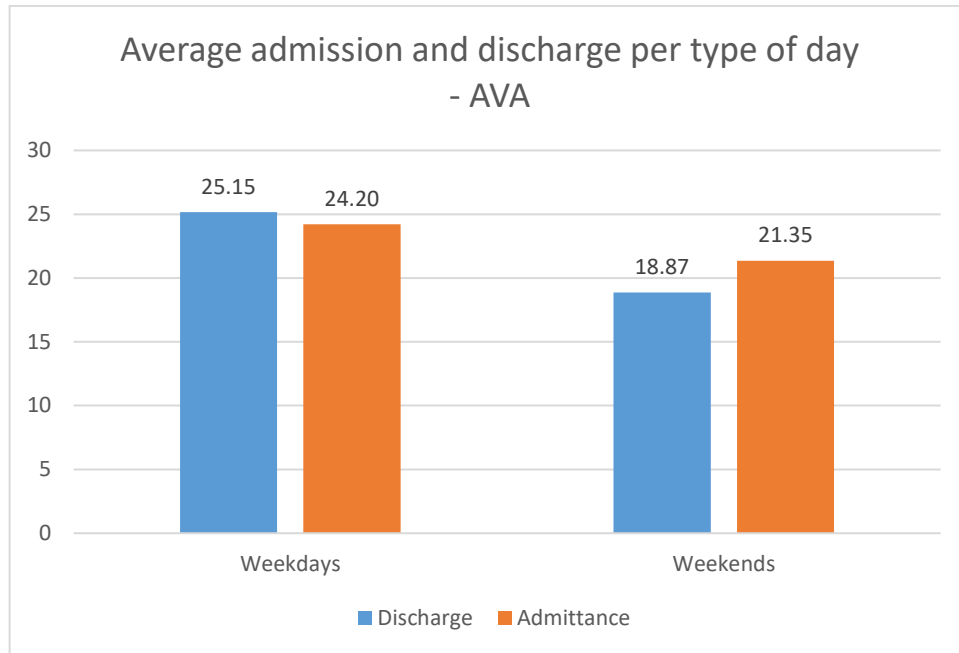


Figure 10 Average admission and discharge per type of day – AVA.

For the hospital, the optimal scenario is to be able to make the decisions as soon as possible and there is the opinion from the AVA staff that the solution can be the patient flow to become more effective, in comparison with other solutions, for instance the immediate increase of the capacity with more beds. Beds are not the only necessary resources which are demanded in order to treat acute patients. There should be enough staff, such as nurses and doctors, as well as necessary medication. A possible increase in beds with the same capacity in resources would not change the problem, as the hospital would not be able to serve and care for all patients.

4.6 The patient flow process

4.6.1 Patient flow between ED and AVA ward

ED patients can be transferred to the AVA ward if this is decided by their health care responsible doctor. Once this happens, the doctor should call the coordinator and inform them of the decision and condition of the patients to be transferred, as well as whether these patients need to or should be transferred to AVA. For its part, AVA should have available resources, mainly available beds, to be able to receive and then care for the patients otherwise the transfers are not possible.

“...the doctor comes to us and says: "I want to put this patient here". It may even be the case that the doctor is clear that: "I want this patient for this ward". Or it could be that: "this patient must be in AVA" or "this patient can be anywhere", so in any ward.” (AVA coordinator C)

Coordinators have access to Belport and Elvis information systems. Most of them can estimate how many patients may come to the AVA ward based on their years of experience doing this job. For instance, the coordinators can see the triage indicators at Elvis of the emergency patients. If a patient has an orange or red triage indicator, it is expected to be hospitalized. Patients with green indicators mostly go home after their stay at ED.

“I watch the triage section in Elvis. Is it an orange or red triage indicator on the patient? Then you expect it to be hospitalized. But is it a green triage for example? Then maybe you do not really focus so much on it, but then you think it might go home.”

(AVA coordinator C)

Also, the nurses treating patients within AVA inform the coordinators about the health of the patients. Most nurses have many years of experience too and are able to advise the coordinators about when patients will leave the ward judging by how patients respond to their treatment. Additionally, the nurses visit the AVA coordinator room and give a summary coming from the comments of doctors about the situation in AVA, which patients should be discharged and who will need to stay. All these channels of information ease the role of coordinators. The most common issues they face are when beds are not available for the ED patients who need to come to AVA, and they are called upon to make the right decisions. However, physicians are also actively involved in this process by supporting AVA coordinators with their medical advice and suggestions.

“And then the nurses come out to us and say about any patient (the doctors) want in a specific ward... which patients may have to stay on AVA, or which patients will go home, or may go home” (AVA coordinator B)

At times when the beds in the AVA are full and the patients in the category need-to be transferred to the AVA, the ward informs the doctor at the ED that this transfer is not possible and alternative wards should be found in the specialized departments in order for patients to move. However, if patients in the category should be transferred to AVA, this movement will take place as soon as an available bed in AVA is released. Once this happens, the ED doctor informs the AVA ward of what it needs to know about these patients and additionally writes their health reports. This is where the first bottleneck in patient flow after ED is created, as there is no movement in the flow between ED and AVA, and in addition new patients visit the ED and the number of patients attending the emergency area is increased.

“And usually, it is the case that in the morning there are no spaces, then I take the report from the doctor and then this patient has to wait for there to be a vacant care place somewhere.” (AVA coordinator B)

When a patient arrives at AVA, the last step of this part of the process is to find the most proper unit for the patient. AVA coordinators mostly try to place patients into groups that have approximately the same needs. Then the responsible nurse or assistance nurse is notified to communicate and report this movement decision. The movement completes when the nurse calls the AVA coordinator and inform that the patient is ready to be transported in a chair or bed. The aim is that the patient to be picked up from ED within half an hour.

“And then I look at the situation in the department. We have care weight measurement in the department, so then I might see that it is heavier in a group and maybe easier in a group. And then I choose the group that has a small value.” (AVA coordinator B)

4.6.2 Patient flow between ED and the specialized departments in Skövde

If it is decided a patient to leave from the ED and go to a ward that belongs to either the medical or surgical department, the process is more complicated than in the AVA ward. The main reason is because more actors are involved. In this case the doctor should call the AVA coordinator too and inform about the decision and the condition of the patients who should be transferred, as well as suggest which is the most suitable place for the patients.

“The doctor seeks us out, gets an idea of where the patient is fitting best and then we try to get the patient to the right place, in the right ward.” (AVA coordinator A)

The AVA coordinators monitor through Belport the situation that prevails regarding the availability of beds in every part of the hospital organization. The reason why doctors is preferable to turn to AVA coordinators is to make it easier for them, avoiding spending more time calling other wards and departments to find out if there are vacant places for patients to go. Therefore, AVA has been given a central role in terms of coordinating the patient flow. This is the reason that AVA coordinators should have full knowledge of how many patients the other wards can support under their specific resources. Moreover, the coordinators have the proper feedback from the information systems, as well as from the nurses.

However, the rest of the wards sometimes fail to update their status to Belport every three hours. This fact delays the patient flow process, as AVA coordinators will have to call the wards who did not update their status, as a result significant time will be lost. In the mornings, there are often not many admissions, but at the same time there are not many discharges. During this time the specialized departments are overcrowded in their wards because except from the acute patients of these departments, there are patients who are there temporarily until a suitable ward and unit is found for them, but also

because elective patients visit them too. Therefore, most wards cannot pick up more patients during the mornings.

“But there are not so many admissions in the morning. Then it is clear that there are some days where a lot of patients come in the morning. And usually, it is full in the hospital when you get on.” (AVA coordinator D)

In the afternoons there are vacant beds as elective patients leave and several patients are discharged, allowing patients to be transferred from the ED to specialized departments. For this type of patient moves the responsibilities of the coordinator is only to verify to the doctor of the ED that the specialized ward the patient needs to be transferred has an available bed and to report the move for those patients. A person from the ED then takes contact with the specialized ward and organizes the moves with a similar way as it happens when a patient from the ED is transferred to AVA.

“ED patients can be transferred directly to specialized departments too. It is usually finished then. In that case, just document that there is a place taken in that department in our own papers. But otherwise, nothing more. I do not take a report for that patient.” (AVA coordinator C)

4.6.3 Patient flow among AVA and specialized departments

As described before, most acute patients are transferred from the ED to the AVA ward or a specialized ward. But some patients need to be transferred from the AVA to a specialized ward or from one specialized ward to another one. Movements between two specialized wards essentially only happen if the patients are temporarily in a different ward from the ward they should be due to the unavailability of beds. And for this reason, when there is an available bed, they are transferred to the ward where they should have been from the beginning. In general in the purpose of the hospital is to limit their movements and to make only the necessary ones, because it was observed by the staff that movements may risk the health condition of the patients.

“If there are places in the ward where the patient belongs, then maybe they call me and ask me if I agree and it's OK for me to make the movement. Only I can allow this. But it is said that we should try to avoid moving between departments as much as possible. Some are patients who really need to be in the right ward, because they will have the proper treatment, then we try these to move them. But moving for the sake of moving is not done, only if there is a real need for it.” (AVA coordinator C)

It is very important for the AVA coordinator around 11:00 every day to have knowledge about the status of each ward of the hospital in Skövde regarding the empty beds, since after 11:15 site meetings are held, and this information is transferred to the AVA unit manager. The AVA unit manager then collects the relevant information from the

Lidköping hospital and at 11:45 participates in the meeting with all the unit managers to make decisions about the transfers of the patients. In this meeting there is a discussion about how many patients can receive the specific wards and the specific number of patients is decided. This information is then shared with the coordinator and the coordinators of the Lidköping hospital. The only exception is the weekends where only two managers participate in the meeting and have the authority to make specific decisions. Then the wards organize the movements and ensure the way the patients are transported, as well as to receive the patients' health report.

“If they (the wards) have not reported then, I usually call there in order to learn the exact numbers. And it is especially important on the weekend that it is updated. On weekdays, it is all managers who are in that meeting, they usually know the available places. But on the weekend, only two managers have the meeting, and then I as coordinator must make sure that it is right.” (AVA coordinator B)

4.7 The overcrowding problem in the hospital

One of the most important problems that Skaraborg Hospital faces and is directly related to patient flow is the occurrence of overcrowding of patients. The overcrowding of patients causes several disadvantages in the organization, as it prevents the smooth flow of patients inside the hospital and creates the appearance of bottlenecks, long queues, and waiting times, as well as reducing the quality of health care services of clinics.

In the existing research, an attempt was made to identify the various reasons why the work content of the coordinators becomes more difficult to be executed. Its results showed that the main problems the coordinators of Skaraborg hospital faced consist of organizational, procedure, human factor, decision-making, and capacity issues.

4.7.1 Fishbone diagram

The overcrowding problem was assembled into a fishbone diagram, Figure 11, showing the relation of experienced problems. Items in the diagram came from both interviews and a workshop in which the fishbone diagram was finalized.

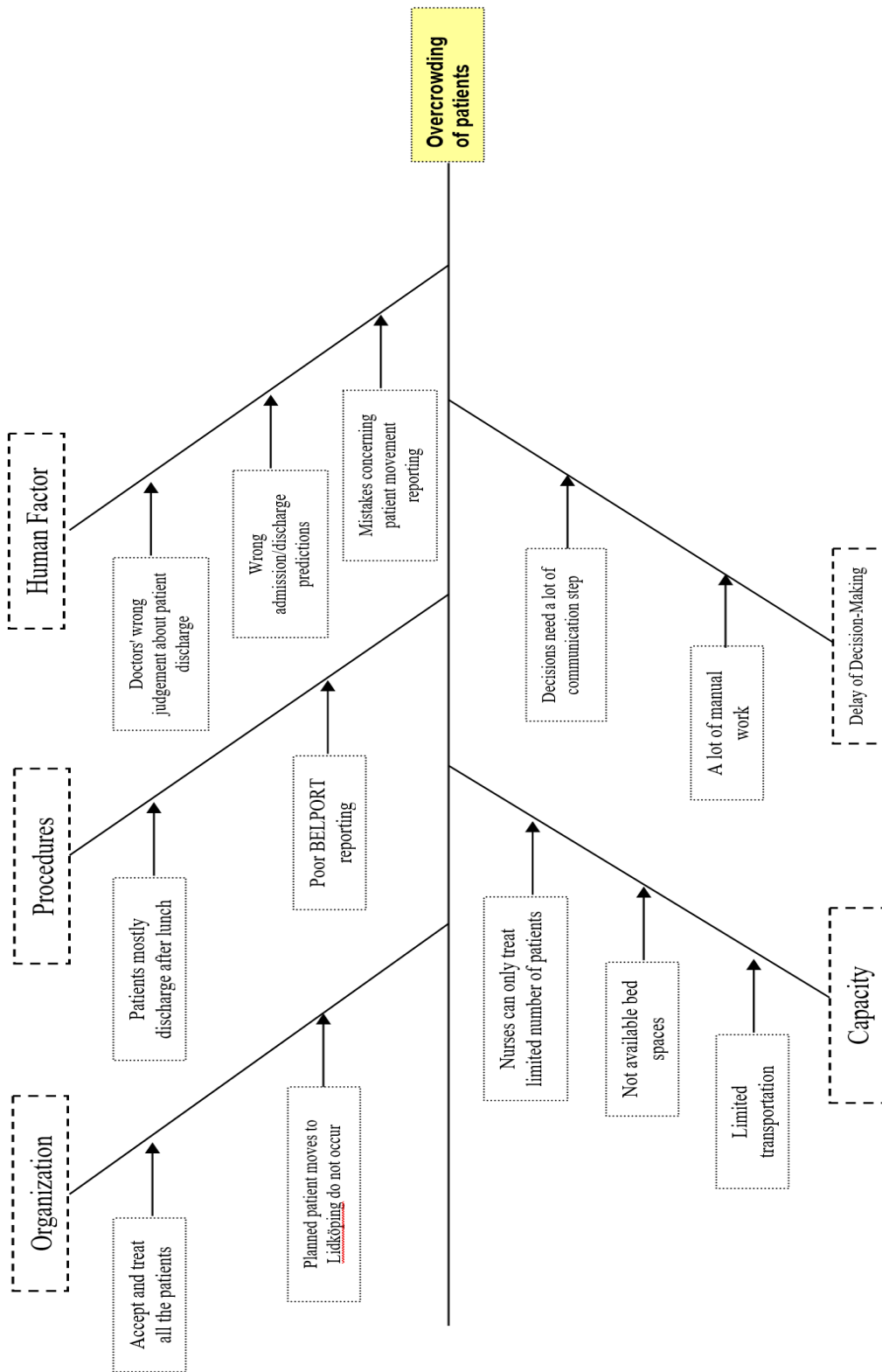


Figure 11 Fishbone diagram of the overcrowding problem.

4.7.2 Organization issues

Like any health care organization, Skaraborg hospital is responsible for providing medical care to any patient who visits it. Therefore, even if there is no bed available for some time inside the hospital, the organization will continue to receive patients increasing the chances of creating an overcrowding situation. Furthermore, all the patients admitted to the hospital do not always have ED as their starting point in the patient journey. Many times, patients visit the various specialized wards directly and are treated immediately there, making it more difficult to the coordinators to monitor in terms of bed occupancy. At this point it should be noted that the coordinators do not have the authority to decide how specialized departments should fill their vacancies.

“Sometimes patients do not go home as we think. They can receive patients from the reception that we do not know of before. It may also be a situation, which we call “open returns”. It is mainly cancer patients who are allowed to come directly to the ward, and we do not know that until then. We have no control over that.” (AVA coordinator D)

“But then it is not always true, there may be some patients that we do not find out about. “Open returns” and cancer patients who come directly to wards and so on. They come from home and only call the ward, and it is not certain that the ward calls and tells the coordinators that they have had a patient. Then maybe you think you have spaces that do not exist.” (AVA coordinator E)

Although the hospital cannot refuse to take on patients, the hospital wards can refuse patients within the hospital to move from one ward to them. There are several reasons why this happens. Initially these wards may already be overcrowded with patients and not update this on the coordinators. They may also feel that they cannot handle more patients as the staff is already busy with the existing patients. There are clearly cases where the condition of patients is complicated, and they need more care than usual, making nurses devote more time to them. Finally, there are patients who do not specifically belong to a ward of a specialized department. This prevents the wards from receiving these patients, either because they do not know how to provide proper treatment to them, or because they prefer to fill these positions with patients whose profile best fits the specialized ward, suggesting these patients to be transferred to other units of the hospital.

“They say they may not have space. They may say: “No, but we have locked rooms”, “We have patients who need their own rooms, so we do not have this place”. Even though (an available bed) is on paper, it does not exist. And it is very difficult to argue against, I am just accepting it. You may not be able to add patients. Then you have to respect that.” (AVA coordinator B)

“But that is because the patients are not in the wards where they should actually be. And then some wards have a lot of elective patients who come in to maybe have surgery during the day and then of course they also take place. Some wards may write “full” even though they are not full, because they do not want more patients, it also happens. But overall, it is because there is a shortage of care places and a shortage of staff at the hospital.”(AVA coordinator C)

“It is often these people to say “no, we are full.”, “we get patients tomorrow, we cannot take more patients today”, “This patient is too sick.” Unfortunately, it is usually about the wards thinking that the patient is too demanding. There are those who do not want to take those patients. So, there is too much nursing with the patient, and they want patients who take care of themselves.” (AVA coordinator D)

Even the instructions that coordinators often receive from their managers create ambiguity about how to determine which patient corresponds to each bed. There are managers who emphasize that the patients should be in the ward where they should be, while others that the occupancy rate should be covered, so a number of patients can be transferred for some days to a unit of another ward. Therefore, the trade-off between these two policies is not obvious to the coordinators.

“Some managers think that it is a given that the right patient should be in the right ward first and foremost. While some people think that this is very simple: firstly, you need to fill all the spaces.” (AVA coordinator E)

Finally, there may even be planned patient moves to the hospital of Lidköping with the intention to create some available bed positions. However, these transfers are seldom carried out. Apart from the fact that the patient or the hospital of Lidköping may refuse this transfer because its capacity does not allow it, there are other reasons that explain the phenomenon. Generally, movements are avoided, which may aggravate the state of health of the patients or there may not be suitable patients to transfer to the hospital in Lidköping, since the hospital is smaller with less available resources. Additionally, staff or ambulances may not be available on time for the transfer.

*“And then there are many patients who may refuse to go to Lidköping. And relatives call and are very angry that we should send them to Lidköping and so on.”
(Managerial staff)*

“So that it can be a great inconvenience. Like last night, we had maybe thirteen vacancies in Lidköping and full here in Skövde, but we did not get any patients to Lidköping because there are none that are suitable to send. And those who would go to send them might refuse.” (AVA coordinator C)

4.7.3 Procedural issues

An obvious problem with patient flow related procedures is the way digital systems such as Belport are used. Coordinators often need to monitor two or more platforms to get a complete understanding of the hospital situation. In addition, during the interviews the coordinators described that the way Belport is used lacks in standardization and there is often a lack of understanding by the people who report on the online platforms resulting in routines being omitted or not followed.

“Belport right now is bad, overall bad. It is usually not in time, but you often have to call and ask and make an appointment. And so, there is a lot of misunderstanding as well. You report in different ways, you count in different ways. And especially during on-call time, when they do not have a person with coordinator duties in the department.” (AVA coordinator B)

Another issue that arises regarding procedures is that most patients are discharged after lunch. Discharge rounds are performed at specific times, and they need a lot of time to be completed. Also, the large number of doctors and the non-constant communication between doctors and nurses slow down the pace of hospital discharges.

“But it is usually always in the afternoon that the wards send their patients at home. So, we are ready to move our patients” (AVA coordinator B)

4.7.4 Human Factor issues

Another factor in creating overcrowding situations is the inevitable human factor. Human factor errors have to do with wrong predictions from the various wards about the number of patients that may be admitted and discharged. Also, doctors are often under a lot of pressure in making their decisions and this can lead to wrong judgment about patient discharge. Moreover, it is noticed that there are mistakes concerning patient movement reporting. Many times, doctors transfer patients from ED to specialized departments and forget to inform the coordinators about these movements.

“They must update continuously if there are any changes. But it is clear that it is very stressful at night, of course, you may not think about calling. You may have a patient in the middle of it and you may not think about calling to the coordinator and telling them that another patient has arrived.” (AVA coordinator D)

Finally, coordinators described that many times necessary information from Belport is missing. This can happen at different wards either because they report inaccurate data to Belport, or they do not update their status every three hours as they should. Interviewees testified that they had experienced cases where wards informed that they did not have beds available according to the system, while, at the same time, it appeared that empty

beds did really exist. in Belpport. There could also be times when the wards have to care for more patients than is expected, simultaneously being informed that elective patients will arrive at the ward soon or already having patients who demand complicated and time-consuming care procedures. However, this fact makes the work of the coordinators more difficult, and they need extra time to handle this situation. Also, it is even more tough for them to determine exactly how many beds are available within the hospital.

“Some wards are great, but some wards can write long novels in the comment box sometimes. And then you still do not understand the circumstances of the department There may be other things that are a bit confusing and then you have to call. There is a routine on what to write, you get certain departments that do not follow it, and then it becomes an extra step to call.” (AVA coordinator B)

“It is not uncommon to have to call ten or fifteen wards at eight in the evening. There you can sit for an hour and a half or something and you have all the numbers collected.” (AVA coordinator C)

“Then there is the problem that the departments do not update but that you still have to call. Last night I worked as a coordinator and at 20:00 all departments must report. But there was only one ward that had reported at 20:00. So, then I had to call around for 45 minutes to all departments and hear their numbers.” (AVA coordinator E)

4.7.5 Decision-Making issues

Even the way decisions are made in patient flow activities can lead to overcrowding of patients. From the description of the patient flow process, it can be led to the conclusion that the direct communication between all the actors involved in it is at a low level. In order for a decision to be made by the coordinators they must be in constant contact with the doctors, the nurses, the coordinators at the Lidköping hospital, as well as with the staff at the various local elderly homes at the municipalities. Moreover, even if they are led to a decision, there is a possibility that some of the other actors mentioned earlier will state their objections and the whole decision-making process will be repeated from the beginning. This delay in decision-making decreases the patient flow efficiency, as the movements of patients are delayed and bottlenecks are created.

Furthermore, the communication among many and different actors inside a hospital has a lot of manual work. The coordinators explained that currently they need a lot of time to be able to collect all the data about the available beds from the wards under their responsibility. Also, this data is constantly changing so this process is repeated. There is also a need to confirm the reports of the patients that might be discharged. Their work requires knowledge of how many patients will actually be discharged so that they can later fill the vacancies with patients waiting in queue or with patients being temporarily

in a ward whose specialty does not match their disease. Finally, doctors need to fill their reports to give the right instructions mainly to the coordinators, but also to the rest of the hospital staff, and nurses who must communicate as well as prepare the movement of the patients. The high workload of the staff apparently slows down the pace at which decisions are made, and therefore the pace of the patient flow.

4.7.6 Capacity issues

Finally, one of the most crucial factors for overcrowding in all hospitals is limited capacity. Unfortunately, hospitals do not have an unlimited number of beds and staff (doctors and nurses). Furthermore, the available nurses can only treat a specific number of patients in order to ensure patient safety and a sustainable work environment. Finally, transportation capabilities are also limited. The number of available ambulances is limited at any given moment, why patient movements cannot all take place at the same time.

“It depends on where they go from. From AVA, we called the transport, and they say they come as soon as they can, and we cannot hold on and make them come quicker. After that in the evening the transportation is less.” (Managerial staff)

5 Discussion

5.1 The patient coordination process

The research is the first to describe the patient coordination process within a hospital in Sweden. The main goal of most health care managers at this current time is the continuous improvement of health processes so that organizations can cope with the ever-increasing demand for their services (Hoyem et. al., 2018; Sanner & Ovrelid, 2020). For this reason, they resort to established and non-established methods of process improvement, with the most popular option being the application of lean management methods and tools (Tlapa et. al., 2020). However, in order to achieve improvement, it is necessary for the organizations to have knowledge about which are the inputs and outputs in their patient coordination processes, and which is the interaction between the resources and staff.

Therefore, learning is a necessary part of process improvement. The more a process is understood about how it works overall, the easier it is to improve. At Skaraborg hospital where the study took place, there was no formal design and definition of how the hospital coordination process should evolve, but it emerged from the experience of management and staff working at the hospital for many years. Right now, according to the staff of the AVA ward, it appears that there is an awareness of which factors influence the patient coordination process of the hospital combined with corresponding measurements.

More specifically, the most important factors that determine the decisions that coordinators and unit managers have to make are the bed occupancy and the number of available beds. For this reason, coordinators are constantly collecting data on these variables either through Belport or by calling the wards in specialized departments. However, the way the process is managed and controlled relies on tacit knowledge, which means that the staff has some instructions, but for the most part the coordination process management actions come from the experiences they have. Currently, it is observed that the patient flow consists of several and different roles, nevertheless the coordinators of AVA wards seem to have as a priority the general management of the patient flow of the hospital, while the other wards give more importance to how their own ward should be managed better. It is also observed that the hospital staff from a ward often makes decisions without considering how and to what extent they affect the other wards within the whole hospital group.

The study can help Skaraborg hospital achieve the transformation of tacit knowledge that currently characterizes patient flow into a more formal way of gaining an improved patient flow management. The organization can use research as a starting point to learn

how the patient coordination process actually works and to acquire, communicate and use this knowledge to have immediate and also indirect benefits.

Skaraborg hospital has assigned to AVA the central coordination of the entire hospital in Skövde, with a special emphasis on a wider approach regarding the patient flow management. Patients in addition to ED on their patient journey can visit other wards before being discharged from the hospital, so the problem is not only limited to the flow of patients in ED. Flow problems on a ward can cause problems also in other wards linked with it. For instance, lack of available beds in AVA ward would be an issue in ED, as patients could only be transferred to specialized departments, confirming that with a broader approach, health care organizations will be able to increase their overall patient flow efficiency (Gualandi et al., 2020). However, this does not mean that the implementation of a wider plan does not involve difficulties for health organizations and all their functions are effective.

Overall patient flow is quite complicated (Olsson & Aronsson, 2015). A hospital consisting of many different wards where each has a different specialization, as it was seen, increases the degree of complexity in terms of the patient coordination process. The hospital coordinators in their decisions have to take into account many different factors depending on the condition of each patient, but also the communication channels, with different wards and roles that they need to constantly have, are many. Therefore, in order for the patient flow to function smoothly, there must be full alignment by all the staff roles (doctors, nurses, administrative staff) from every ward. In case a part of the hospital is under-functioning, it affects the proper functioning of the others. This has also been highlighted in the literature, as it is argued that health care organizations currently place greater emphasis on finding solutions in a single department compared to the entire hospital (Hoyem et. al., 2018; Luther et. al., 2017; Sanner & Ovrelid, 2020).

The role of the coordinators at Skaraborg hospital seems to be quite accurate and the coordinators showed that they knew their role within the organization. Moreover, as Izumi et. al. (2018) claim, the skills they need to have, are not specific. However, the coordinators in AVA ward had experience in this position, as well as communication, and negotiation skills, attributes that Wise et. al. (2022) explain that they need too.

An efficient patient flow needs the optimal use of medical care of the patients, physical resources, as well as of internal systems (Tlapa et. al., 2020). In order for the patient flow to be considered to have the desired results, not only the doctors with the nurses must provide the appropriate care to the patients, but also the hospital must be able to provide beds directly to its patients and an integrated information system to its staff, which manages the different aspects of the health care processes. From the results of the research, the last two areas are in greater need of improvement, as the medical care of the patients seems to be at a high level.

Additionally, it seems that the coordinators in Skaraborg hospital have similar experiences with the coordinators from the hospital in Norway, where Sanner and Ovrelid (2020) conducted their research. The coordinators there had many times to face the reluctance of the other wards to accept new patients stating different motivations and excuses. Furthermore, another obstacle the two hospitals both faced was the priority that each ward gave to maintain its own capacity. Finally, Skaraborg hospital is not the only one that its online platform is not always up to date, since the hospital in Norway had similar issues.

5.2 Problems experienced by the coordinators

During the efforts of collecting data and identifying the problems faced by coordinators in managing the patient flow, the state of the relationship between AVA and the other wards came up several times. As did the problems with trustworthy and timely information, and the skew of patient discharge during the afternoon, leaving the mornings overcrowded. How these problems relate to previous research might provide insight into potential improvements to the coordinating process in the future.

5.2.1 The relationship between AVA and the other wards

Derived from the interviews was data suggesting that there currently exist problems with inter-organizational communication. The data indicates that there exists a level of animosity between AVA and the wards receiving their patients, an animosity directed by both parties. In fact, from the workshop conducted with staff members from the AVA ward in which a fishbone diagram regarding overcrowding at the hospital was designed and discussed, the poor understanding between AVA and other wards was pointed out as the most important issue (See Figure 11).

Staff members from wards other than AVA also conveyed that they experienced poor understanding between them and AVA. They expressed that they felt like the coordinators at AVA did not understand their situation, for example, that they sent patients unfit for their ward (See section 4.7.1. Organization issues). In the same fashion staff members at AVA expressed the opinion that the other wards did not understand the hospital's complete objective and the important role of the coordinating process.

This relationship between AVA and the other wards has been pointed out by the coordinators as leading to direct problems in the coordinating process (See Figure 11). Poor understanding is said to lead to poor communication and reporting. In turn, the coordinators claim that extra work and effort are required on their end; needing to collect information that is missing or verify reported information that is unclear or mistrusted. This extra work and effort obviously take time away from other patients in need of transfer or staff at AVA in need of support by the coordinators in other ways. In addition, the coordinators' decisions are sometimes met with direct questioning by

the receiving ward, slowing down the coordinating process further as well as furthering the animosity between the two parties (See section 4.7.1. Organization issues).

As stated by Drupsteen et al. (2013) the patient flow is said to benefit from collaboration between actors in the flow. The actors in the current coordination process do, despite the communicated issues of animosity, share information and collaborate. Of the four integrative practices outlined by Drupsteen et al. (2013) (See section 2.4. Internal communication) waiting list information, and planning information is shared at least to some extent. However, according to the interviewed coordinators, the timing and reliability of the shared information are lacking (See section 4.4. Information). The lack of understanding between AVA and the other wards that were established during the interviews is, according to the coordinators, a driving force in the quality of the collaboration. This aligns with the view expressed by Kreindler (2017) in that different parts of the organization should align for a common purpose, and not take adversarial positions toward each other. This sentiment is shared by Athlin et al. (2013) as well.

As such, given the current understanding by the coordinators themselves, and supporting literature, the hospital should make efforts in minimizing the animosity between AVA and the other wards by aligning them with a common, hospital-wide, goal. Of the literature in Section Internal communication, only Athlin et al. (2013) had performed its observations at a Swedish hospital, but the lessons of mitigating lack of teamwork and non-aligned patient transfers from all the literature should still hold true for the situation experienced in Sweden at AVA.

5.2.2 The discharge process

As mentioned in the literature review part of this report, the discharge process plays a vital role in the overall med management of a health care organization (See section 2.3. The discharge process). Planning for discharge as well as spreading out discharges more evenly have been identified by previous studies as beneficial to the patient flow (Ortiga et al. 2012; Destino et al, 2019). Therefore, it is of deep interest to what extent patient discharge is planned today, and what the current timing of discharge is.

From the performed interviews it became quite evident that the discharge process at the AVA ward specifically, and the Skaraborg hospital generally, was not planned nor distributed evenly. It was mentioned that members of staff do communicate a general estimation of discharge towards the later stages of a patients stay at the ward, but from this report's findings such estimations were only given a couple of hours before discharge. Similar findings were found in relation to the discharge process of wards receiving patients from AVA, and the ED: One of the pieces of information presented in the software Belpport was an estimation of the number of patients soon to be discharged. Again, this estimation only came for patients a few hours away from discharge. According to the literature (See section 2.3. The discharge process) scheduling discharge at least a day in advance enables better bed coordination, and as such might

be an area where AVA and the hospital in general can look for improvements in its discharge process.

The timing of patient discharge became clear from the interviews; patients were to a large extent discharged in the afternoon. This also became evident from the quantitative data which showed that the number of discharges grew dramatically in the afternoon. In fact, the average number of discharged patients increased from 25 patients before noon, to 84 patients after noon i.e., an increase of 236%. However, one should note that the data also showed an increase of hospital admissions in the afternoon as well. While this points towards some planning when it comes to the timing of discharge the increase in admissions is of a smaller magnitude than the increase in patient discharge. In fact, the admissions are proportionally larger than patient discharges during mornings, evenings, and nights and only becoming smaller during the afternoon. The relative size of discharge compared to admission is smallest during the night, being roughly 28%, meaning that hospital admissions are more than three times the number of patients discharges. During the afternoon the number of patient discharges instead overtakes the number of admissions resulting in patient discharges being 154% of the hospital's admissions during that time frame. In other words, the hospital fills up all their available spaces during the nights, mornings, and evenings, and then attempts to empty it out during the afternoon. This of course results in periods of overcrowding where coordinators are given less choice in where to place patients.

Both qualitative and quantitative data points towards a skewed timing of patient discharges, showing a favor towards discharge in the afternoon. According to Destino et al. (2019) providing earlier discharges contribute towards an improved patient flow. The current discharge process at AVA does not easily facilitate an earlier discharge of patients in its current configuration since discharge is always followed after doctor rounds which in turn only occur before noon. From the interviews it became apparent that the only scheduled doctor rounds are performed before noon, and patients identified as being fit for discharge are then sent from the ward in the afternoon. While there are some patient evaluations done in the afternoon, it does not constitute a complete doctor's round.

Evidently, Ortiga et al. (2013) and Kreindler et al. (2022a) show preference towards more planned patient discharge and a more even timing of patient discharge. Currently, neither of these factors are fulfilled within the AVA ward and would require a restructuring of the patient discharge process to do so. Planning the patient discharges better is something that could facilitate better bed coordination, but it was overshadowed by the amount of concern regarding timing of patient discharge voiced by members of staff during the interviewing process. It should also be noted that both Ortiga et al. (2013) and Kreindler et al. (2022a) were not looking at one ward in particular, or just elective patients, but instead the whole hospital. This could mean that the situation is not applicable to the AVA ward, and that better planning of discharge would not provide the same benefit as stated by the literature. Before making further

efforts in increasing the planning of patient discharge at the AVA ward care needs to be taken in order to ensure that an earlier start of planning is possible at AVA, and after that, if it is beneficial to the patient flow.

The article by Destino et al. (2019) was performed in an environment most closely resembling AVA, when comparing it to the other article presented in this thesis on the subject. The researchers looked at acute care wards, which is a direct translation of AVA. In the article, discharge earlier in the day was presented as a remedy for poor timing of patient discharge. As stated earlier, poor timing of patient discharge was experienced by the interviewees and supported by qualitative data. As such, the solutions presented by Destino et al. (2019) like more rounds, discharge identification on the evenings before, and acknowledgement for wards with early discharges could be viable efforts by AVA to undertake in order to better time discharge with admission.

6 Conclusions

The research focuses on a problem that concerns a large number of health care organizations in the 21st century and this is the patient flow management. Several managers, as it has been observed from the literature (Gualandi et al., 2020), have changed their perspective. Now, the solutions are sought in broad environments and the holistic view of a hospital is increasingly taken into consideration (Winasti et. al, 2018). The goals of patient flow management are the patient flow efficiency but also the quality of care of the patients and it has broad consequences on patients, as well as on staff outcomes (Benjamin & Jacelon, 2021).

A big part that affects the success of patient flow management is the role of coordinators within the hospital (Izumi et. al. 2018; Sanner & Ovrelid, 2020). The duties and responsibilities of coordinators are continuously progressed and for this reason the research focuses on to describe how the coordinating process in a hospital looks like in 2022. The study was conducted in Sweden and more specifically at Skaraborg hospital in Skövde. There the coordinators work in the acute ward called AVA and their priority is the extensive coordination of the whole hospital. In this section the conclusion of the thesis is summarized by providing answers to the research questions.

What does the patient coordinating process at AVA look like?

It is noticed that the patient coordinating process in Skaraborg hospital includes many activities concerning the decision-making of the hospital regarding the hospitalization and treatment of its patients and sharing information regarding the health condition and care of patients among all the main actors, such as doctors, nurses, and unit managers, in order to accomplish a more secure and effective care. Coordinators essentially need to always know how many beds are available in each hospital ward and how many patients must be admitted, transferred, and discharged. This information is crucial for the proper functioning of the coordination process and arises from the constant communication with the doctors and nurses of this hospital, as well as other clinics, where some patients potentially will be transferred. Real time information has also the advantage of saving valuable time for decision-making.

Nurses inform coordinators about the needs and preferences of the patients. Moreover, doctors notify whether patients either have to stay in a ward or leave to go to their home or to another ward, which is more specialized and suitable for their health. The decision on whether a patient is discharged or not belongs to the doctors, but the coordinators determine in which unit, and in which ward the patients will stay, since they need to assign the patients in available beds. For this reason, the doctors advise the coordinators on what they believe is best for each patient's case, such as the ward that suits more for the patient's needs, and the coordinators act accordingly. Doctors' involvement in the coordinating process reduces the pressure that coordinators feel during decision-making.

In addition to coordinators, doctors, and nurses, unit managers also have an active role in the coordination process. At this moment, every day before lunch there is a meeting with all the unit managers of the hospital organization in which is discussed extensively the number of available beds that each ward currently has and how many patients it can receive from the other wards. Once the relevant decisions have been made, the information then is communicated to the coordinators.

What factors are considered when making coordinating decisions at AVA?

Furthermore, the study records the factors that are taken into consideration when making coordinating decisions at AVA. In general, in Skaraborg hospital the quality of the patients' treatment has the highest priority, so the decisions are made based on this fact. Therefore, coordinators must find a bed available to each patient without patients to wait long times in queue. Also, patients should be in the most appropriate unit for their health treatment. In addition, patient movements have been shown to adversely affect patient health, so they should be avoided unless they are necessary.

Moreover, special importance is given to the wide flow management of the entire hospital and not individually of each ward, because flow problems on a ward can cause problems also in other wards linked to it. However, as the results of the research show, decision-making is neither simple nor easy for coordinators. The patient coordination process has not been officially designed, but it emerged from the experience of management and staff working at the Skaraborg hospital. So, even if the coordinators have the necessary knowledge and experience about their role, the trade-offs that the coordinators need to give more weight are not clearly obvious to them.

What problems do the coordinators face in managing the patient flow?

The role of coordinators is not always easy. One of the main problems that makes their job difficult is when overcrowding of patients occurs in the hospital. There are several reasons why hospitals are faced with such incidents. Initially, every health care organization must accept and offer its services to all patients. Therefore, even if the capacity of the hospital is covered, i.e., no beds are available, and the health care staff are busy, patients may continue to visit the hospital creating long queues and bottlenecks.

Furthermore, most of the patients are discharged after lunch and the discharge process is not continuous. As a consequence, there are patients who are ready to be discharged staying more in the hospital and other patients waiting to use their beds after their discharge. This fact has led the mornings the hospital to be most of the times overcrowded. It is more efficient for the organization if the patients are discharged more evenly, preferably before lunch time. So far, discharges are decided mainly during doctors' rounds with the first round being before noon. Continuous discharge of patients is an area that the hospital needs to improve. The current imbalance between the inflow

and the discharge of the patients is now known to the top management and there is an increased focus on trying to improve and complete the discharge processes before lunch

Also, there is often a delay in decision-making about patient flow. Health care organizations are environments in which several different actors are involved. So, coordinators should have open channels of communication with doctors, nurses, unit managers, but also with the other staff such as ambulance drivers. For this reason, decision-making needs much time for all the members involved to be informed and agree. Additionally, the workload of all actors involved is considered high, making decision-making a difficult task.

Moreover, the coordinators are influenced by the relationship that AVA has with the other wards. There is a level of animosity between AVA and the other wards in the hospital. AVA coordinators, it is considered by other wards, that they do not fully understand the content of the work and the situation of the wards, while AVA staff members expressed the view that the wards did not fully understand the purpose of the hospital and the important role of the coordinators. This relationship has been pointed out by the coordinators as leading to immediate problems to collaboration and the internal communication in the patient coordination process.

Finally, errors sometimes occur that reduce patient flow efficiency. Such errors can be wrong estimations in the number of patients admitted or discharged from the hospital and mistakes concerning patient movement reporting. Coordinators also note that several times the reporting of wards on digital platforms, such as Belport, as well as the data and information they collect, is incomplete or wrong. Nevertheless, human errors can be considered to be part of human nature. Recognizing this fact will require constant efforts to automate more of these various critical tasks.

6.1 Limitations, future work, and recommendations

The research process carried out in the context of this study is a first step in investigating the patient coordination process that takes place in a hospital in Sweden and can be improved by facilitating both staff and patients who use its services. However due to time constraints, the research process and conclusions are clearly subject to some limitations.

First of all, the hospital where the research was done is located in Sweden, so it is not certain that the way it works is similar to hospitals in other countries. This means that the conclusions can only be used to the benefit of this hospital and other similar hospitals in Sweden and it is not safe to use them as general conclusions.

Moreover, for the investigation of patient flow management in the present study, it was chosen to examine the patient coordination process. The issue of patient flow management clearly does not end at this point and more processes could be explored.

Investigating also all those factors that are crucial for the patient's experience as an external customer in the hospital would be useful material for guiding the organization in providing a high-level of health services.

During the study of the patient coordination process, a valuable help in understanding and describing it were mainly the staff members of AVA ward who shared their experiences related to their daily involvement in these activities. Due to time constraints, experiences were not evaluated by staff members working in the ED. Of particular interest in a future research process would be the participation of doctors and other hospital administrators who would cover the issue from a different perspective.

Additionally, areas were identified in the thesis, where their improvement can have a positive effect on patient flow. The way modern hospitals use to exchange different departments and wards information with each other is based on online platforms. In future research it would be useful to clarify and describe what elements the online platforms need to have in order to lead to fast and successful internal communication throughout the hospitals. Also, in Skaraborg hospital, initiatives have been launched for the design of a new online digital platform that will facilitate its staff and to make overall patient flow more effective. Belpport will be closed down soon and routines for flow management have been updated and the importance of updating Elvis has also been improved.

Finally, it is also suggested that further research be conducted on how hospitals can achieve continuous discharge of their patients and ways to overcome animosity and silo mindset within health care organizations. Already, it is in the next immediate plans in Skaraborg hospital to improve these areas. Nevertheless, it would be valuable in future research to place great emphasis on goals for patient flow management and how to measure them. It is necessary to achieve continuous improvement in a health care organization to have not only knowledge for the possible improvement actions but also their monitoring and control. And this will be possible only if there are quantitative indicators, which will reveal whether there is indeed an improvement and development with the improvement actions implemented.

References

- Abdalkareem, Z. A., Amir, A., Al-Betar, M. A., Ekhan, P., & Hammouri, A. I. (2021). Healthcare scheduling in optimization context: a review. *Health and Technology*, 1–25
- Al Owad, A., Samaranayake, P., Ahsan, K., Alidrisi, H., Karim, A. (2020). Enhancing patient flow in emergency department (ED) using lean strategies-an integrated voice of customer and voice of process perspective. *Business Process Management Journal*, 27(1), 75-105.
- Al Owad, A., Samaranayake, P., Karim, A., Ashan, K., B. (2018). An integrated lean methodology for improving patient flow in an emergency department – case study of a Saudi Arabian hospital. *Production Planning & Control*, 29(13), 1058-1081.
- Athlin, A. M., Schwarz, U. von T., & Farrohknia, N. (2013). Effects of multidisciplinary teamwork on lead times and patient flow in the emergency department: a longitudinal interventional cohort study. *Scandinavian Journal Of Trauma Resuscitation & Emergency Medicine*, 21.
- Austin, E., Blakely, B., Salmon, P., Braithwaite, J., & Clay-Williams, R. (2021). The scope for adaptive capacity in emergency departments: modelling performance constraints using control task analysis and social organisational cooperation analysis. *ERGONOMICS*
- Bacelar-Silva, G., M., Cox III, J. F., & Rodrigues, P. P. (2022). Outcomes of managing healthcare services using the Theory of Constraints: A systematic review, *Health Systems*, 11:1, 1-16.
- Bai, J., Fugener, A., Schoenfelder, J., & Brunner, J. O. (2018). Operations research in intensive care unit management: a literature review. *Health Care Management Science*, 21(1), 1–24.
- Barnes, S., Hamrock, E., Toerper, M., Siddiqui, S., & Levin, S. (2016). Real-time prediction of inpatient length of stay for discharge prioritization. *Journal Of The American Medical Informatics Association*, 23(E1), E2–E10.
- Benjamin, E., & Jacelon, C. (2021). An analysis of the concept of patient flow management. *Nursing Forum*.
- Benjamin, E., & Jacelon, C. (2022). An analysis of the concept of patient flow management. *Nursing Forum*, 57(3), 429–436.

Boiko, O., Edwards, M., Zschaler, S., Miles, S., & Rafferty, A. M. (2021). Interprofessional barriers in patient flow management: an interview study of the views of emergency department staff involved in patient admissions. *Journal Of Interprofessional Care*, 35(3), 334–342.

Breen, L., M., Trepp, R., Gavin, N. (2020). Lean Process Improvement in the Emergency Department. *Emergency Medicine Clinics of North America*, 38(3).

Burström L., Nordberg M., Örnung G., Castrén M., Wiklund T., Engström M., & Enlund M. (2012). Physician-led team triage based on lean principles may be superior for efficiency and quality? A comparison of three emergency departments with different triage models. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*, 20(1), 57

Chen, L. M., Freitag, M. H., Franco, M., Sullivan, C. D., Dickson, C., & Brancati, F. L. (2009). Natural History of Late Discharges from a General Medical Ward. *Journal Of Hospital Medicine*, 4(4), 226–233.

Crawford, K., Morphet, J., Jones, T., Innes, K., Griffiths, D., & Williams, A. (2014). Initiatives to reduce overcrowding and access block in Australian emergency departments: A literature review. *Collegian*, 21(4), 359–366.

Daly A., Teeling S.P., Ward M., McNamara M, & Robinson C. (2021). The Use of Lean Six Sigma for Improving Availability of and Access to Emergency Department Data to Facilitate Patient Flow. *International Journal of Environmental Research and Public Health*, 18(11030), 11030.

Davis, S., & Fard, N. (2020). Theoretical bounds and approximation of the probability mass function of future hospital bed demand. *Health Care Management Science*, 23(1), 20–33.

De Freitas, L., Goodacre, S., O'Hara, R., Thokala, P., & Hariharan, S. (2021). A qualitative exploration of value and waste in a Trinidadian emergency department patient flow process: perspectives of patients and clinicians. *Journal of Health Organization and Management*, ahead-of-print(ahead-of-print).

de Mast J., Kemper B., Does R.J.M.M., Mandjes M., & van der Bijl Y. (2011). Process improvement in healthcare: Overall resource efficiency. *Quality and Reliability Engineering International* (07488017) Vol.27 (2011) Nr.8 p.1095-1106.

DeAnda, R. (2018). Stop the bottleneck: improving patient throughput in the emergency department. *Journal of emergency nursing*, 44(6), 582–588.

- Destino, L., Bennett, D., Wood, M., Acuna, C., Goodman, S., Asch, S. M., & Platchek, T. (2019). Improving Patient Flow: Analysis of an Initiative to Improve Early Discharge. *Journal Of Hospital Medicine*, 14(1), 22–27.
- Deveraj, S., Ow, T. T., Kohli, R. (2013). Examining the impact of information technology and patient flow on healthcare performance: A Theory of Swift and Even Flow (TSEF) perspective. *Journal of Operations Management*, 31, 181-192.
- Diefenbach, M., & Kozan, E. (2011). Effects of bed configurations at a hospital emergency department. *Journal Of Simulation*, 5(1), 44–57.
- Drupsteen, J., van der Vaart, T., & van Donk, D. P. (2013). Integrative practices in hospitals and their impact on patient flow. *International Journal Of Operations & Production Management*, 33(7), 912–933.
- Elamir, H. (2018). Improving patient flow through applying lean concepts to emergency department. *Leadership In Health Services*, 31(3, SI), 293–309.
- Germack, H. D., Fekieta, R., Britton, M. C., Feder, S. L., Rosenberg, A., & Chaudhry, S., I. (2020). Cooperation and conflict in intra-hospital transfers: A qualitative analysis. *Nursing Open*, 7(2), 634–641.
- Goldwasser, R. S., de Castro Lobo, M. S., de Arruda, E. F., Angelo, S. A., Lapa e Silva, J. R., de Salles, A. A., & David, C. M. (2016). Difficulties in access and estimates of public beds in intensive care units in the state of Rio de Janeiro. *Revista De Saude Publica*, 50.
- Gualandi, R., Masella, C. and Tartaglioni, D. (2020), Improving hospital patient flow: a systematic review, *Business Process Management Journal*, Vol. 26 No. 6, pp. 1541-1575.
- Hajewski, C. J., & Shirey, M. R. (2014). Care Coordination A Model for the Acute Care Hospital Setting. *Journal Of Nursing Administration*, 44(11), 577–585.
- Hamza N., Abdul Majid M., & Hujainah F. (2021). SIM-PFED: A Simulation-Based Decision Making Model of Patient Flow for Improving Patient Throughput Time in Emergency Department. *IEEE Access*, 9, 103419–103439.
- Hanne, T., Melo, T., & Nickel, S. (2009). Bringing Robustness to Patient Flow Management Through Optimized Patient Transports in Hospitals. *Interfaces*, 39(3), 241–255.
- Haraden, C., & Resar, R. (2004). Patient Flow in Hospitals: Understanding and Controlling It Better. *Frontiers of Health Services Management*, 20(4), 3.

Hendrich, A.L., Fay, J. and Sorrells, A.K. (2004), “Effects of acuity-adaptable rooms on flow of patients and delivery of care”, *American Journal of Critical Care*, Vol. 13 No. 1, pp. 35-45.

Hoyem, A., Gammon, D., Berntsen, G. R., & Steinsbekk, A. (2018). Policies Make Coherent Care Pathways A Personal Responsibility For Clinicians: A Discourse Analysis Of Policy Documents About Coordinators In Hospitals. *International Journal Of Integrated Care*, 18(3).

Izumi, S., Barfield, P. A., Basin, B., Mood, L., Neunzert, C., Tadesse, R., ... Tanner, C. A. (2018). Care coordination: Identifying and connecting the most appropriate care to the patients. *Research In Nursing & Health*, 41(1), 49–56.

Koushan, M., Wood, L. C., & Greatbanks, R. (2021). Evaluating factors associated with the cancellation and delay of elective surgical procedures: a systematic review. *International Journal for Quality in Health Care : Journal of the International Society for Quality in Health Care*, 33(2).

Kreindler SA. Planning without action and action without planning? Examining a regional health system's efforts to improve patient flow, 1998–2013. *Int J Health Plann Mgmt*. 2017, 33: 333–343.

Kreindler, S. A., Hastings, S., Mallinson, S., Brierley, M., Birney, A., Tarraf, R., ... About, Z. (2022a). The “hard, relentless, never-ending” work of focusing on discharge: a qualitative study of managers’ perspectives. *Journal Of Health Organization And Management*, 36(2), 164–177.

Kreindler, S. A., Hastings, S., Mallinson, S., Brierley, M., Birney, A., Tarraf, R., ... Johnson, K. (2022b). Managing intergroup silos to improve patient flow. *Health Care Management Review*, 47(2), 125–132.

Lee, S.-Y., Chinnam, R. B., Dalkiran, E., Krupp, S., & Nauss, M. (2020). Prediction of emergency department patient disposition decision for proactive resource allocation for admission. *Health Care Management Science*, 23(3), 339–359.

Liu, S., Hobgood, C., & Brice, J. H. (2003). Impact of critical bed status on emergency department patient flow and overcrowding. *Academic Emergency Medicine*, 10(4), 382–385.

Lot, L., T., Sarantopoulos, A., Min, L., L., Perales, S., R., Boin, I., D., S., F., de Ataide, E., C. (2018). Using Lean tools to reduce patient waiting time. *Leadership in Health Services*, 31(3), 343-351.

Luther, B., Martial, M.-A., & Barra, J. (2017). A Statewide Survey Report of Roles and Responsibilities In Current Utah Care Management Processes. *Professional Case Management*, 22(3), 116–125.

McHugh, M., Van Dyke, K. J., Yonek, J., & Moss, D. (2012). Time And Expenses Associated With The Implementation Of Strategies To Reduce Emergency Department Crowding. *Journal Of Emergency Nursing*, 38(5), 420–428.

Nicosia, F. M., Park, L. G., Gray, C. P., Yakir, M. J., & Hung, D. Y. (2018). Nurses' Perspectives on Lean Redesigns to Patient Flow and Inpatient Discharge Process Efficiency. *Global Qualitative Nursing Research*, 5.

Official reports of the Swedish Government. (2021). Vägen till ökad tillgänglighet - långsiktig, strategisk och i samverkan. Ministry of Health and Social Affairs. Retrieved from:

https://www.regeringen.se/4a7710/contentassets/b4d9ad7b41624ea79e9ff4be8d2cbf80/sou-2021_59.pdf

Olsson, O., & Aronsson, H. (2015). Managing a variable acute patient flow - categorising the strategies. *Supply Chain Management-An International Journal*, 20(2), 113–127.

Oredsson, S., Jonsson, H., Rognes, J. et al. A systematic review of triage-related interventions to improve patient flow in emergency departments. *Scand J Trauma Resusc Emerg Med* 19, 43 (2011).

Ortiga, B., Salazar, A., Jovell, A., Escarrabill, J., Marca, G., & Corbella, X. (2012). Standardizing admission and discharge processes to improve patient flow: A cross sectional study. *Bmc Health Services Research*, 12.

Sanchez, M., Suarez, M., Asenjo, M., & Bragulat, E. (2018). Improvement of emergency department patient flow using lean thinking. *International Journal For Quality In Health Care*, 30(4), 250–256.

Sanner, T. A., & Ovrelid, E. (2020). Informating Hospital Workflow Coordination. Computer Supported Cooperative Work-The Journal Of Collaborative Computing And Work Practices, 29(4), 387–417.

Statistics Sweden. (2018). Sveriges framtida befolkning 2018-2070. Statistics Sweden. Retrieved from: https://www.scb.se/contentassets/b3973c6465b446a690aec868d8b67473/be0401_2018i70_br_be51br1801.pdf

Swan, B. A., Haas, S., & Jessie, A. T. (2020). An Exploratory Descriptive Case Study on Care Coordination: A Consumer Perspective. *Nursing Economics*, 38(5), 244–251.

Thomas, B. G., Bollapragada, S., Akbay, K., Toledano, D., Katlic, P., Dulgeroglu, O., & Yang, D. (2013). Automated Bed Assignments in a Complex and Dynamic Hospital Environment. *Interfaces* 43(5), 435–448.

Tlapa, D., Zepeda-Lugo, C. A., Tortorella, G. L., Baez-Lopez, Y. A., Limon-Romero, J., Alvarado-Iniesta, A., & Rodriguez-Borbon, M. I. (2020). Effects of Lean Healthcare on Patient Flow: A Systematic Review. *Value in Health*, 23(2), 260–273.

vanAchterberg, T., Stevens, F. C. J., Hekkink, M. J. H., Crebolder, H., & Philipsen, H. (1995). Implementing coordination of care - Task performance and problems encountered. *Scandinavian Journal Of Caring Sciences*, 9(4), 209–217.

Villa, S., Barbieri, M., & Lega, F. (2009). Restructuring patient flow logistics around patient care needs: implications and practicalities from three critical cases. *Health Care Management Science*, 12(2), 155–165.

Waring, T. S., & Alexander, M. (2015). Innovations in inpatient flow and bed management An action research project in a UK acute care hospital. *International Journal Of Operations & Production Management*, 35(5), 751–781.

Williams, T. A., Leslie, G. D., Brearley, L., Leen, T., & O'Brien, K. (2010). Discharge delay, room for improvement? *Australian Critical Care*, 23(3), 141–149.

Winasti, W., Elkhuisen, S., Berrevoets, L., van Merode, G. and Berden, H. (2018), Inpatient flow management: a systematic review, *International Journal of Health Care Quality Assurance*, Vol. 31 No. 7, pp. 718-734

Wise, S., Duffield, C., Fry, M., & Roche, M. (2022). Nurses' role in accomplishing interprofessional coordination: Lessons in 'almost managing' an emergency department team. *Journal Of Nursing Management*, 30(1), 198–204.

Zepeda-Lugo, C., Tlapa, D., Baez-Lopez, Y., Limon-Romero, J., Ontiveros, S., Perez-Sanchez, A., Tortorella, G. (2020). Assessing the Impact of Lean Healthcare on Inpatient Care: A Systematic Review. *International Journal of Environmental Research and Public Health*, 17(15).

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