



# UNIVERSITY OF TWENTE.

Faculty of Science & Technology

## Inpatient discharge process in a hospital; a case-study at Medisch Spectrum Twent

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M.Sc. Thesis

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MST



## Preface

In front of you lies the master thesis “Process optimization of inpatient discharges in a hospital; a case-study at Medisch Spectrum Twente”. This thesis is the finalization of the master study Health Sciences (optimization of healthcare processes track) at University Twente.

This case-study has been carried out at the Medisch Spectrum Twente (MST) hospital in Enschede, Netherlands. With help of an alumnus of University Twente, I found the interesting project I was looking for. Together with my supervisor from MST, I formulated the research question. It took some time before it was perfected. Apart from a few setbacks, the research went well. Just like my supervisor from Universiteit Twente told me, “That’s the way it goes in the professional world, those things happen”. I’m grateful that I was allowed to write my thesis in the form of a graduation internship. I have learned more than I ever expected, especially concerning hospital processes. The way choices are made within a hospital fascinate me.

I thank my MST-supervisor Rozemarijn van Erp for all the help she provided during the research. She was always available for meetings and encouraged me throughout the entire process. I admire her professionalism. I also thank my University supervisors Carine Doggen and Erwin Hans for their academic insight. Prof. Doggen always steered me into the right direction rather than telling specifically what to do, for which I’m thankful.

To my friends: I thank you for your interest in my thesis and the long conversations helping me out. I thank my parents for always supporting me and my decisions. My friend Ellen Geuzebroek deserves a particular note of thanks: thank you for every single time you gave me feedback, and thanks for being my office buddy.

I hope you enjoy reading this thesis.

Yunus Deniz

Enschede, April 11, 2019

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# **Abstract**

## **Background**

The patient flow at Medisch Spectrum Twente (MST) from admission to discharge is not optimal. This is mainly caused by that the discharge of inpatient patients from the wards take place rather late on the day. Since the discharges take place late on the day, subsequently, the admissions from the Emergency Department (ED) and the Acute Admission Department (AOA) to the clinic also shifts to a later moment. The problem faced in this shift in timing is that the peak of patient arrivals takes place at roughly the same moment (between 1 and 3 P.M.). Besides late discharge of patients, wrong-bed days of patients at the clinic play a role in the continuation of the patient flow. Wrong-bed days reduce the clinical capacity which means that there are fewer beds available for patients who need to be transferred from the ED and AOA to the clinic.

## **Objective**

The objective of this study was to identify aspects of the patient discharge process of Medical Spectrum Twente that need to be optimized in order to achieve a better throughput of patients between wards and a lower amount of wrong-bed days.

## **Methods**

A literature study was conducted to gain information on the discharge process in a hospital. Existing documents have been used derived from the MST platform Qdesk to report the documented discharge process. The five steps of the documented discharge process of MST, and the literature study were used to develop a script for the focus groups. Focus groups and one interview were organized to gather information concerning the current discharge process. Physicians, physician's assistants, nurses, nurse specialists, and team leaders were present during the focus groups and the interview.

## **Results**

The results of the literature study show that hospital occupancy is strongly associated with length of stay (LOS) of patients in a hospital. Discharge Before Noon is found to have an effect on LOS; when patients are discharged before noon, the LOS will most likely decrease. Literature on discharge timing shows that earlier discharge has a positive effect on the patient flow. The earlier patients are discharged, the better the patient flow from the ED to the clinic gets. Improving Patient discharges and reducing the LOS help achieving a better patient flow.

The documented discharge process of MST consists of five phases. These phases are pre-admission, admission to the ward, completion of admission, discharge, and aftercare.

Ten themes for possible optimization were found based on the findings of the focus groups. These are: patient visits, discharge timing, provisional discharge date, transfer from AOA to the clinic, discharge without being seen by the physician, discharge during weekend, transfer office, wrong-bed days, medication, and provision of information. All themes consist of more aspects that can be optimized for a better throughput of patients and a lower-amount of wrong-bed days. A lot of specialties share the same bottlenecks that could be improved and optimized. However, some specialties have their own specific improvement points. According to the transcripts and focus groups, the themes cited most and with more impact on the discharge

process are: patient visits, discharge timing, provisional discharge date, transfer from AOA to the clinic, and wrong-bed days.

## **Conclusion**

This study was conducted to answer the research question: *‘Which aspects of the patient discharge process does Medical Spectrum Twente need to optimize in order to achieve a better throughput of patients between wards and a lower amount of wrong-bed days?’*. The aspects/themes MST should optimize to achieve a better throughput between wards and a lower amount of wrong-bed days are: patient visits, discharge timing, provisional discharge date, transfer from AOA to the clinic, and wrong-bed days.

Hospital occupancy is strongly associated with LOS of patients in a hospital. Literature on discharge timing shows that early discharge has an effect on the patient flow. The earlier patients are discharged, the better the patient flow from the ED to the clinic gets. Improving Patient discharges and reducing the LOS help achieving a better patient flow. Based on the findings out of the focus groups, it can be seen that the current discharge process is subject to many variations across all specialties. Operational tasks (protocols) for healthcare professionals are present in the current discharge process, however, the tasks are not detailed. This way it is harder to work towards the goal of discharging patients before 11 A.M. Eliminating variability between professionals and wards will most likely result in earlier discharge and better throughput of patients.

# 1. Introduction

In 2016, the hospital Medisch Spectrum Twente in Enschede moved from its old location Haaksbergerstraat to the newly built hospital at Koningsplein. In the same year, the Board of Directors took measures to structurally compensate the increased capital costs at MST since the costs were higher than budgeted. These measures come together in the “Rendementsprogramma”. The objective of this program is to achieve a process improvement of €30 million over the years from 2017 to 2019 (MST, 2017).

The “Rendementsprogramma” consists of multiple projects to optimize processes. One of those projects is “Project Kliniek”. Project Kliniek focusses on the optimization of the discharge of patients. The discharge process is regarded as the process that involves all the steps that need to be taken for a patient to be discharged from the hospital. This is a complex process with various substantive and time-bound aspects that need to be well structured and coordinated. These five aspects of the discharge process are pre-admission, admission to the ward, completion of treatment, discharge, and aftercare.

The MST clinic has 30,000 to 40,000 patient admissions each year. There is an in-, through-, and outflow of roughly 100 patients a day. For optimal patient logistics, the patient flow between departments needs to be well organized to ensure continuity of care and to meet the patients' care needs. The transitions between wards (from the emergency department to acute admission department (in Dutch Acute Opname Afdeling (AOA)), and from acute admission department to the clinic) need to be organized well so that the actual discharge of the patient goes well and without problems.

## 1.1. Discharge of patients in a hospital

The discharge of patients in hospitals is a complex process which involves multiple stakeholders. Hospital discharge of patients can be described as the moment where hospital care gets transferred into other domestic environments or institutions such as nursing homes. This means that the discharge of patients is not the end of care, but rather the moment where transitions take place in the provided care (Waring, Marshall, & Bishop, 2014). Respondents of a qualitative study among fifteen healthcare providers in the United States emphasized the importance of the involvement of the caregiver, safety of the patient's home environment, and access to healthcare community resources as determinants that influence the transitions in care (Abu et al., 2018). To organize and provide such transitional care, multiple health and social care providers such as transfer-nurses in hospitals are involved. These care providers are often based in different organizations. For the patients to receive safe and good care, the care providers need to coordinate their activities. The complexity of the coordination of multiple care actors leads to the view that hospital discharges can be vulnerable, time-dependent and with high risks in the pathway of the patient (Waring et al., 2014).

An example of the complexity of coordination is delayed discharge. In case of delayed discharge, the patient has to stay in the hospital because of certain reasons. For example, because the arrangement of after-care has not been arranged yet. Delayed discharges often occur because additional tests of patients have to be made, or the results of the performed tests are yet to be released (Da Silva, Valácio, Botelho, & Amaral, 2014). Delayed discharge is also caused



because of bad coordination between care providers. A systematic review on the impact and experiences of delayed discharge performed by Rojas-Garcia et al. shows that between 8 and 10% of beds for acute care in hospitals were occupied by delayed patients (Rojas-Garcia et al., 2017). Furthermore, delay of discharge results in additional hospital costs and lowers the number of available inpatient beds (Waring et al., 2014).

Sometimes the demand for hospital beds exceeds its capacity. This leads to the delay of patient admissions, transfers, and cancellations of surgical procedures. Hospitals have to use effective strategies and find ways to make use of the existing beds as efficient as possible (Moleney, Wolfe, Gesteland, Hales, & Nkoy, 2007).

Delayed discharge also has an influence on the length of hospital stay. The length of hospital stay is an indicator of the changes in the efficiency of provided care. Data from The Organization for Economic Co-operation and Development (OECD) for the average length of hospital stay for acute care in the Netherlands shows that the average length of hospital stays for patients in 2015 was 6.2 days (OECD, 2015). MST's general average LOS was 5.4 days in 2016 (MST Business Objects). This is slightly higher than the national average, which was 5.2 days in 2016 (Staatvenz, 2018). Among 87 general, clinical, and academic Dutch hospitals, MST is ranked as the 70<sup>th</sup> (1<sup>st</sup> has lowest LOS) hospital regarding the LOS (Gelderman & Wegmann, 2015).

## **1.2. Discharge of patients at MST**

Discharges of patients at MST are rather late (after 11 A.M.) and there is a high amount of wrong-bed days. This leads to an unnecessary long LOS of patients. It also results in reduced clinical bed capacity in the clinic and a stagnation of the throughput from the AOA to the clinic. It leads to the stagnation of the risk of canceling the elective operating room (OR) program as well. This situation is undesirable for MST according to the "Rendementsprogramma". The recent decline in the number of clinical beds (after moving to the new hospital) requires optimization in discharges to obtain a structural improvement for optimal patient logistics. No specific numbers of the decline in beds are known.

The unnecessary LOS of patients is called wrong-bed days. Wrong-bed days are days that the patient stays in the hospital after the patient's treatment has already been finished. This is often caused because there is no possibility to be admitted to an institution with accommodation (NZa, 2018). The delayed discharge and wrong-bed days cause overcrowding at the emergency department (ED). When patients do not get discharged from the wards early in the day, there is no room for the patients to be admitted to the wards from the ED and AOA. Since new patients arrive at the ED at the end of the morning and in the afternoon, the ED and AOA might get overcrowded. Hospital overcrowding has become a widespread problem. Overcrowding is a worldwide problem because it might decrease the quality of care (Forster, Stiell, Wells, Lee, & Van Walraven, 2003). Limited bed capacity and admission to the ward bottlenecks have negative impacts on the discharge process. According to Molla et al. (2018), focusing on the time of discharge and the transition of patients may be the most effective way to address the problem (Molla, Warren, Stewart, Stocking, & Johl, 2018).

Table 1 shows that over the course of 13 months, MST had 4125 wrong-bed days. According to MST business intelligence, MST uses an estimate of €500, - per wrong-bed day. This means

that the total costs for wrong-bed days from June 2017 to June 2018 were roughly €2.062.500. These are costs that could partially be prevented.

Specialty	2017							2018						Total
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Thorax Centrum Twente	5	2	11	7	8	12	25	15	17	6	24	38		170
Internal Medicine	21	17	11	17	7	49	27	50	54	138	116	76	52	635
Gastroenterology	11	2	10		7	9	6			11	14	11	1	82
Pulmonology	11	12	16	4		13	18	8	17	37	48	39	7	230
Gynecology and Pediatrics		3		4		6			13	5	25	1	3	60
Neuro-center	121	80	152	66	69	70	61	140	226	251	135	129	121	1621
Psychiatry	6	2			6	32	7		2					55
Surgery	95	66	33	33	27	30	81	82	108	68	61	101	66	851
Orthopedics	23	11	19	24	2	17	21	35	45	39	59	70	35	400
Urology	4	2	3				7			3		2		21
<b>Total</b>	<b>297</b>	<b>197</b>	<b>255</b>	<b>155</b>	<b>126</b>	<b>238</b>	<b>253</b>	<b>330</b>	<b>482</b>	<b>558</b>	<b>482</b>	<b>467</b>	<b>285</b>	<b>4125</b>

Table 1: Wrong-bed days per specialty MST

Figure 1 shows the stagnation of the throughput from the AOA to the clinic as discussed earlier in the introduction. The figure also shows that the peak of discharges is around the same time as the peak in admissions. This leads to overcrowding in the AOA. For a better throughput of patients from the AOA to the clinic, the patient discharges need to take place earlier than the patient admissions. MST strives to a situation where patients get admitted to the clinic from the AOA up until 11:00 A.M. This means that the patient discharges at the clinic need to take place before 11:00 A.M. However, Table 2 shows that only 4% of the patients are admitted to the clinic before 11:00 A.M. This may imply that the discharges at the clinic do not take place on time (before 11:00 A.M.) and that the AOA might get overcrowded at some point. Moreover, the large majority (66%) of the patients even gets admitted after 2 P.M.

Admissions, discharge & throughput AOA	2017							2018					Total
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	
Total amount of AOA admissions	849	902	778	825	816	837	859	946	808	899	857	793	10169
Discharged from AOA	349	386	334	329	357	370	385	402	298	383	364	346	4303
% Discharged from AOA	41%	43%	43%	40%	44%	44%	45%	42%	37%	43%	42%	44%	42%
Admitted to clinic from AOA	500	516	444	496	459	467	474	544	510	516	493	447	5866
% Admitted to clinic from AOA	59%	57%	57%	60%	56%	56%	55%	58%	63%	57%	58%	56%	58%
Admitted to clinic before 11 A.M.	20	21	14	15	16	20	29	24	24	19	28	28	258
% Admitted to clinic before 11 A.M.	4%	4%	3%	3%	3%	4%	6%	4%	5%	4%	6%	6%	4%
Adm. clinic between 11 A.M. & 2 P.M.	153	162	155	184	138	119	165	158	123	114	133	128	1732
% Adm. clinic between 11 AM & 2 P.M.	31%	31%	35%	37%	30%	25%	35%	29%	24%	22%	27%	29%	30%
Admitted to clinic after 2 P.M.	327	333	275	297	305	328	280	362	363	383	332	291	3876
% Admitted to clinic after 2 P.M.	65%	65%	62%	60%	66%	70%	59%	67%	71%	74%	67%	65%	66%

Table 2: In-, through-, and output of patients in the AOA

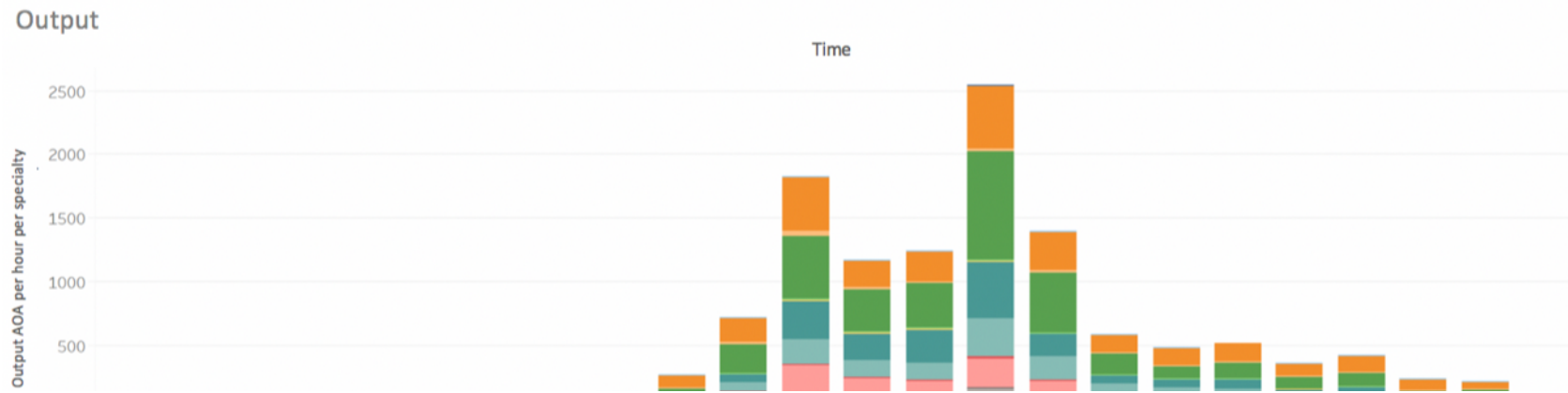
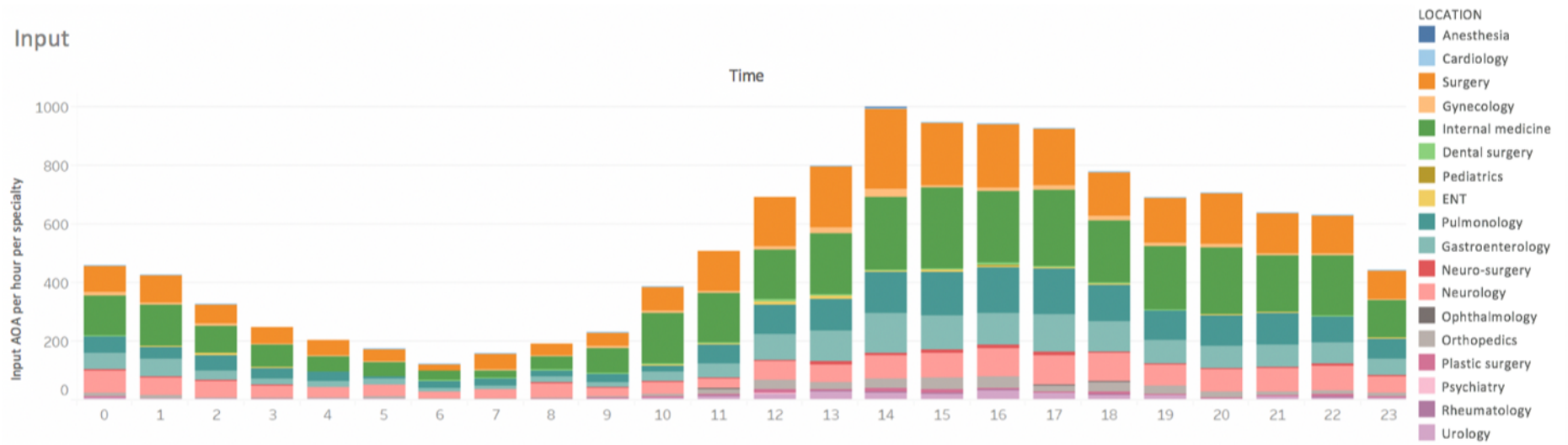


Figure 1: In- and outflow AOA per hour per specialty MST (MST Business Objects)

The main problem addressed in the introduction is that the patient flow from admission to discharge at MST is not optimal. This is mainly caused because the discharge of inpatient patients from the wards take place rather late on the day. Since the discharges take place late on the day, subsequently, the admissions from the ED and AOA to the clinic also shifts to a later moment. The problem faced in this shift in timing is that the peak of patient arrivals takes place at roughly the same moment, which is between 11 A.M. and 3 P.M. As a result, it becomes harder for patients to be transferred to the clinic and the ED and AOA become overcrowded. Besides late discharge of patients, wrong-bed days of patients at the clinic play a role in the continuation of the patient flow. Wrong-bed days reduce the clinical capacity which means that there are fewer beds available for patients who need to be transferred from the ED and AOA to the clinic. To find out what specific bottlenecks are present in the whole discharge process and where optimization in the discharge process is needed, the following research question and associated sub-questions have been formulated:

Research question:

*Which aspects of the patient discharge process does Medical Spectrum Twente need to optimize in order to achieve a better throughput of patients between wards and a lower amount of wrong-bed days?*

Sub-questions:

1. What is known about process optimization of patient discharge within hospitals in general?
2. How is the current patient discharge process organized in the clinic of MST?
3. What are the bottlenecks in the current patient discharge process?
- What improvements can be implemented to optimize the discharge process?

## 2. Research Design

### 2.1. Literature study

To answer the first sub-question – what is known about process optimization of patient discharges in hospitals in general? – a literature study was performed by searching for articles in scientific databases Scopus and PubMed in September 2018. The keywords used for the search were: hospital patient discharge process, LOS hospital patients, hospital patient flow, and before noon hospital discharge. Relevant referenced articles of the articles found were also included. Articles were regarded relevant when they provided information concerning discharge processes or the patient flow in hospitals. Screening of abstracts was done based on the information regarding the discharge process. If the article was specifically aimed at an illness, for instance, it was excluded. Thirty-three articles were selected based on screening of abstracts. After analyzing those 33 articles thoroughly, 16 articles were included in the report.

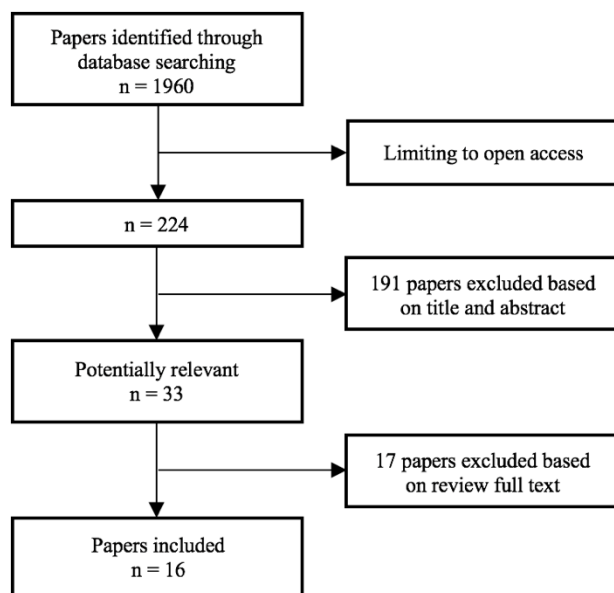


Figure 2: Flow chart selection papers

### 2.2. Documented discharge process MST

To answer the second sub-question – How is the current patient discharge process organized in the clinic of MST? – existing documents have been used derived from the MST platform Qdesk. Qdesk is a platform where hospital-wide and department specific documents, guidelines, and protocols can be found. The document regarding the discharge process was written by department manager M. Jongbloed and quality & safety advisor I. Duindam in 2016. This document was reviewed, and the main features were included in the results.

### 2.3. Current operational discharge process at MST

To answer the third sub-question – What are the bottlenecks in the current patient discharge process? – focus groups and an interview were organized. The main goal of the focus groups was to gain insight into the experiences of the healthcare professionals and to find out what aspects of the discharge process could be improved. The focus group with the ED turned into an interview due to the fact that the ED was crowded on the planned day. A total of n=31 professionals attended the focus groups and the interview. Two quality & safety advisors attended the focus groups for guidance with a maximum of one advisor per focus group. The

outpatient clinic was excluded since outpatient patients do not spend the night in the hospital. Table 3 shows an overview of clinical specialties included in the focus groups.

Group	Unit	Department
Group 1	Thorax Centrum Twente	Nursing unit A5/C5
Group 2	Internal Medicine	E6 (Internal/HIV/nephrology/Oncology)
	Gastroenterology	A6/C6
	Pulmonology	A6/C6
Group 3	Gynecology and Pediatrics	Gynecology and Obstetrics
		H21 – Mother/Child department
		H31 – Children/Teen department
	Neuro-center	Outpatient clinic/neuro-clinic/clinical neurophysiology
Group 4	Surgery	E4 – Surgical oncology
		C4 – Vascular/Orthopedics/Trauma
	Orthopedics	B4/C4 – Vascular/Orthopedics/Trauma
	Emergency department	
	Acute admission department	
	Urology	E5 – Nursing department

*Table 3: Overview of clinical specialties MST*

MST distinguishes five steps in their discharge process by MST (as can be found in Qdesk). The process includes steps before and after the actual discharge (step 4).

1. Pre-admission
2. Admission to the ward
3. Completion
4. Discharge
5. Aftercare

These five steps functioned as guiding topics during the focus-group meetings. The literature study (chapter 3.1.) was used to specify topics and formulate questions. A script was made for guidance during the focus groups (see Appendix B,C). The duration of the meetings was a maximum of 1 hour. All meetings were recorded with a laptop and a mobile phone as a back-up. Per specialty, healthcare professionals were invited to attend the meetings based on their availability. This includes the team leader, a physician (or assistant), a nurse specialist, and a ward nurse. A requirement for the healthcare professionals was that they needed to have sufficient knowledge concerning the specialty they represented during the meetings. They had to have at least one year working experience in the hospital. The composition of the focus groups was supposed to be as diverse as possible to gain as much information as possible. The current discharge process was assessed per specialty. It was not desirable for both the physician and physician's assistant to be present at a meeting since the physician's assistant may leave out information because of the presence of the physician. A maximum amount of six persons was allowed to attend the meetings so that there would not be too much noise, and to avoid multiple persons speaking at the same time. Five focus groups were rescheduled at the request of the team leaders of the departments. The focus groups were rescheduled because of the availability of healthcare professionals and due to illnesses. This resulted in a delay of one and a half months of focus group data collection.

After all the focus-group meetings were held, every meeting was transcribed and coded for analyses. Codes were derived from the topics specified in the script for the focus groups (see Appendix B,C). The script was divided into five parts based on the five phases of the MST discharge process. The process of transcribing and coding was done manually. The transcripts

and the codes of every specialty were compared to each other to map out the bottlenecks and to look for opportunities for optimization.

**Inclusion criteria**

Healthcare professionals who are eligible to participate in the focus-group meetings must have at least one of the following status:

- Nurse
- Nurse specialist
- Team leader
- Physician
- Physician's assistant

**Exclusion criteria**

- Professionals with less than a year of working experience.

**2.4. Improvements to optimize the discharge process**

To answer the last sub-question – What improvements can be implemented to optimize the discharge process? – bottlenecks derived from the focus groups are used to interpret what improvements could be made to optimize the discharge process. No detailed proposals for improvement are given since some aspects to be improved are complex and need to be studied on how to improve it. However, some methods found in literature are proposed that might help improving aspects of the discharge process that can be optimized.

### 3. Results

In the results section, the in the introduction formulated sub-questions will be answered and elaborated. This will be done based on the findings of the literature study, MST processes, and focus-group meetings.

#### 3.1. Literature study

Paragraph 3.1. presents a literature study to gain more insight regarding patient discharges in hospitals in general. First bed occupancy and overcrowding are looked into. These are interrelated determinants that influence the LOS of patients in the hospital. In the second paragraph, the effect of early discharge on (among others) LOS is addressed. In the third paragraph, timely discharge and discharge before noon is further looked into. Finally, paragraph 3.1.4. is focusing on improving the patient flow as a whole. Every subject in the literature study in some way is related to the in-, through-, and output of patients in the hospital. Figure 3 shows the patient flow of MST-patients.

Patients either go to the hospital because of acute reasons or because of a planned admission. The planned admissions in the outpatient clinic are excluded. Depending on the reason of admission, patients will be treated at the emergency department, the AOA and/or the clinic. After treatment has been finalized, the transition to home or a different health care institution can take place. The subjects of the literature study all have influenced the patient flow.

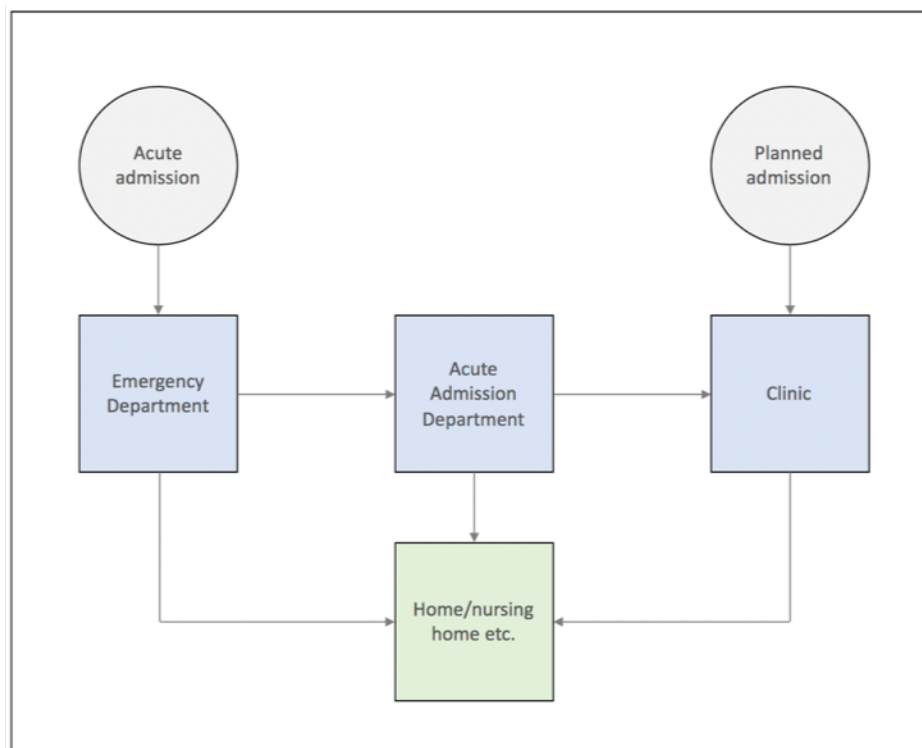


Figure 3: Patient flow MST-patients (outpatient clinic excluded)



### 3.1.1. Bed occupancy and overcrowding

This paragraph focuses on the effect of occupancy levels on overcrowding. When occupancy levels remain high at the clinic, for instance, because of late discharge of patients, that might result in overcrowding at the ED and AOA. The throughput of the patients from the ED to AOA and AOA to the clinic is obstructed because the beds at the clinic are occupied. Table 4 provides an overview of included studies and their objectives.

Study	Year	Country	objective
(Forster et al., 2003)	2003	Canada	To identify the effect of hospital occupancy on ED LOS for admitted patients and patient disposition
(Moskop, Sklar, Geiderman, Schears, & Bookman, 2009a)	2009	United States	Ethical and policy analysis of ED crowding
(Moskop, Sklar, Geiderman, Schears, & Bookman, 2009b)	2009	United States	Identification and description of operational and financial barriers to resolving the crisis of ED crowding
(Khanna, Boyle, Good, & Lind, 2011)	2011	Australia	To identify the impact of admission and discharge timing on hospital occupancy
(Khanna, Boyle, Good, & Lind, 2012b)	2012	Australia	To investigate the effect of hospital occupancy levels on inpatient ED patient flow parameters

Table 4: Study objectives papers paragraph 3.1.1.

The ability of hospital staff to schedule a patient to the right bed at the right time is dependent on bed occupancy and is an important issue in all acute care hospitals. Researchers tried to identify the impact of admission and discharge timing on hospital occupancy with reference to the peak in daily admissions and discharges (Khanna et al., 2011). The peak of patient arrivals occurs during the morning in most acute hospitals. However, the peak in discharges occurs in the late afternoon. Khanna et al. (2011) hypothesized that hospital occupancy can be improved by earlier discharge of patients. They quantified the impact of earlier discharge by reporting the LOS, the measured bed occupancy, and peak occupancy and by assessing hourly occupancy data. Five categories were made to classify days in which the peak in discharge and the peak in admission were compared to each other. Category 1 for instance, indicates that the peak in discharge takes place 5 hours or more before the peak of admission; category 5 indicates that the peak in admission takes place 5 hours or more before the peak of discharge. Days classified as category 5 contributed significantly to overcrowding. A total amount of 717 out of 913 days were classified as category 5 according to preliminary analysis. The analysis provides evidence that earlier discharge during the day can reduce occupancy levels and overcrowding in hospitals (Khanna et al., 2011).

Occupancy levels have a direct influence on the throughput of patients in the hospital. Late discharge of patients contributes to higher occupancy levels. With higher occupancy levels, fewer patients can be transferred to the hospital wards. This may lead to overcrowding at the ED. Forster et al. identified the effect of hospital occupancy on ED LOS for admitted patients and patient disposition (Forster et al., 2003). In their observational study, they used administrative data of a 500-bed acute care teaching hospital. The average hospital occupancy was 89%. Out of 155 daily visits of ED patients, 19% were admitted. There was an increase of 18 minutes for daily ED LOS for admitted patients when there was an increase of 10% in occupancy. The ED LOS is 6 hours with an occupancy level of 99%. When the hospital occupancy was above 90%, the ED LOS appeared to increase extensively. Forster et al. concluded that an increased hospital occupancy is strongly associated with ED LOS for admitted patients.

In another study on the effect of hospital occupancy levels on inpatient ED patient flow parameters, researchers tried to simulate the impact of shifting discharge timing on occupancy levels (Khanna et al., 2012b). They conducted an analysis of hospital inpatient data and ED data from 23 reporting hospitals in Queensland, Australia. Quantification was made on the impact of shifting discharge timing on occupancy level using observed and simulated data. In their study, they identified three stages of ‘choke points’ where hospital occupancy increased. These are points where the system performance was declining, namely on occupancy levels of 91%, 96%, and 99%. The identified choke points were dependent on hospital size, and reflect a system change from the “usual” to “crisis”. Understanding where the bottlenecks around the choke points come from and design capacity management strategies around them (like alternate boarding arrangements for patients, and the use of predictive technology to better manage capacity use) would improve patient outcomes and reduce access block (when patients are unable to gain access to hospital beds within 8 hours). An occupancy level of 85% is often prescribed for modern hospital systems to have the ability to operate efficiently for the patient flow (Khanna et al., 2012b).

Literature shows increased hospital occupancy is strongly associated with LOS for admitted patients. High occupancy rates lead to an increased LOS for patients, causing overcrowding. Earlier discharge during the day is a possible solution to reduce occupancy levels and prevent overcrowding in hospitals.

### **3.1.2. The effect of early discharge on hospital length of stay**

Research shows that there is evidence that early discharge has an effect on occupancy levels, overcrowding, and LOS. This paragraph elaborates on the first paragraph by looking further into the effect of early discharge on hospital LOS.

To improve the patient flow in acute hospitals, it is recommended to focus on an early discharge of patients (Khanna, Boyle, Good, & Lind, 2012a). Khanna et al. (2012) analyzed the effect of inpatient discharge timing on flow parameters such as LOS. A comparison was made with the effect on hospital occupancy as well to understand the response of the hospital to discharge timing. Khanna et al. also investigated the impact of hospital size. The analysis shows that on days when the admissions peak takes place earlier than the discharge peaks, hospitals of all sizes experience increased levels of occupancy, access block, and increased inpatient LOS. To fix the system, they advise approaching the problem from the hospital as a whole. (Khanna et al., 2012a).

The key approach for the improvement of bed utilization is discharging patients before noon (Rajkomar, Valencia, Noveler, Mourad, & Auerbach, 2016). Rajkomar et al. identified the association between discharge before noon (DBN) and LOS. A retrospective analysis was conducted of data from medical and surgical discharges from a single academic hospital from July 2012 to April 2015. To evaluate the association between DBN and LOS, a multivariable generalized linear model was used.

Earlier discharge was found to be associated with a longer LOS, particularly among emergency patients. This however seems contradictory. The association between early discharge and LOS is potentially bidirectional. The interpretation of Rajkomar et al. (2016) is that patients were kept longer in order to be discharged by noon the following day, which results in a higher LOS (Rajkomar et al., 2016).

### 3.1.3. Timely discharge and discharge before noon

The literature on discharge timing shows that early discharge has an effect on the patient flow. The earlier patients are discharged, the better the throughput gets. Early discharge results in a better throughput from the ED to the clinic, therewith a better patient flow and a higher rate. Table 5 shows the results of interventions held at hospitals to increase DBN-rates.

Study	Year	Country	DBN-rate (pre-intervention)	DBN-rate (post-intervention)	Duration	Intervention
(Beck, Okerblom, Kumar, Bandyopadhyay, & Scalzi, 2016)	2016	N/A	14%	26%	N/A	LEAN
(Kane et al., 2016)	2016	United States	14%	24%	22 months	LEAN
(Patel, Morduchowicz, & Mourad, 2017)	2017	United States	10,4%	19,7%	24 months	Process change, feedback, audit, educational campaign

Table 5: Performed interventions to increase DBN-rates at hospitals

In 2014, Stanford Health Care developed an organizational goal to increase their DBN rate. To improve the quality of care for the patients, Stanford Health Care incorporated the Lean management system. The aim was to raise the DBN rate from 14% to 40% by evaluating the effect of two hospital-wide interventions. The interventions (patient flow management techniques) were to identify two patients to be discharged before 11 A.M., and to develop a system to manage ED crowding. To develop a system to manage ED crowding, *‘twice-daily weekday multidisciplinary huddles with consistent senior physician and administrative leaders who are empowered to escalate issues quickly with real-time problem solving and rapid feedback loops for suggested solutions were conducted’*.

All inpatient patients who got discharged across 19 inpatient units in a 484-bed academic teaching hospital were observed in a retrospective analysis. The DBN rate, patient satisfaction, and readmission rates were measured. As a result of the two hospital-wide interventions, the DBN rate increased from 14% to 24% in a 22-month pre- and postintervention period. The readmissions and patient satisfaction scores remained stable. Although the interventions increased the DBN rate, the goal of a DBN rate of 40% was not achieved (Kane et al., 2016).

Beck et al. also used a Lean intervention to improve the throughput and reduce the ED boarding by improving patient discharge efficiency at a children’s hospital. They studied the impact of Lean changes on ED efficiency. The intervention included a few aspects. The discharge work of the patient could be done at the patient’s bedside using a checklist. Meetings were set up in the afternoon to work on the discharges of the following day. A determination was made on the impact of the intervention on median times of discharge order entry, patient discharge, and percent of patients discharged before noon (Beck et al., 2016). The median discharge order entry time for the general pediatrics service decreased from 1:43 P.M. to 11:28 A.M. and the median time of discharge decreased from 3:25 P.M. to 2:25 P.M. The DBN rate increased from 14% to 26%. Concludingly, the Lean intervention applied to the children’s hospital improved patient discharge times and the patient discharge times, and reduced ED boarding times (Beck et al., 2016).

A needs assessment performed by Patel et al. (2017) identified the next four common barriers to early discharge:

1. Lack of communication between nurses, case managers, and teams about discharge planning;
2. Obtaining home services, equipment, and oxygen early in the morning;
3. Arranging transportation to facilities earlier in the day
4. Communicating discharge expectations with patients and family members (Patel et al., 2017).

Patel et al. tested and implemented interventions in the areas of education, process changes, and audit and feedback. Furthermore, they conducted an educational campaign on the safety implications to reduce the admission time and used an electronic dashboard to provide real-time DBN. As a result of the interventions, the DBN rate increased from 10,4% to 19,7% in a period of 24 months. Significant improvements were gained in the average LOS (from 5,88 to 5,60). A structured approach (for instance the Plan Do Check Act cycle) to improve early discharges can lead to rapid and sustainable results in increasing the DBN (Patel et al., 2017).

According to Kravet et al. (2007), patient discharges from the hospital frequently occur late in the day. Quality of care can be improved if the discharge of patients could be shifted to earlier in the day because it will help to improve the throughput to the clinic. When patients leave the hospital earlier in the day, patients who wait to be admitted in the ED are able to leave the ED sooner. Furthermore, the ED waiting room backlog can be reduced. Nursing staff can benefit from earlier discharge since they can spread out their work across a longer part of the day since the patients leave the hospital earlier. Discharging patients earlier may also increase patient satisfaction (Kravet, Levine, Rubin, & Wright, 2007).

Discharge timeliness and its impact on hospital crowding and flow performance were studied by Khanna et al. (2016). Their objective was to identify optimal discharge time targets to help hospitals reduce overcrowding and improve the patient flow for inpatient patients who get admitted to the hospital. To reconstruct patient pathways from admission to discharge, 15 months of emergency and inpatient records from a large hospital were used. Discrete event simulation was used to assess discharge scenarios on flow performance. National Emergency Access Target (NEAT, an ED performance target introduced by the Australian government), time spent waiting for a bed, LOS, and occupancy were included as output measures (Khanna, Sier, Boyle, & Zeitz, 2016). Targets like “80% discharged before 11 A.M.” and other targets that spread the workload of the staff resulted in 9 more available beds for incoming patient flow. The time spent for an inpatient bed, the LOS, and occupancy were significantly reduced. This study proves that early in the day discharges contribute to a better flow of patients (Khanna et al., 2016).

In another retrospective study, Wertheimer et al. (2015) evaluated the effect of a higher DBN rate on the admission arrival time on the ward and the number of admissions per hour and the sustainability of their DBN-intervention (Wertheimer, Jacobs, Iturrate, Bailey, & Hochman, 2015). Along with the previous increase of the DBN rate, they found a statistically significant change in the median arrival time of ED admissions and transfers. The median arrival time of ED admissions and transfers decreased from 5 P.M. to 4 P.M.. The admission peaks the hospital used to have were significantly reduced for admissions. The DBN rate sustained at 35%. Thus, the increase of the DBN rate has an effect on the admissions arriving earlier in the day and reduces peaks of admissions (Wertheimer et al., 2015).

### 3.1.4. Improving the patient flow

Finally, the last paragraph combines the previous paragraphs and looks at everything as a whole, namely the patient flow. Interventions used in order to improve the patient flow in hospitals are summed up and examples of best practices are given.

Waits, delays, and cancellations are common phenomena in healthcare. Hospitals responded to delay by adding resources such as more beds, buildings, and staff, as the only way to deal with the needy population. Assessment of reasons for delays suggests that adding resources is not the solution. In many cases, delays are not a resource problem, they are a flow problem (Haraden & Resar, 2004). An evaluation was made by The Institute for Healthcare Improvement on what influences the smooth and timely flow of patients through hospital departments to develop and implement methods for improving the patient flow. The Institute for Healthcare Improvement focused on the flow of elective surgery, achieving timely and efficient transfer of patients to medical units, reducing waits for inpatient admissions through the ED, and improving flow from the inpatient wards to long-term-care facilities. Hospitals need to view the problem in term of an interdependent system rather than individual departments to improve the flow (Haraden & Resar, 2004).

There are a variety of initiatives designed to improve the patient flow from admission to discharge through the hospital such as: to create multidisciplinary teams to address ED and inpatient overcrowding as a systems problem; to establish coordinated bed management programs to optimize occupancy of inpatient beds; to adopt “smoothing” strategies to distribute admissions more evenly across the workweek, relying on data about predictable weekly or daily peaks in demand for admission; to create inpatient units to relieve ED overcrowding; to implement "full-capacity protocols" in periods of severe hospital- and ED overcrowding (Moskop et al., 2009b).

To improve patient discharge and reduce LOS, King Faisal Specialist Hospital and Research Center decided to improve their efficiency and enhance the patient flow. In order to do so, eight interventions were implemented. These include the following:

1. *Dedicating slots in radiology department for discharging patients*
2. *Establishing a clear line of communication between radiology and head nurses to coordinate procedures*
3. *Reviewing all radiology exams pending from previous days and addressing the reason for delays by supervisors*
4. *Identifying all actual and potential discharges the day before by rounding consultants*
5. *Labeling laboratory sample for morning discharge patients with a different color and handling those in priority in collection, transportation and in lab*
6. *Requesting the pharmacy team to coordinate with head nurses to improve response and accelerate the expedite medications*
7. *Establishing a clear line of communication between head nurses and housekeeping to improve on the turnaround time of cleaning patient rooms after discharge*
8. *Assigning case managers to coordinate with different departments and family to facilitate discharge (Khalifa, 2017).*

These interventions have led to multiple process improvements. Discharges that experienced delays went from 21.7% to 14.1% after improvement. The discharge cycle duration decreased

from 17.9 to 9.2 hours. Discharges that experienced procedure delays decreased from 14.8% to 4.1% after improvement. The average LOS was reduced from 12 days to less than 10 days. The improvement of the discharge process and a decrease in LOS of inpatients (as a result of the eight interventions summed up above) are considered among the most effective ways to improve the hospital efficiency and the patient flow inside hospitals (Khalifa, 2017).

Hospitals can increase their service capacity by improving the throughput of patients. One way to do so is by making use of patient tracking technologies. Patient tracking technologies may help caregivers to work more efficiently by providing real-time information on patients and updates about labs, orders, applications for follow-up institutions, and other notifications that could enhance their workflow. Patient tracking technologies provide information to improve the patients' flow throughout the hospital. Benefits of implementing patient flow solutions such as patient tracking technologies include increased throughput, decreased LOS, higher patient satisfaction rating, and improved recording of treatment costs (Drazen & Rhoads, 2011). Drazen & Rhoads (2011) identified best practices for implementing patient flow technologies. These include the following:

- *Before implementing patient flow technologies successfully, organizations need to view patient flow as a system-wide phenomenon requiring system-wide attention.* The cause of a patient flow problem may be a few steps away from where the effect is noticed. For instance, patient flow issues at inpatient wards may be the result of poor bed placement coming from the ED or poor adherence to discharge procedures.
- *Organizations need to conduct a detailed review of the process and workflows prior to implementation.*  
Before implementing technologies to improve patient flow, organizations need to understand what processes they are trying to fix and which performance parameters they are targeting, and why.
- *A link must be made between patient tracking and discharge planning.*  
Discharge planning reduces the average LOS and frees up beds for incoming patients. Discharge planning should begin as soon as a patient is admitted. Timers in the patient tracking system can be used to show the amount of time remaining before a scheduled discharge.
- *Organizations need to examine variation in the processes concerning the patient flow.*  
Variation in processes has a negative impact on the high throughput of patients. By standardizing processes, process variation could be reduced. For instance, standardizing processes for initiating a bed request instead of accommodating many.

### **3.1.5. Summary literature study**

Many studies have been carried out concerning the discharge process in relation with the ED. Bed occupancy, overcrowding, and DBN are popular terms in the literature regarding the discharge process. However, little is studied on the throughput of patients in a hospital. The following paragraphs summarize the findings of the literature study.

Literature shows increased hospital occupancy is strongly associated with LOS for admitted patients. High occupancy rates lead to an increased LOS for patients, causing overcrowding. Earlier discharge during the day is a possible solution to reduce occupancy levels and prevent overcrowding in hospitals. The peak of patient arrivals occurs during the morning in most acute

hospitals. However, the peak in discharges occurs in the late afternoon. Studies show that on days when the admissions peak takes place earlier than the discharge peaks, hospitals experience increased levels of occupancy, access block, and increased inpatient LOS. Discharge Before Noon is found to have an effect on decreased LOS. LEAN interventions were successfully applied in hospitals to increase the DBN-rate.

The literature on discharge timing shows that early discharge has an effect on the patient flow. The earlier patients are discharged, the better the throughput gets. Early discharge results in a better throughput from the ED to the clinic, therewith a better patient flow and a higher DBN-rate. Multiple interventions exist to enhance the patient flow. Improving Patient discharges and reducing the LOS help achieving a better patient flow. Another way to improve the patient flow is the use of patient tracking technologies.

Quality of care could be improved if the discharge of patients could be shifted to earlier in the day because it will help to improve the throughput to the clinic. When patients leave the hospital earlier in the day, patients who wait to be admitted in the AOA and ED are able to leave the AOA and ED sooner. Ultimately, that might result in a better throughput of the patients.

### **3.2. Documented discharge process MST**

The vision of MST regarding the discharge process is that during hospitalization, the patient is at the right place at the right time for optimal throughput. This way, the patient most likely will be discharged on the expected discharge date. The essence is to involve the patient (during meetings before and throughout the admission) in the process of admission and discharge as soon as possible, and during admission inform the patient about the expected pain, the possible restrictions in habits, the continuation of the treatment after discharge, and what to do with unexpected problems (Jongbloed & Duindam, 2016).

#### **3.2.1. Process criteria**

MST uses some guidelines under which the discharge process must be operated. These guidelines are:

- The discharge process is based on the norms of Niaz Qmentum accreditation program (see Appendix A)
- The process is applicable to all patients (including day-care admissions) who are clinically hospitalized.
- In the entire discharge process, patients need to be well informed and expectations need to be well managed. The provision of information is adjusted to the needs of the patient.
- The LOS becomes more predictable because of the use of the pre-operative screening (POS) form based on the 'DBC op weg naar transparantie' (DOT) with expected admission time linked to it. The condition is that all operative departments have to work with the form.
- A probable end-of-treatment date has to be filled in for admissions at non-operative departments. This probable end-of-treatment date is shared with the patient. The specified end-of-treatment date might give some insight afterwards in what kind of delays might occur.
- All patients who get transferred to the clinic have to see either a POS-nurse or an inpatient clinic nurse.
- All specialties need to involve the end-of-treatment date in the daily visits. This date has to be visible for the patients and the involved parties.
- Discharge criteria are essential in the management of the expectations of the patient, the actual discharge, and possible aftercare. All specialties have to work with discharge criteria, but these may vary between patients and specialties. This too is a fixed part of the daily process and the information provision towards the patients. The discharge criteria and the steps that have to be taken towards discharge have to be shared with the patients and other involved parties.
- The information provision towards the patients needs to be shared both verbally and written.
- As soon as the end-of-treatment date (which is set by the physician) is known, the transfer-nurse has the mandate in accordance with the ward nurse in the decision of the moment of discharge. From that point on, the transfer-nurse is responsible for the discharge date. The nurse has to inform the patients, their family, or their representatives.
- Rules of living have to be addressed for all specialties, surgeries, and treatments.
- Obstructive factors for discharge have to be solved 24/7. Think of arranging after-care, visits by the physician in the weekend, tests that need to be carried out.

#### **3.2.2. The five phases of the discharge process**

MST distinguishes five phases in the discharge procedure. These were documented by Jongbloed et al. The five phases include the pre-admission phase, admission to the ward,



completion of admission, discharge, and aftercare. These phases are explained later in this chapter. Five types of different healthcare professionals are included in the five phases of discharge, namely: the physician, the POS-nurse, the outpatient clinic nurse, the ward-nurse, and the transfer-nurse. Not every patient sees a POS-nurse. The tasks these healthcare professionals carry out are displayed in Table 6 (Jongbloed & Duindam, 2016). Figure 4 shows a visual representation of the discharge process.

Healthcare professional	activities
Physician	<ul style="list-style-type: none"> <li>- The provision of information that contributes to a successful discharge</li> <li>- Preparation for discharge</li> <li>- Determination of end-of-medical-treatment-date</li> <li>- Completion of admission (inform the patient, transmission)</li> </ul>
POS-nurse/outpatient clinic nurse	<ul style="list-style-type: none"> <li>- Preparation of patient for admission, provision of information regarding the treatment</li> <li>- Discuss aftercare, post-treatment and follow-up process with the patient (Done by the outpatient clinic nurse).</li> <li>- Gaining insight into the patients' home situation</li> </ul>
Ward nurse	<ul style="list-style-type: none"> <li>- Preparation for discharge</li> <li>- Provision of information to the patient</li> <li>- Organize the discharge (inform patient, transmission, administrative completion)</li> </ul>
Transfer-nurse	<ul style="list-style-type: none"> <li>- Assessment and organization of needed aftercare</li> <li>- Inform patient, involved parties, and healthcare providers concerning the process of aftercare</li> </ul>

*Table 6: Roles of healthcare professionals in the discharge process*

### **Phase 1: Pre-admission**

The pre-admission phase starts at the moment when the decision is made to admit the patient to the clinic. In this phase, the patient will be instructed on the consequences of the treatment and the process of admission to the clinic. Furthermore, the consequences of the treatment to the home situation are discussed and it will be discussed whether it may cause obstructions for discharge.

### **Phase 2: Admission to the ward**

The execution of this phase will start as early as possible, if possible on the day of admission (for all specialties). The discharge and the needs (aftercare/means/materials) need to be made clear. In this phase the patient receives information. Visits are a fixed part of this phase and a daily returning process. The transfer-nurse tries to get an insight of in the process as early as possible to arrange the aftercare.

### **Phase 3: Completion of admission**

In this phase, the actual discharge and the completion of the discharge are organized by means of checklists. The physician, nurse, and transfer-nurse are included in this phase. The medication letter is sent to the pharmacy and if needed post-discharge care has been arranged. The patient is informed about all the steps taken.

### **Phase 4: Discharge**

This is the phase where the actual discharge and administrative completion takes place. The physician discharges the patient after everything regarding the treatment has been finished. The only thing that remains is the patient leaving the hospital and the administrative discharge of

the patient. In this phase, a letter is sent to the general practitioner of the patient. When needed, the general practitioner receives a phone call.

### Phase 5: Aftercare

In the aftercare-phase, it has to be checked whether the discharge went well, and adjustments need to be made if necessary. Possible remaining questions and uncertainties need to be answered and solved by calling the patient the day after discharge.

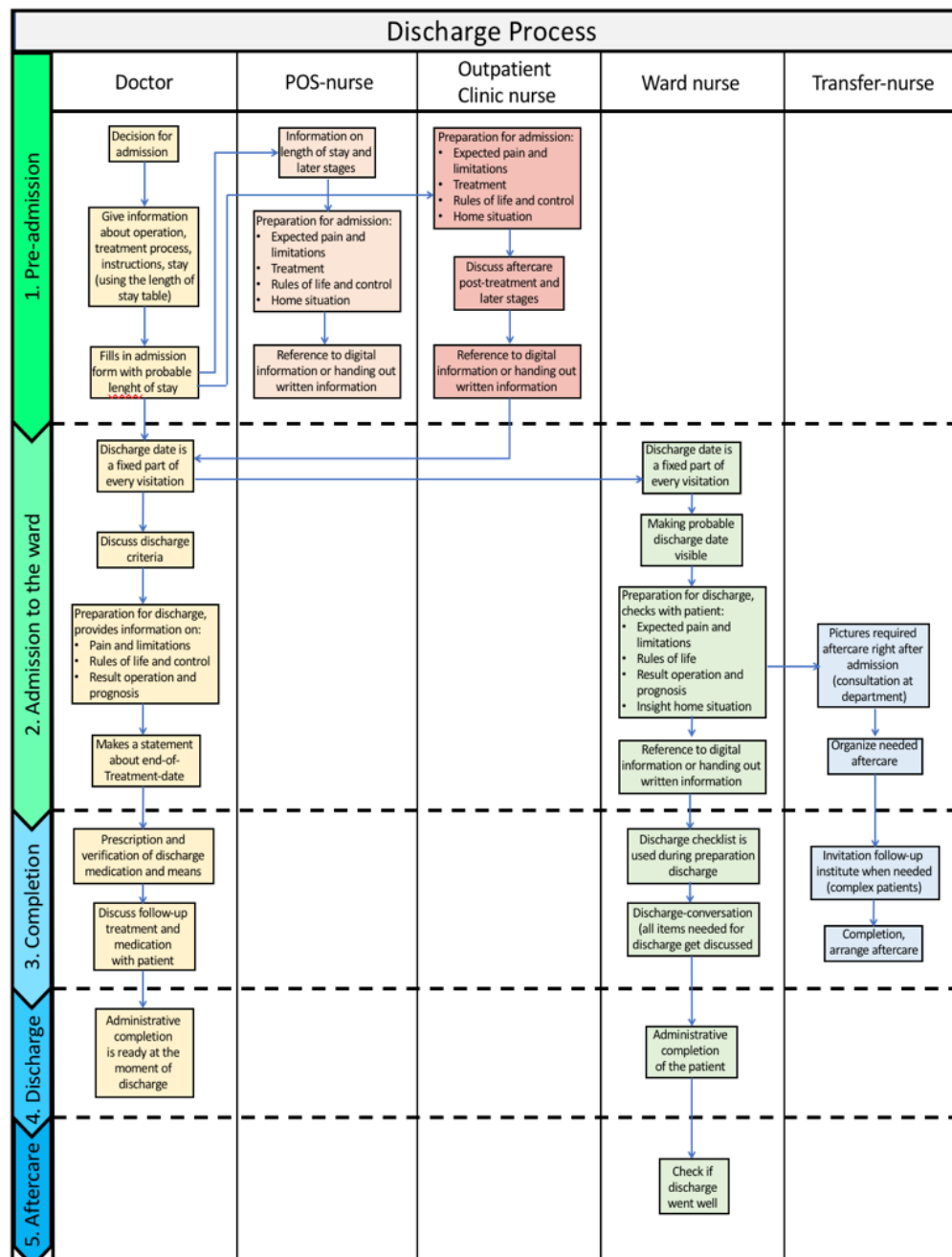


Figure 4: Flowchart discharge process (Jongbloed & Duindam, 2016)

### 3.3. Current operational discharge process at MST

To map out the current operational discharge process at MST, ten focus groups and an interview (n=11) were organized for clinical specialties. Each focus group was guided by means of a script (Appendix B,C). Nurses, nurse specialist, physicians, physician's assistants, and team leaders had a lot of input during the focus groups. Findings were transcribed and coded for analysis. The findings collected out of the focus groups and the interview can be categorized into ten themes based on the coding of the transcripts of all specialties. These are:

- Patient visits
- Discharge timing
- Provisional discharge date
- Transfer from AOA to the clinic
- Discharge without being seen by the physician
- Discharge during weekend
- Transfer office
- Wrong-bed days
- Medication
- Provision of information

A lot of specialties share the same bottlenecks that could be improved and optimized. However, some specialties have their own specific bottlenecks. Table 7 shows the professions and the number of the attendees of all focus groups combined. Table 8 shows an overview of the aspects within themes that need to be optimized according to the attendees of the focus groups. The themes are further elaborated in the following paragraphs by discussing specific aspects that need optimization.

Profession	frequency
Nurse	13
Nurse specialist	1
Physician's assistant	5
Physician	3
Team leader	9

*Table 7: Profession attendees and frequency of professions focus groups*

Themes	Bottlenecks (derived from focus groups)
Patient visits	No fixed times for visits
	No prioritization in visits
	Late arrival of physician (assistant) at the department
	Late/little time for visits due to nursing of patients
	Lack of concrete decision making regarding treatment
	Pre-assessment of patients take a long time
Discharge timing	Lab results arrive late
	Patients get picked up late by family/friends
	Discharge times is not always communicated with patients and family
	Administrative discharge of patients does not always comply with actual discharge
	Timing of transfers to other institutions later than desired discharge time
	Ambiguity on what needs to be arranged for discharge
	Waiting for patients to wake up and have a shower
	Lack of/use of protocols
	Last minute complementary tests
	Misplacement of patients at other departments

Provisional discharge dates	Lack of use of provisional dates
	Determination of discharge dates is found hard by physicians/assistants
	LOS matrices to determine discharge dates also hard to use
	Correspondence LOS matrices with reality
Transfer from AOA to the clinic	Duration of cleaning rooms and making requests for cleaning is long
	Acquired medical history of the patient from AOA not sufficient enough (preparatory work)
	Lab results arrive late
	Later transfer to clinic because of arrangement of lunch of the patient
	Unnecessary care requests because of protocols by nurses
Discharge without being seen by the physician	Lack of use of discharge criteria
Discharge during weekend	Continuation of processes not always possible
	Arrangement of aftercare on Friday
	Transfer office closed during the weekend
	Work pressure physicians is high; low number of healthcare professionals
	Visits take place on a later moment of the day
	Administrative discharge postponed to Mondays/ Physicians not always familiar with discharge and medication
	Writing discharge letters is often postponed to the evening or Mondays
Transfer office	Transfer office is closed during the weekend
	No arrangements by transfer office without discharge dates
	Limited capacity ambulatory services
	Arrangement home care only possible during weekdays
	Instructing patients regarding discharge
	Follow-up institutions admit patients on a later moment than the hospital's desire to discharge the patients
Wrong-bed days	Limited space follow-up institutions
	Discharge during weekend
	Requests for aftercare too late (transfer office)
	Waiting for transport to home
Medication	Communication with the patient not always clear
	Medication verification by pharmacy not always done
Provision of information	Administration of patients not always completed on the moment of discharge
	Too many ICT-systems
	Updating discharge letters by physicians
	Whiteboards in patient's room are not always used

Table 8: Bottlenecks per theme derived from focus groups

### 3.3.1. Patient visits

Specialties across MST use different times at which they start the patient visits. Table 9 shows an overview of starting times visits of specialties. All the departments gave several reasons what the start of patient visits depends on.

Specialty	Starting times visits
Gastroenterology	9:30 A.M.
Surgical Oncology	8:00 A.M. – 11:00 A.M.
AOA	8:00 A.M.
Thorax Cardiology	8:15 A.M.
Thorax Cardio Surgery	9:00 A.M.
Pulmonology	9:30 A.M.
Children/Teen	9:00 A.M.
Mother/Child	9:00 A.M.
Internal Medicine	9:00 A.M.
Orthopedics	Not specified
Neuro Center	Not specified

Table 9: Starting time visits per specialty

At the Pulmonology department, according to nurses, physicians arrive later because they exchange patient information between the shifts. According to physicians they arrive later because nurses are busy nursing the patients. The nurses and physicians sometimes experience too little time for visits due to care of patients and lack of lab results in the morning. Some physicians could be more decisive according to nurses when it comes to decisions made regarding the patient's pathway.

At the Child/Teen department, before actual visits take place, physicians assess which children are allowed to be discharged, without actually visiting the room. Depending on the number of children that get discharged before the visits, the visits may start later. Unlike other specialties, visits (when the patient's health is being discussed) at the Child/Teen department do not take place in the patient's room but in a meeting with the physician, pediatrician, and the nurse. After assessing the patients, they actually visit the children who are ready to be discharged, then the sicker patients, and finally all other patients.

Visits at the Internal Medicine department start as soon as the physician assistants arrive. The nurses and physicians start visits with patients who will be discharged the same day. Sometimes the nurse is still nursing the patients, in that case, the patient has to wait until all other patients are visited. This results in delayed discharge of the patient. Physician assistants are usually holding back when it comes to making decisions. They want to discuss decisions first with the supervisor and that leads to delays in the discharge process. However, according to a physician, that is inherent in being an educational hospital.

At the Orthopedics department, there is no fixed time at which visits take place due to the fact that the physician needs to go to several places (such as AOA and ED) in the hospital. This may cause the visits to start later and has an influence on the discharge timing. Physicians and physician assistants try to be at the department at 9 A.M., but sometimes it takes until 11 A.M. before they arrive. Before visits take place, patients are being discussed by nurses and physicians.

At the Neuro Center there are no fixed times for visits. Physicians usually arrive between 8 A.M. and 10 A.M. When physician assistants are involved, physicians tend to come on time. When there are patients in need for surgery, the physician visits neurosurgery first. That means that visits at neurology can take up until 12 A.M. The patient's pathway becomes clear at around 2 P.M. There is no fixed time at which the pathway needs to be concrete. Physicians start visits after the patients have been pre-discussed with the nurses. There is no priority based on possible discharges, visits happen in the order that the Neurologist wants. Some physicians are not able to work with advanced ICT system.

### **3.3.2. Discharge timing**

In general, most specialties want the patients to be discharged before 11 A.M. because that is the time the AOA wants their patients to be transferred to the clinics. Some departments use different discharge times (see Table 10). There are multiple reasons why specialties are not always able to realize discharge before 11 A.M. For instance, the arrival time of lab results of the patients causes delay in every specialty. This paragraph looks into what reasons departments give for delays in discharge.

Specialty	Desired discharge times
Gastroenterology	10:00 A.M.
Surgical Oncology	10:00 A.M.
AOA	All day
Thorax Cardiology	11:00 A.M.
Thorax Cardio Surgery	11:00 A.M.
Pulmonology	9:00 – 10:00 A.M.
Children/Teen	All day
Mother/Child	11:00 A.M.
Internal Medicine	9:00 A.M.
Orthopedics	11:00 A.M.
Neuro Center	11:00 A.M.

*Table 10: Desired discharge times departments*

The Gastroenterology department sometimes administratively discharges patients at later moment on the day. As a result, the system thinks that the bed is still occupied, but in reality, the patient has already left the hospital. This results in the fact that patients at the AOA are not able to be transferred to the clinic even though there is an unoccupied bed.

The AOA has two types of patients: patients who get discharged directly from the AOA (to home or follow-up institution), and patients who are admitted to the clinic. Patients are allowed to stay a maximum of 48 hours at the AOA. The AOA does not use specific times for discharge; patients can be discharged 24 hours a day. Patients who need to be admitted to the ward however have to be admitted before 11 A.M., before new patients arrive at the ED. Most patients usually arrive between 12 AM and 5 PM at the ED.

According to nurses at the Pulmonology department, a reason for delay in discharge is that final steps regarding the patient's treatment need to be taken care of on the day of discharge. Sometimes it is unclear what needs to be done to realize the discharge. For instance, there are a lot of checklists. Other departments also stated that physicians sometimes decide to conduct complementary examination right before discharge, which leads to delay of discharge.

At the Child/Teen department patients can be discharged at any time during the day. At the Mother/Child department, healthcare professionals wait for the patients until they wake up and have a shower. Furthermore, the Mother/Child department is not as focused on the discharge time of 11 A.M. as they would want to. According to the team leader, they could communicate the discharge times better with the patient and the family so that they can anticipate on it.

At the Orthopedics department, patient discharges are prepared one day in advance. The discharge is dependent on whether the wound is still bleeding or not and if the patient is mobile enough to leave the hospital. For short-stay patients, it is not always possible to be discharged before 11 A.M. The admission of short stay patients is planned. They are planned for surgery and usually get discharged 24 hours after surgery. For instance, when a patient is planned for surgery at 4 P.M., the patient gets discharged at 4 P.M. the next day.

At the ED patients can be discharged all day long. However, they experience problems with vulnerable elderly patients. After treatment at the ED, patients either go home or proceed to the AOA. However, vulnerable elderly people often cannot go home because they have multiple complaints. In this case, the ED has to arrange a crisis-admission.

A common reason for a delay in discharge is transport to home. All departments experience delays in discharge because the patients have to wait for their family or friends to pick them up. Departments sometimes arrange a taxi for the patients. Friends and family pick up the patients later because they often have to work. Because of that, the patient is not discharged before 11 A.M.

Another reason for a delay in discharge is the misplacement of patients. When there is no room in a department and a patient has to be admitted to the clinic, the choice can be made to place the patient in a different department. This is however not that efficient. Nurses are specialized to care for patients at the specialty they work for. When a patient is placed somewhere other than its own specialty, that might cause some inconveniences for the nurses. Furthermore, the visit has to be done by the patient's own specialty, and not the department the patient is staying at. This way the visits will take longer because the physician has to go to several departments which is logistically inefficient.

The discharge time of patients across different specialties is subject to many variables. The departments try their best to keep the discharges as early as possible but indicate that the discharge time is dependent on a lot of factors of which some are beyond their control.

### **3.3.3. Provisional discharge date**

Provisional discharge dates need to be set to have a grip on the discharge itself according to team leaders. This way healthcare professionals can work towards the discharge of patients. Most departments find it difficult to determine provisional discharge dates because the LOS of the patient is dependent on multiple factors (e.g. patient not mobile enough, bleeding wound, lab results etc.). A pilot study on the discharge process was conducted at the Gastroenterology department. The department was provided of a LOS matrix to help determine the discharge date. Even when using the matrix, it was hard to determine the discharge dates according to nurses, since the standard deviations were too deviant with respect to the average LOS.

Surgical Oncology is provided of LOS predictions for treatments as well and experiences somewhat the same as Gastroenterology. The provided predictions for LOS do not correspond to the reality, it needs to be adjusted during visits. The AOA always sets provisional discharge dates, but it also differs from reality. Because provisional discharge dates do not comply with the reality,

When departments do not work with provisional discharge dates, it is difficult to get a grip on the actual discharge according to some team leaders. They think that using provisional discharge dates will help monitor the progress of the treatment to eventually discharge patients on the pre-set discharge date, and not later. This way delayed discharge might be prevented. The consequence of not working with provisional discharge dates is that the LOS will increase. This also makes it harder for the transfer office since they need an actual discharge date before making requests for a follow-up institution.

### **3.3.4. Transfer from AOA to the clinic**

The throughput from the AOA to the clinic depends on the discharge times of patients in the clinic. The earlier the patients are discharged from the clinic, the earlier new patients can move to the clinic from the AOA. Patients are not picked up from the AOA at fixed times because patients are discharged at different times. Sometimes the department has to wait for the rooms

to be cleaned. This can take up to several hours, during which the potential new patient stays at the AOA. The room service employees make the requests to clean the room in accordance with the nurses. Sometimes they have to make an urgent request, but that requires multiple steps to be taken and is time-consuming. The room service employee has to inform the bed coordinator; the bed coordinator assesses whether it is really urgent or not and then forwards the request to CleanCare. CleanCare is the company that cleans the patients' rooms.

The AOA has two moments they want their patients to transfer to the clinic, 11 A.M. and 2 P.M. Unfortunately, the AOA does not succeed in moving the patients to the clinic before 11 A.M. because of the visits at the clinical departments. The beds need to be empty first before patients can be admitted to the clinic. Since the AOA has fewer beds available after moving to the new hospital, patients structurally stay longer at the AOA. Furthermore, the AOA has to wait for lab results before patients can go to the clinic. When patients transfer from the ED to the AOA, patient data and medication need to be measured again, which is inefficient. This is caused because of the use of different ICT-systems.

The Internal Medicine department believes that transfer before 11 A.M. is not realistic and wishes for more continuity from the AOA. The Orthopedics department states that information needed from the AOA for admission concerning the medical history of the patient is often missing. When the Orthopedic department receives patients after surgery with nearly no acquired medical history of the patient, it is hard to gather information afterward since the patient had surgery.

The Neuro Center states that the AOA does not perform preparatory work. For instance, patients are not being washed before they are transmitted to the clinic. The Neuro Center also experiences the same problem as the Gastroenterology department regarding cleaning the room. Some room service employees think along and act quick, but others need to be well instructed to make a request to clean the room. This results in patients being admitted later than they actually could have.

The problem with delays in transfers from the AOA to the inpatient wards is that the transfer times are not always met. This is caused because patients at the clinic are not always discharged before 11 A.M. When the discharge peak of patients shifts to a later moment in the day, overcrowding occurs at the AOA and ED because patients cannot be transferred to the inpatient wards since the beds are still occupied.

### **3.3.5. Discharge without being seen by the physician**

To be discharged without seeing a physician by using discharge criteria might save time during visits at a department and therefore lead to a quicker discharge of patients. Some physicians want to see their patients before they are discharged to have one last conversation; other physicians use discharge criteria by which the patient is allowed to be discharged without seeing the physician. This is however dependent on what kind of disease the patient is being treated for. Some physicians questioned the ethics and stated that it does not feel right to see the patient for the last time one day before the actual discharge since they want to speak to the patient on the day of discharge as well. A nurse stated that they do work with discharge criteria, but they often need the assistance of physicians on the day of discharge.



### **3.3.6. Discharge during weekend**

In general, discharge during weekend often is disrupted due to processes (such as patient visits) that go differently during the weekend. Most departments try to arrange discharge the same as during weekdays but that does not always happen as desired. Since the transfer office is closed in the weekend, discharges to other institutions such as nursing homes, or to home with home care need to be arranged before Friday. If aftercare has not been arranged before Friday, patients stay in the hospital until Monday. The transfer office is closed during the weekend because healthcare institutions such as nursing homes often do not admit patients in the weekend.

Other reasons patients do not always get discharged during the weekend include the work pressure of healthcare professionals. At the Gastroenterology department for instance, there is only one physician during the weekend. He has to see all patients at the ward, ED, AOA, and also has the mobile phone. The work pressure is too high to perform the visits thoroughly. However, it also depends on whom of the physicians has to work during the weekend. Some let the patients stay the weekend, others arrange the discharge. Not all physicians are familiar with how to arrange the discharge and medication for instance. That causes the patients to remain in the hospital until Monday as well.

Summarized, the weekend is subject to a lot of variables that differ from how things go during the week. The work pressure is high, discharge is not always arranged before Friday, not all physicians have the knowledge how to arrange discharge or medication, and the transfer office is closed. The reasons cited above may lead to delay in discharge and wrong-bed days for some patients.

### **3.3.7. Transfer office**

The transfer office arranges aftercare for all patients in need of care after discharge, whether that is at home or in a different institution. All departments stated that the cooperation with the transfer office went better the moment every department had transfer nurses placed on their department. All departments also stated that the transfer office does not arrange requests without receiving a discharge date of the patient. The departments can make the requests, but the transfer office will not arrange something until they receive a discharge date. Because of that, when the discharge date is communicated fairly late, it is hard to arrange aftercare on the day that the patient leaves the hospital. That may lead to wrong-bed days. Limited capacity in transporting patients to other institutions may lead to wrong-bed days as well.

The transfer office is closed during the weekend. All requests need to be made before Friday in order to handle discharges with aftercare during the weekend. Otherwise, the patients have to stay until Monday. As mentioned earlier, the transfer office is closed during the weekend because healthcare institutions such as nursing homes often do not admit patients in the weekend. According to nurses and physicians, that is one of the main reasons why patients remain in the hospital during the weekend.

### **3.3.8. Wrong-bed days**

There are several reasons why departments experience wrong-bed days. One of the main reasons is that patients are not able to be transferred to other health care institutions like nursing homes. Because of that, patients remain in the hospital, which leads to higher costs for the hospital. Some patients wait several months for a spot in a nursing home. This causes the bed capacity to drop temporarily. Another reason for wrong-bed days is discharge (of patients in

need for aftercare) during the weekend. If aftercare has not been arranged by Friday, patients have to stay in the hospital until Monday. Even if their treatment is finished on Saturday or Sunday, they have to wait until Monday so that the transfer office can arrange aftercare.

At the Gastroenterology department patients also stay longer in the hospital because the request for aftercare was done too late. At Surgical Oncology it is hard to place patients who received tracheal cannula in a follow-up institution because there often is no place. When patients remain in the hospital, there is the possibility that new complications may occur, which results in a higher LOS.

The Thorax Center states that younger colleagues decide for the patient to stay a little longer because they are insecure regarding the treatment of the patient. The Children/Teen department does not register wrong-bed days as such. Patients often only have to wait to be admitted to rehabilitation center 't Roessingh. This delay is only one day in most cases. The domestic environment of children concerning psychosocial circumstances need to be safe before they can be discharged. If the domestic environment is not safe enough, the child will remain in the hospital, even after treatment is finished. This is not seen as wrong-bed days because it is part of the policy. Children sometimes stay longer in the hospital because they have to wait for their parents to pick them up. That is a major point of improvement. Some parents don't seem to care what time they pick up their child.

At the Mother/Child department there is a special program for wrong-bed days. Just like the Children/Teen department it is not registered as such. The Mother/Child department has a "healthy mother program". Whenever the mother is healthy, but the child is sick, mothers are given the opportunity stay with their child so that they don't have to be separated. Patients at the Orthopedics department patients often stay longer in the hospital because they haven't arranged a wheelchair or a bed at home.

### **3.3.9. Medication**

At the Gastroenterology department discharge medication is not always discussed with the patient. Discharge medication is arranged one day before discharge so that patients don't have to wait for that. The list with medication is sent to the pharmacy one day before discharge.

Nurses at Surgical Oncology think that discharge medication takes a lot of time. They want the pharmacists to do the medication verification. The thorax Center states that medicines are faxed to the pharmacy. They think that that is an old-fashioned way to communicate the medication. Medication verification does not go well at the Pulmonology department either. It is not always clear, and not always communicated on time.

The Children/Teen department sends the medication to the pharmacy. A printed overview of the medication has to be given to the parents of the patients, but that is not always done. Medication verification also does not go well, the pharmacy could play a bigger role in discharge medication. Patients at the Internal Medicine department often have to wait for medication to be arranged. It sometimes happens that when the patient is discharged at 11 A.M., but at 4 P.M. there still is an instruction in the system to arrange the medication.

### **3.3.10. Provision of information**

The provision of information is important so that patients stay informed. This way unnecessary calls from patients afterwards can be prevented. According to a physician assistant, administratively it is not optimal at the Mother/Child department. That is partially caused by the ICT-system which not optimal either. The department believes that it will not improve until a new system is introduced. They don't want patients to wait for discharge because the discharge letter for instance is missing.

At the Internal Medicine department, the discharge letter is not always ready the moment the patient is allowed to leave the hospital. The administrative tasks are sometimes postponed to the evening because work pressure was higher during the day. This leads to delay in discharge. A possible solution for not postponing administrative task is continuity regarding physicians (assistants). When physician assistants work longer at a department for instance, it is better for patients since the assistants get to know the patients better. That way it is easier to update letters. The Oncology department has different assistants every day.

At the Orthopedics department an evaluation takes place before discharge. Patients receive information letters, surveys, and they have to assess their stay at the hospital. At the Neuro Center there is a meeting with the family right before discharge. It usually takes place one day before discharge. Another way to provide patients with information is the whiteboards in the rooms. Basic information such as the physician's names, nurse's names, phone numbers, and discharge dates are communicated through the whiteboards. However, it is not always updated or even filled in. Some nurses do not see the added value of the whiteboards. Team leaders however state that writing down the discharge date might help physicians work towards a certain date and eventually deviate as little as possible from the provisional discharge date.

### 3.4. Improvements to optimize the discharge process

To optimize the discharge process, solutions that lead to improvement need to be implemented on several fields (see chapter 3.3.). When implementing a solution for improvement, one must not be tempted to implement the solution too quickly without fully understanding the problem and the context. The Institute for Healthcare Improvement (IHI) uses a model for improvement that is simple, systematic, and effective to identify problems and bring effective change (IHI, 2019). The model distinguishes three stages in between the plan, do, check, act-cycle can be used to test shortlisted changes. The identified stages are:

1. What do you want to achieve?
2. How will you know that a change is an improvement?
3. What changes will result in improvement?

In the first stage, the issue that is wanted to be solved and the required outcomes need to be defined, as well as the main internal and external stakeholders. The context of the issue needs to be considered. In the second stage, a decision needs to be made on what metrics there will be used to monitor the progress. This needs to be done in order to demonstrate the desired outcomes are achieved and to spot possible unintended consequences. Once the problem is defined and the metrics are identified, ideas for changes that will result in the desired improvements can be generated. Brainstorm sessions and simple rules might help generating new ideas. This three-staged model is helpful to map out what improvements an organization wants to make.

Table 11 shows the bottlenecks derived from the focus groups. An interpretation was made per bottleneck on what improvements could be made to optimize the discharge process. The interpreted improvements can be seen in the right column.

Themes	Bottlenecks (derived from focus groups)	Improvements
Patient visits	No fixed times for visits	Make agreements on fixed times so that visits (and consequently discharges) can take place on time
	No prioritization in visits	Prioritize visits based on patients with possible discharge on the same day. That way the discharge of those patients will take place earlier
	Late arrival of physician (assistant) at the department	Make agreements on times the physician has to be present at the department
	Late/little time for visits due to nursing of patients	Nurses help out nurses who have patients with possible discharge in order to do the visits on time
	Lack of concrete decision making regarding treatment	More guidance of physician assistants during visits by experienced physicians
	Pre-assessment of patients take a long time	Making sure the pre-assessment of patients does not take long time by setting a time
Discharge timing	Lab results arrive late	Earlier assessment of lab-monsters so that the results are available in time for the visits
	Patients get picked up late by family/friends	When the discharge date of the patient is known, immediate communication with family to prevent late discharges due to transport on the discharge date
	Discharge times is not always communicated with patients and family	Making 'Communication of discharge times with patients and family' a fixed subject during patient visits
	Administrative discharge of patients does not always comply with actual discharge	Complete administrative discharge immediately after actual discharge of patient (by secretary)
	Timing of transfers to other institutions later than desired discharge time	Make contact with follow-up institutions to communicate possible discharge times
	Ambiguity on what needs to be arranged for discharge	Consulting fellow nurses or physicians on time so that delays in discharge are prevented

	Waiting for patients to wake up and have a shower	Waking up patients on time so that their discharge will go as scheduled
	Lack of/use of protocols	Consult team leader for more information. More feedback towards nurses from team leader
	Last minute complementary tests	[dependant of condition patient]
	Misplacement of patients at other departments	Communication with AOA and other departments to look for a better solution than to misplace patients when possible. If necessary, letting patients remain a little longer at the AOA
Provisional discharge dates	Lack of use of provisional dates	Healthcare professionals need to use provisional discharge dates so that they will work towards the goal of discharging the patient on that specific day. If done otherwise, adjusting the discharge date is easier
	Determination of discharge dates is found hard by physicians/assistants	Use of LOS matrices
	LOS matrices to determine discharge dates also hard to use	Discuss discharge date with supervisor
	Correspondence LOS matrices with reality	[inevitable]
Transfer from AOA to the clinic	Duration of cleaning rooms and making requests for cleaning is long	As soon as a patient is discharged, the room should be cleaned right away. The requests to clean rooms should be monitored by nurses to prevent rooms from staying empty for multiple hours
	Acquired medical history of the patient from AOA not sufficient enough (preparatory work)	Making sure the patient's medical history is complete before transferring the patient to the clinic. A possible way to this is to block the transfer in the system when no medical history is available
	Lab results arrive late	Earlier assessment of lab-monsters so that the results are available earlier
	Later transfer to clinic because of arrangement of lunch of the patient	The transfer of patients should not be dependent on the lunch time. When patients are ready to be transferred around lunchtime, they should be transferred without nurses having to worry about the patient receiving lunch at the AOA or at the clinic.
	Unnecessary care requests because of protocols by nurses	Protocols should be adjusted if it results in unnecessary care requests by nurses
Discharge without being seen by the physician	Lack of use of discharge criteria	Physicians should use discharge criteria in order to discharge patients earlier
Discharge during weekend	Continuation of processes not always possible	Healthcare professionals should try to continue the usual 'weekdays' process as much as possible
	Arrangement of aftercare on Friday	At the start of the week, healthcare professionals need to use provisional discharge dates to predict when the patient might be discharged. Based on that information, the professionals can see if the discharge might take place on Friday. If so, the healthcare professionals can anticipate on arranging aftercare before it is too late. That way the risk of the patient staying for the weekend will be smaller
	Transfer office closed during the weekend	/
	Work pressure physicians is high; low number of healthcare professionals	More physician assistants present in the weekend to enlighten the work pressure
	Visits sometimes take place on a later moment of the day	[unavoidable due to high work pressure]
	Administrative discharge postponed to Mondays/ Physicians not always familiar with discharge and medication	Arrange administrative discharge right away. If physicians have no knowledge how to administratively discharge patients, they need additional training
	Writing discharge letters is often postponed to the evening or Mondays	Physicians/assistants need to update the discharge letter regularly in order to complete the discharge letter the moment the patient is discharged.
Transfer office	Transfer office is closed during the weekend	[inevitable]
	No arrangements by transfer office without discharge dates	Transfer office should use provisional discharge dates to at least look into patient-

		cases and adapt to it as early as possible. This way possible delays in discharge are prevented because the transfer office already knows what the patient might need for aftercare.
	Limited capacity ambulatory services	Making a consideration which patients are really in need to be transported by means of ambulatory services, and which patients are mobile enough. The patients who are mobile enough could grab a taxi or could be transported by friends and family
	Arrangement home care only possible during weekdays	At the start of the week, healthcare professionals need to use provisional discharge dates to predict when the patient might be discharged. Based on that information, the professionals can see if the discharge might take place on Friday. If so, the healthcare professionals can anticipate on arranging aftercare before it is too late. That way the risk of the patient staying for the weekend will be smaller
	Instructing patients regarding discharge	Possible discharge date needs to be communicated timely with the patients (during visits) so that patients can take the discharge date into account and for instance arrange transport if needed.
	Follow-up institutions admit patients on a later moment than the hospital's desire to discharge the patients	Communicate the discharge times that the patients need to be discharged on with follow-up institutions. The follow-up institutions can look for opportunities to adjust their schedule
Wrong-bed days	Limited space follow-up institutions	[inevitable]
	Discharge during weekend	Try to avoid patients from staying during the weekend. If a patient is able to be discharged on Friday, but is not discharged because of a late request at the transfer office for instance; those are avoidable wrong-bed days. Healthcare professionals should try to anticipate on discharge as early as possible to avoid wrong-bed days in the weekend
	Requests for aftercare too late (transfer office)	(see 'Transfer office')
	Waiting for transport to home	When the discharge date of the patient is known, immediate communication with family to prevent late discharges due to transport on the discharge date
Medication	Communication with the patient not always clear	Making sure discussing medication with the patient is a fixed subject during visits
	Medication verification by pharmacy not always done	Communication with the pharmacy needs to be easily accessible so that ward nurses and physicians can summon the pharmacists to the patient
Provision of information	Administration of patients not always completed on the moment of discharge	Needs to be arranged by the secretary
	Too many ICT-systems	Introduce one new ICT-system compatible for the entire hospital
	Updating discharge letters by physicians	Needs to be done regularly so that the discharge letter is finish at the moment of discharge
	Whiteboards in patient's room are not always used	Healthcare professionals should try to make this a fixed subject during visits. This way the patient is easier to keep the patient update regarding the discharge date

Table 11: Improvements for bottlenecks derived from focus groups

## 4. Conclusion & Discussion

This study was conducted to answer the research question: *‘Which aspects of the patient discharge process does Medical Spectrum Twente need to optimize in order to achieve a better throughput of patients between wards and a lower amount of wrong-bed days?’*. In order to answer the research question, literature was studied, the documented discharge process of MST was looked into, and a qualitative study was performed to research the operational discharge process of MST, and possible solutions for optimization. The aspects/themes MST should optimize to achieve a better throughput of patients between wards and a lower amount of wrong-bed days are: patient visits, discharge timing, provisional discharge date, transfer from AOA to the clinic, and wrong-bed days.

The results of the literature study show that hospital occupancy is strongly associated with LOS of patients in a hospital. A cause for increased levels of occupancy and increased inpatient LOS is when the admissions peak takes place earlier than the discharge peak. Discharge Before Noon - shifting the discharge peak to earlier than the admission peak - is found to have an effect on decreased LOS. Literature on discharge timing shows that early discharge has an effect on the patient flow. The earlier patients are discharged, the faster the patient flow from the ED to the clinic gets. Improving Patient discharges and reducing the LOS help achieving a better patient flow.

The documented discharge process of MST consists of five phases. These phases are pre-admission, admission to the ward, completion of admission, discharge, and aftercare. In the first phase, the patient receives instruction on the consequences of the treatment and the process of admission to the clinic. In the second phase, the discharge and the needs of the patient in terms of aftercare, means and materials (such as wheelchair etc.) need to be made clear. The actual discharge and the completion of the discharge are organized in the third phase. The fourth phase consists of the actual discharge and administrative completion. The last phase is to check if the discharge went well and possible remaining patient questions and uncertainties are answered.

Based on the findings out of the focus groups, it can be concluded that the current discharge process is subject to too many variations across all specialties. The discharge process needs to be revised in such way that the departments can actually apply it to their patients. Operational tasks are given, however, not in detail. For instance, based on the documented discharge process, there are no hospital-wide agreements concerning visit times at the inpatient clinic. That means that time of visits varies across the clinical departments. The AOA wants to transfer their patients to the inpatient clinics before 11 A.M. to free up beds for the new patients, since the admission peak of new patients is from 11 A.M. to 3 P.M.. The lack of hospital-wide agreements concerning visit times makes it harder to work towards the goal of discharging patients before 11 A.M. When there are no clear guidelines and protocols concerning processes, healthcare professionals will operate as they see fit. That results in professionals working in multiple different ways. That variability in some cases causes delay in discharge. Eliminating variability between professionals and wards will most likely result in earlier discharge and a better throughput of patients.

#### 4.1. Discussion

The objective of this study was to identify aspects of the discharge process that need optimization in order to achieve a better throughput of patients in the hospital and less wrong-bed days. Ten themes were identified which influence the discharge process on multiple facets. All themes include aspects, of little and high impact, that in some way influence the discharge process. According to the transcripts and focus groups, the themes less cited and with less impact on the discharge process are: discharge without being seen by the physician, discharge during weekend, transfer office, medication, provision of information. Though these themes are also eligible for optimization, they have less impact on the discharge process or they are harder to optimize. Discharge without being seen by the physician might result in earlier discharges, but physicians in general still want to see the patients before they leave the hospital. Some physicians question the ethics of it. Discharge during weekend can contribute a lot to a better patient flow and less wrong-bed days, but the transfer office is closed during the weekend which often results in delay of discharge until Monday. Less patients are admitted in the weekend and also less physicians and nurses are present during the weekend. The transfer office can contribute to a quicker discharge by assessing cases sooner, even when they do not have a definitive discharge date. According to some focus groups, patients sometimes have to wait for medication. The pharmacy already took steps to improve medication verification. The theme 'provision of information' is more of a means to improve discharge communication but does not directly influence quicker discharge.

The identified themes in need for optimization are: patient visits, discharge timing, provisional discharge date, transfer form AOA to the clinic, and wrong-bed days. According to the focus groups, these are themes that influence the throughput and discharge of patients directly. These were also the themes cited most during the focus groups. Discharge timing and patient visits are interrelated. Discharge timing is key in order to have a good throughput of patients. According to the literature study, earlier discharge can be achieved when visits take place on time and as early as possible.

To help patient visits to take place on time for the goal of discharge before 11 A.M., MST needs to make protocols regarding patient visits and communicate this with all inpatient clinics. All the departments should adhere to the protocols in order to lead patient discharges in the right direction. For an earlier discharge, all departments need to prioritize the visits where possible. This will result in earlier discharge of patients who will be discharged the same day. Right before starting the visits, the physician needs to discuss the order of visits with the nurses. This could be done in form of a "day-start". This is a meeting in the morning where healthcare professionals come together to discuss the patients. Some departments such as Thorax Center are already familiar with this concept. Other departments could integrate this as well. The correlation between the number of wrong bed-days and a day-start was not studied, but data shows that the Thorax center had 242.5 less wrong-bed days than the average number of wrong-bed days across the included departments. Another aspect that should be tackled early on is the time when lab results are received. MST should investigate whether it is possible to receive lab results earlier. Since patient discharges among all departments are sometimes dependent on lab results, this may result in quicker discharge of patients.

To control discharge timing, the healthcare professionals need to clearly communicate discharge times with the patient's friends and family and they need to be demanding towards



friends and family regarding the times that the patient can be picked up. Patients should not stay longer in their room because their partner is doing groceries. For patients who are mobile enough, a discharge lounge could be a possibility. This way the patients will not keep the beds occupied, but still can wait for their friends and family to pick them up.

The administrative discharge of patients should be arranged immediately so that the system does not think that the bed is still occupied. This way the admission of patients from the ED/AOA to the clinic is not blocked. After discharge, the rooms need to be cleaned as quickly as possible in order to be able to receive new patients.

The admission of patients to the wrong department also contributes to delay in discharge. At the AOA, healthcare professionals need to assess well whether it is the best choice for a patient to be transferred to the wrong department, concerning the illness and discharge of the patient. If staying a couple hours more at the AOA will result in transferring the patient to the right department, the choice to let the patient stay for a few more hours must be evaluated.

Discharge during the weekend is a big contributor to a distorted discharge process because patients often have to stay in the hospital due to the fact that aftercare has not been arranged yet. In order to have as little delays as possible during the weekend, the protocols and rules applied for weekdays should be applied during the weekend as well. However, there are less healthcare professionals during the weekend. This results in the fact that the workload for physicians significantly increases. It even increases to the extent that some departments do not even carry out the visits. An investigation must be made to calculate whether it is better to plan more physicians during the weekend, or to let patients stay the weekend until Monday. When patients stay until Monday, chances are that wrong-bed days will occur. However, to plan more physicians is costly as well. Additional research needs to be conducted to study what the possibilities are for discharge during the weekend and the transfer to other healthcare institutions.

According to the focus groups, a major reason for wrong-bed days is the scarcity of available spots for patients who need aftercare in a follow-up institution. Patients remain in the hospital even though their treatment has actually ended. The wrong-bed days caused because of the scarcity of spots in follow-up institutions is unavoidable, unless more institutions are opened, according to focus group attendees. Another reason for wrong-bed days is the fact that the transfer office is closed during the weekend. This means that aftercare for patients who have to go to a follow-up institution needs to be arranged before Friday. If aftercare has not been arranged by Friday, patients are forced to stay until Monday. If the transfer office would operate seven days a week, wrong-bed days could be prevented. However, for the transfer office to be opened during the weekend, follow-up institutions also need to admit patients during the weekend. The fact that less professionals are present during the weekend lead to delays in discharge and wrong-bed days. The higher workload results in the fact that visits take place later on the day, or even not at all.

Overall it can be stated that the results of this study comply with the literature. It was found to be correct that the ability of hospital staff to schedule a patient to the right bed at the right time is dependent on bed occupancy. In addition, the peak of patient arrivals at MST also occurs during the morning like in most acute hospitals. MST also experiences increased levels occupancy on days when the admissions peak takes place earlier than the discharge peaks. All

four common barriers formulated by Patel et al. (2017) were also cited by attendees during focus groups. Literature showed that patient discharges from the hospital frequently occur late in the day. This is the same for MST, where the majority of inpatient patients are discharged after noon.

#### **4.1.1. Strengths**

Focus groups were organized using the five steps MST uses in its discharge process. All inpatient departments were included, except for the Psychiatry department. Since all but one inpatient clinics were included to the focus groups, it can be stated that the study is generalizable. The prerequisite to only include professionals with more than one year of working experience was met. All focus group participants had a working experience of at least one year in the hospital. The focus groups were recorded with two separate recording devices to prevent inaudible fragments. This way there was no information loss due to inaudible fragments. The script used for guidance during the focus group was set up by means of scientific literature and confirmed by the Quality & Safety advisor of MST. A test focus group was organized to test the script and add topics/questions where needed. This resulted in a more complete topic list for the actual focus groups.

#### **4.1.2. Limitations**

There is a certain limit to the internal validity. The composition of the focus groups was supposed to be as diverse as possible. Unfortunately, some focus groups only included nurses, and others did not have any nurses at all. This may have resulted in missing information from certain perspectives. The reason the group compositions differed from each other can be explained by the availability of the healthcare professionals. Another reason for differentiated results is that attendants might have said things that do not comply with the reality. To make the appointments with the inpatient clinics, mails were sent to the team leaders of all clinics. The team leaders were asked to provide names of other healthcare professionals to be invited, or to invite them themselves. Each team leader invited healthcare professionals for the focus groups themselves. This way the composition of the focus groups was fully dependent on the team leader. This may have led to the selection of healthcare professionals by the team leader who do not comply with the in- and exclusion criteria.

The focus group organized at the ED turned into an interview with only one nurse. The ED focus group was dependent on how crowded the department was, since the admission of patients to the ED is not predictable. Other healthcare professionals (nurses, physician, team leader) were not able to join the focus group. This way the aim of gaining as much information as possible from different type of healthcare professionals was not met.

The focus groups for Urology and Orthopedics were put together (at the request of the team leaders) because the departments shared the same team leaders. Healthcare professionals from both departments joined the combined focus group. That means that the focus was not only on one, but two departments. The duration of the focus group was no longer than one hour, the average length of a focus group for one department only. That means there is a high probability of incomplete or missing information.

The focus group at the Neurology department only included two nurses. Information might be missing since there were no other type healthcare professionals.

When carrying out the literature study, a high number of articles could be found concerning the ED. This made it convenient to write about the ED. However, it was rather hard to find articles concerning the patient flow in general (from admission to discharge). It is desirable for the literature study to cover articles for every step in the patient flow. MeSH terms were not used to find articles. Using MeSH terms could have helped searching more efficiently for articles in PubMed. Furthermore, papers found in Scopus were limited to open access. This should not have been done since possible relevant articles were not included.

#### **4.1.3. Recommendations**

In order to achieve a better throughput of patients between wards and a lower amount of wrong-bed days, MST needs to optimize the aspects that influence the patient flow found in this study. Further research is needed to find out what the best way is to operationally improve aspects found for optimization. For instance, how to protocolize the patient visits, the possibility to receive lab results earlier, the timing of transfer to other institutions, whether to plan more physicians in the weekend, the role of transfer office, the determination of discharge dates, the role of the follow-up institutions etc. The discharge process is complex and contains too many aspects to optimize all at ones. A detailed planning should be made in which the aspects are spread over a period of time into phases in order to optimize them piece by piece. To optimize the aspects, multiple groups consisting of nurses/assistants/physicians can be formed to monitor the progress per aspect to be optimized. The phase-based implementation of improvements will result in a successful optimization of the discharge process. For the discharge process to remain optimized, it is important to monitor the optimized aspects in order to prevent the optimizations to deteriorate again. This can be done by a multidisciplinary committee.

## 5. References

- Abu, H. O., Anatchkova, M. D., Erskine, N. A., Lewis, J., McManus, D. D., Kiefe, C. I., & Santry, H. P. (2018). Are we “missing the big picture” in transitions of care? Perspectives of healthcare providers managing patients with unplanned hospitalization. *Applied Nursing Research*, 44, 60-66.
- Beck, M. J., Okerblom, D., Kumar, A., Bandyopadhyay, S., & Scalzi, L. V. (2016). Lean intervention improves patient discharge times, improves emergency department throughput and reduces congestion. *Hospital Practice*, 44(5), 252 - 259.
- Da Silva, S. A., Valácio, R. A., Botelho, F. C., & Amaral, C. F. S. (2014). Reasons for discharge delays in teaching hospitals. *Revista de Saude Publica*, 48(2), 314 - 321.
- Drazen, E., & Rhoads, J. (2011). Using Tracking Tools to Improve Patient Flow in Hospitals. *California Healthcare Foundation*.
- Forster, A. J., Stiell, I., Wells, G., Lee, A. L., & Van Walraven, C. (2003). The Effect of Hospital Occupancy on Emergency Department Length of Stay and Patient Disposition. *Academic Emergency Medicine*, 10(2), 127 - 133.
- Gelderman, P., & Wegmann, U. (2015). Ligduurmonitor Nederlandse ziekenhuizen 2013 & 2014. *COPPA*.
- Haraden, C., & Resar, R. (2004). Patient flow in hospitals: understanding and controlling it better. *Frontiers of health services management*, 20(4), 3-15.
- HSO. (2018). Quality Norms Qmentum Global Niaz.
- IHI. (2019). How to improve. Available via:  
<http://www.ihl.org/resources/Pages/HowtoImprove/default.aspx>.
- Jongbloed, M., & Duindam, I. (2016). Ontslagproces - MST breed. *Intranet MST*.
- Kane, M., Weinacker, A., Arthofer, R., Seay-Morrison, T., Elfman, W., Ramirez, M., . . . Welton, M. (2016). A Multidisciplinary Initiative to Increase Inpatient Discharges Before Noon. *The Journal of Nursing Administration*, 46(12), 630 - 635.
- Khalifa, M. (2017). Reducing length of stay by enhancing patients' discharge: A practical approach to improve hospital efficiency. *Studies in Health Technology and Informatics*, 238, 157-160.
- Khanna, S., Boyle, J., Good, N., & Lind, J. (2011). Impact of Admission and Discharge Peak Times on Hospital Overcrowding. *Studies in Health Technology and Informatics*, 168, 82 - 88.
- Khanna, S., Boyle, J., Good, N., & Lind, J. (2012a). Early discharge and its effect on ED length of stay and access block. *Studies in Health Technology and Informatics*, 178, 92 - 98.
- Khanna, S., Boyle, J., Good, N., & Lind, J. (2012b). Unravelling relationships: Hospital occupancy levels, discharge timing and emergency department access block. *Emergency Medicine Australasia*, 24, 510 - 517.

- Khanna, S., Sier, D., Boyle, J., & Zeitz, K. (2016). Discharge timeliness and its impact on hospital crowding and emergency department flow performance. *Emergency Medicine Australasia*, 28(2), 164 - 170.
- Kravet, S. J., Levine, R. B., Rubin, H. R., & Wright, S. M. (2007). Discharging patients earlier in the day: A concept worth evaluating. *Health Care Manager*, 26(2), 142 - 146.
- Moleney, C. G., Wolfe, D., Gesteland, P. H., Hales, J. W., & Nkoy, F. L. (2007). A Tool for Improving Patient Discharge Process and Hospital Communication Practices: the Patient Tracker. *Annual Symposium Proceedings Archive*, 493 - 497.
- Molla, M., Warren, D. S., Stewart, S. L., Stocking, J., & Johl, H. S., V. (2018). A Lean Six Sigma Quality Improvement Project Improves Timeliness of Discharge from the Hospital. *The Joint Commission Journal on Quality and Patient Safety*, 44(7), 401 - 412.
- Moskop, J. C., Sklar, D. P., Geiderman, J. M., Schears, R. M., & Bookman, K. J. (2009a). Emergency Department Crowding, Part 1—Concept, Causes, and Moral Consequences. *Annals of Emergency Medicine*, 53(5), 605 - 611.
- Moskop, J. C., Sklar, D. P., Geiderman, J. M., Schears, R. M., & Bookman, K. J. (2009b). Emergency Department Crowding, Part 2—Barriers to Reform and Strategies to Overcome Them. *Annals of Emergency Medicine*, 53(5), 612 - 617.
- MST. (2017). Jaarverslag 2016. Available via: [https://www.mst.nl/storage\\_static/2017/08/jaarverslag-mst-2016.pdf](https://www.mst.nl/storage_static/2017/08/jaarverslag-mst-2016.pdf), 79.
- NZa. (2018). Prestatiebeschrijving en tarief verkeerde bed Wlz - BR/REG-18140a. Available via: [https://puc.overheid.nl/nza/doc/PUC\\_21758\\_22/2/](https://puc.overheid.nl/nza/doc/PUC_21758_22/2/).
- OECD. (2015). Length of hospital stay (indicator). Available via: <https://data.oecd.org/healthcare/length-of-hospital-stay.htm#indicator-chart>.
- Patel, H., Morduchowicz, S., & Mourad, M. (2017). Using a systematic framework of interventions to improve early discharges. *Joint Commission Journal on Quality and Patient Safety*, 43(4), 189 - 196.
- Rajkomar, A., Valencia, V., Noveler, M., Mourad, M., & Auerbach, A. (2016). The association between discharge before noon and length of stay in medical and surgical patients. *Journal of Hospital Medicine*, 11(12), 859 - 861.
- Rojas-Garcia, A., Turner, S., Pizzo, E., Hudson, E., Thomas, J., & Raine, R. (2017). Impact and experiences of delayed discharge: A mixed-studies systematic review. *Health Expectations*, 21, 41 - 56.
- Staatvenz. (2018). Ligduur in ziekenhuizen. Available via: <https://www.staatvenz.nl/kerncijfers/ligduur-ziekenhuizen>.
- Waring, J., Marshall, F., & Bishop, S. (2014). *Health Services and Delivery Research; Chapter 2 Hospital discharge and patient safety: reviews of the literature*.
- Wertheimer, B., Jacobs, R. E. A., Iturrate, E., Bailey, M., & Hochman, K. (2015). Discharge before noon: Effect on throughput and sustainability. *Journal of Hospital Medicine*, 10(10), 664 - 669.

## Appendix

### Appendix A: Niaz QMentum Norms for hospital discharge

- The care-team prepares the patients and the family members for transmissions and discharge
- The team applies discharge criteria on every patient to assess and document whether the patient is ready for discharge or not
- The team has set criteria to guide the patient during discharge and transfer (for instance: LOS, diagnosis and prognosis, need for additional care, availability of services through other teams/providers/institutions, and available support of the family and informal caregivers)
- The team immediately starts planning the discharge or transfer of the patient, preferably right at or after admission to the hospital
- The team informs patients, family members, and informal caregivers about the transfer or discharge
- The team prepares the patients, their family members, and informal caregivers for what they can expect during transfer or discharge and gives instruction for aftercare
- The team assesses whether the patient needs support and/or further medical care during transfer or discharge
- When patients get referred to a different caregiver or institution, the team cooperates with those caregivers or institutions to accommodate the transfer of the patient
- During transition between wards, the team exchanges information with other caregivers in an effective way
- The team uses helpful tools during transmission for timely transfer of patient information (for example: transfer forms, checklists etc.)
- When patients get referred to a different caregiver or institution, the team hands in a copy of the discharge- or transfer report to the other caregiver or institution
- The team assesses the needs and expectations of the patient and the involvement of the family members and informal caregivers (evaluation of the availability of family members and informal caregivers after discharge; assessment if they need help or supporting facilities when there is no contact between the patient and the institution anymore)
- The team verifies the medication of the patient before transfer or discharge with the list of possible new or modified prescribed medication
- The team reports everything concerning the transfer or discharge in the patient record, including a summary of all provided services
- After transfer or discharge, the team contacts the patient, their family members or referred institutions to monitor the results of the transfer or discharge and the aftercare (HSO, 2018).

## Appendix B: Script focus-group (English)

Date: Multiple dates  
 Time: Multiple times  
 Location: Medisch Spectrum Twente

### Materials

- Informed consent (Appendix D, E)
- Voice-recorder

### Attendees

#### *Moderator(s)*

Leads the meeting; responds neutrally; makes sure every attendee gets to say something; knows the script; makes sure to receive answers on the questions/topics.

#### *Respondents*

Team leader, physician/ physician's assistant, nurse specialist, nurse. Answer questions, discuss among each other about the discharge process.

### Preparation

- Arrange recording equipment
- Print informed consent forms
- Open script on laptop

#### Part 1: Introduction (5 minutes)

Timeframe	What	Explanation
5 minutes	Welcome	Moderator welcomes every attendee and thanks them for their time. Moderator introduces himself so that the respondents know his background.
	Introduction research	Explains what the research is about and explains the five topics that the meeting is divided into, namely: 1. Pre-admission, 2. Admission to the ward, 3. Completion, 4. Discharge, and 5. Aftercare.  Research question: <i>“Which aspects of the patient discharge process does the Medical Spectrum Twente need to optimize in order to achieve a better throughput of patients between wards and a lower amount of wrong-bed days?”</i> .
	Setup meeting	The moderator will start the conversation by asking questions related to the topics. The attendees need to build on each other's answers. The following things need to be addressed before the start: <ul style="list-style-type: none"> <li>▪ There are no right or wrong answers. It is expected to receive several opinions.</li> <li>▪ The conversation will be recorded so that there will not be any loss of information. However, names will be anonymized in the transcripts. No names will be mentioned in the end-report. All the data is confidential.</li> <li>▪ If an attendee wants to add something to someone's story, correct someone, or given an example, he or she may feel free to do so.</li> <li>▪ Because of limited time, the moderator may have to interrupt the conversation to move on with the next topic/question.</li> </ul>

	Start recording	After everyone has filled in the informed consent form, the moderator will start recording.
	Start conversation	The conversation will start with everyone introducing themselves.

## Part 2: Patient discharge process (50 minutes)

Timeframe	What	Explanation
10 minutes	Pre-admission	<p>The pre-admission phase starts at the moment of determination for admission. In this phase the patient will be prepared for the consequences of the treatment and the process of admission to the clinic. Furthermore, the consequences of the treatment to the home situation are discussed and it will be discussed whether it may cause obstructions for discharge</p> <ul style="list-style-type: none"> <li>How do you think the admission of patient goes?</li> <li>What would you do differently compared to the current situation?</li> </ul>
15 minutes	Admission to the ward	<p>The execution of parts in this phase will be started as early as possible, if possible on the day of admission (for all specialties). The discharge and the needs (aftercare/means/materials) need to be made clear. In this phase the patient receives key information. Furthermore, the visits are a fixed part of this phase and a daily returning process</p> <ul style="list-style-type: none"> <li>What is the policy concerning discharge dates?</li> <li>At what times are the patient visits planned? Do the visits take place on time? Who does the visits?</li> <li>Is a discharge date set during the visits? Is it visually displayed?</li> <li>Are discharge criteria being used? How do you adhere to those criteria?</li> <li>Are nurses allowed to do the last step in discharge? If not, could this be possible in the future?</li> <li>What preparations are done for actual discharge?</li> <li>How is the communication with the transfer-point organized?</li> <li>How is the transmission between shifts organized between nurses?</li> <li>How is the patient informed concerning living rules? What kind of information is provided to the patients?</li> <li>How many days in advance is the end of treatment date known? What happens when ad hoc discharges occur?</li> <li>Is there a time-target for discharge?</li> <li>How well is discharge organized in the weekend? What is needed to optimize discharges in the weekend?</li> <li>Are there wrong-bed days in your ward? What are the reasons for wrong-bed days in your ward, and what means are needed to reduce it?</li> <li>How well is the transmission from AOA organized? Is there anything that needs to be done for a better throughflow? What is the optimal time for the patients to be admitted from the AOA?</li> </ul>
10 minutes	Completion	<p>In this phase, the actual discharge and the completion of the discharge is organized by means of checklists. The physician, nurse and transfer-nurse are included in this phase</p> <ul style="list-style-type: none"> <li>How well is this organized, what things could be done better? (Think of practical things)</li> <li>What information do you want to give the patient before discharge?</li> <li>What is done before discharge concerning medication?</li> <li>Are there any means that could help in discharge (e.g. rollator)</li> </ul>
10 minutes	Discharge/ Aftercare	<p>This is the phase where the actual discharge and administrative completion takes place.</p> <p>In the aftercare-phase, it has to be checked whether the discharge went well, and adjustments need to be made if necessary. Possible remaining questions and uncertainties need to be answered and solved.</p> <ul style="list-style-type: none"> <li>How do you cope with sudden discharges?</li> </ul>



		<ul style="list-style-type: none"> <li>▪ How many sudden discharged do you have?</li> <li>▪ What information do you want to give the patient before discharge?</li> <li>▪ What is the protocol concerning the discharge letter? What are the contents of the discharge letter?</li> <li>▪ What needs to be done for earlier discharge?</li> </ul>
5 minutes	Additions	<p>Attendees get the opportunity to add comments if they want to.</p> <ul style="list-style-type: none"> <li>▪ What would make the whole process easier to work with?</li> <li>▪ Are there any specific patient categories that do not comply with the standard discharge procedure?</li> </ul>

### Part 3: End (5 minutes)

Timeframe	What	Explanation
5 minutes	Remaining questions	Moderator asks attendees if there are any questions remaining or if they want to point out something.
	Stop recording	Moderator stops recording
	End of meeting	Moderator thanks attendees for their time and input and ends the meeting.

## Appendix C: Script focus-group (Dutch)

Datum: Meerdere data  
Tijd: Meerdere tijden  
Locatie: Medisch Spectrum Twente

### Materialen

- Informed consent (Appendix D, E)
- Voice-recorder

### Deelnemers

#### *Moderator*

Leidt het gesprek; reageert neutraal; zorgt ervoor dat alle deelnemers de beurt krijgen om iets te zeggen; kent het script; zorgt ervoor dat alle gespecificeerde onderwerpen behandeld worden.

#### *Respondenten*

Teamhoofd, arts/arts assistent, verpleegkundige. Beantwoord de vragen, onderling het ontslagprocedure bespreken

### Voorbereiding

- Opname apparatuur regelen
- Informed consent formulieren printen
- Script openen op laptop

#### Deel 1: Introductie (5 minuten)

Tijd	Wat	Uitleg
5 minuten	Welkom	Moderator verwelkomt alle respondenten en dankt hen voor hun tijd. Moderator stelt zichzelf voor zodat de respondenten zijn achtergrond kennen.
	Introductie onderzoek	Moderator vertelt waar het onderzoek over gaat en legt de vijf onderwerpen gericht op het ontslagproces uit, namelijk: 1. Pre opname, 2. Opname op de afdeling, 3. Afronding, 4. Ontslag, en 5. Na ontslag.  Onderzoeksvraag: <i>“Welke aspecten van het ontslagproces voor patiënten bij Medisch Spectrum Twente dienen geoptimaliseerd te worden om een betere doorstroom tussen afdelingen, minder verkeerde bed dagen en een optimale bedbezetting in de klinieken te realiseren?”</i>
	Opzet gesprek	De moderator start het gesprek door vragen te stellen per gespecificeerde onderwerp. De respondenten zullen moeten bouwen op elkaars antwoorden. De volgende punten moeten aangehaald worden voor de start: <ul style="list-style-type: none"><li>▪ Er zijn geen goede of foute antwoorden. Er wordt verwacht meerdere meningen te krijgen.</li><li>▪ Het gesprek zal opgenomen worden zodat er geen informatie verloren gaat. Alle respondenten zullen in de transcriptie geanonimiseerd worden. In het eindverslag zullen geen namen van respondenten genoemd worden. Alle data zal vertrouwelijk behandeld worden.</li></ul>

		<ul style="list-style-type: none"> <li>Als een respondent wil aanhaken op iemands verhaal, iemand wil corrigeren of een voorbeeld wil geven is diegene vrij om dat te doen.</li> <li>Vanwege het korte tijdsbestek kan de moderator mogelijk het gesprek onderbreken om verder te gaan met de volgende onderwerp.</li> </ul>
	Start opname	Nadat iedereen de informed consent formulier heeft ingevuld, zal de moderator de opname starten.
	Start gesprek	Het gesprek zal beginnen met een korte introductie rondje.

## Deel 2: Ontslagproces patiënten (50 minutes)

Tijd	Wat	Uitleg
10 minuten	Pre opname	<p>De pre opname fase start op het moment van besluit tot opname. In deze fase zal de patiënt voorbereid worden op de consequenties van de behandeling en het proces van opname op de kliniek. Ook zullen de consequenties van de behandeling op de thuissituatie behandeld worden en of het belemmeringen kan veroorzaken op ontslag.</p> <ul style="list-style-type: none"> <li>Hoe vind je dat het ontslag van patiënten gaat?</li> <li>Wat zou je anders doen in het ontslagproces op basis van de huidige situatie</li> </ul>
15 minuten	Opname op de afdeling	<p>De uitvoering van deze fase start zo vroeg mogelijk, indien mogelijk op de dag van opname (voor alle specialismen). Het ontslag en de benodigdheden (nazorg/middelen/materialen) dienen duidelijk gemaakt te worden. In deze fase ontvangt de patiënt belangrijke informatie m.b.t. ontslag. Verder zijn de visitaties een vast en dagelijks terugkerend onderdeel van deze fase.</p> <ul style="list-style-type: none"> <li>Wat is jullie beleid m.b.t. ontslagdata</li> <li>Op welke tijden zijn de visitaties gepland? Wordt er op tijd visite gelopen? Wie lopen er visite?</li> <li>Wordt er een ontslagdatum vastgesteld tijdens het visite lopen? Wordt de ontslagdatum visueel zichtbaar gemaakt?</li> <li>Worden er ontslagcriteria opgesteld? In hoeverre wordt er gehouden aan de vastgestelde ontslagcriteria?</li> <li>Mogen verpleegkundigen de laatste stap in ontslag uitvoeren? Zo nee, is dat een mogelijkheid voor de toekomst?</li> <li>Welke voorbereidingen worden er getroffen voor het daadwerkelijke ontslag?</li> <li>Hoe wordt er gecommuniceerd met het transferpunt?</li> <li>Hoe vindt de overdracht van shiften tussen verpleegkundigen plaats?</li> <li>Hoe wordt de patiënt geïnformeerd over leefregels? Wat voor informatie krijgen de patiënten daarover?</li> <li>Hoeveel dagen vooraf is de MUD bekend? Wat gebeurt er bij ad hoc ontslagen?</li> <li>Is er een streeftijd voor ontslag?</li> <li>Hoe is ontslag geregeld in het weekend? Wat is er nodig om ontslag in het weekend te optimaliseren?</li> <li>Zijn er verkeerde bed dagen op jullie afdeling? Wat zijn de redenen voor verkeerde bed dagen? Wat is er nodig om verkeerde bed dagen te reduceren?</li> <li>Hoe is de transitie van de AOA naar de afdeling georganiseerd? Is er ruimte voor verbetering voor een betere doorstroom? Wat is de beste tijd voor patiënten om opgenomen te worden van de AOA naar de kliniek?</li> </ul>
10 minuten	Afronding	In deze fase vindt de afronding van ontslag het daadwerkelijke ontslag plaats d.m.v. checklists. De arts, verpleegkundige en transfer-verpleegkundige zijn betrokken in deze fase.

		<ul style="list-style-type: none"> <li>▪ Hoe goed is deze fase georganiseerd? Welke praktische aspecten zouden beter kunnen?</li> <li>▪ Wat voor informatie willen jullie aan de patiënt geven voor ontslag?</li> <li>▪ Wat wordt er gedaan aan medicatie voor ontslag?</li> <li>▪ Zijn er middelen die zouden kunnen helpen bij ontslag? (denk aan rollator)</li> </ul>
10 minuten	Ontslag/ Na ontslag	<p>Deze fase is waar het daadwerkelijke ontslag en administratieve afronding plaatsvindt.</p> <p>In de na-ontslag fase dient er gekeken te worden naar of het ontslag goed verlopen is, en of er zo nodig aanpassingen gedaan moeten worden. Mogelijke overige vragen en onzekerheden moeten beantwoord en opgelost worden.</p> <ul style="list-style-type: none"> <li>▪ Hoe vaak komen ad hoc ontslagen voor?</li> <li>▪ Hoe gaan jullie om met ad hoc ontslagen?</li> <li>▪ Wat zijn de richtlijnen m.b.t. de ontslagbrief? Wat is de inhoud van de ontslagbrief?</li> <li>▪ Wat kan er gedaan worden om patiënten eerder met ontslag te laten gaan?</li> </ul>
5 minutes	Toevoegingen	<p>Respondenten krijgen de kans om laatste toevoegingen te geven.</p> <ul style="list-style-type: none"> <li>▪ Wat zou het algehele proces makkelijker maken?</li> <li>▪ Zijn er specifieke patiënt categorieën waar het ontslagproces niet op toepasbaar is?</li> </ul>

### Deel 3: Afronding (5 minuten)

Tijd	Wat	Uitleg
5 minuten	Overige vragen	Moderator vraagt respondenten of er nog overige laatste vragen of op- of aanmerkingen zijn.
	Stoppen opname	Moderator stopt opname
	Einde bijeenkomst	Moderator bedankt respondenten voor hun tijd en input en beëindigt de bijeenkomst.

## Appendix D: Informed consent (English)

### Informed consent focus-group meeting

*Title: Process optimization of inpatient discharges in a hospital; a case-study at Medisch Spectrum Twente*

**Date:**

#### *To be filled in by participant*

- I have had the opportunity to ask the questions I wanted to. My questions have been answered well. I had enough time to decide whether to participate or not.
- I voluntarily agree to participate in this research
- I give permission for use of the data collected during the focus-group meeting for the research.
- I consent to the storage of data from the research.

Name: .....

Signature participant: .....

#### *To be filled in by the researcher(s)*

- I declare that I have informed this participant as fully as possible about the aforementioned research
- I have answered the remaining questions as best as possible

Name researcher: .....

Signature researcher: .....

Respondentno.: .....

## Appendix E: Informed consent (Dutch)

### Informed consent focus groep gesprek

*Titel: Process optimization of inpatient discharges in a hospital; a case-study at Medisch Spectrum Twente*

**Datum:**

#### *In te vullen door de respondent*

- Ik heb voldoende de mogelijkheid gehad tot het stellen van vragen. Mijn vragen zijn voldoende beantwoord. Ik had genoeg tijd voor de beslissing tot deelname.
- Ik stem geheel vrijwillig in met deelname aan het onderzoek.
- Ik geef toestemming voor gebruik van de gegevens die zijn verzameld in het focus groep gesprek voor het onderzoek.
- Ik geef toestemming voor het bewaren van de gegevens uit het onderzoek.

Naam: .....

Handtekening respondent: .....

#### *In te vullen door één van de uitvoerende onderzoekers*

- Ik verklaar dat ik deze deelnemer zo volledig mogelijk heb geïnformeerd over het genoemde onderzoek.
- Ik heb resterende vragen over het onderzoek naar vermogen beantwoord.

Naam onderzoeker: .....

Handtekening onderzoeker: .....

Respondentnummer: .....