Optimization of the integrated care process

of hip fracture patients at Medisch Spectrum Twente

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MANAGEMENT SUMMARY

Introduction/problem description

One of the major problems in health care is the lack of coordination between hospitals and follow-up care. They work independently, which results in fragmentation and inefficiency (van der Linden, et al., 2000). Integrated care focuses on the cooperation between caregivers and is specified as: *care attuned to the needs of the patient, provided on the basis of cooperation between primary and specialized caregivers, with shared overall responsibility and the specification of delegated responsibilities* (National council for public health & National board for hospital facilities, 1995). Managing the cooperation between those various caregivers is a real challenge. In Medisch Spectrum Twente (MST), patients deal with long access times to follow-up care after medical treatment in the hospital.

Objective

In this study we focus on one specific patient group: hip fracture patients who need short term rehabilitation care after medical treatment in MST. The study focuses on hospital MST and nursing homes AriënsZorgpalet location Eschpoort (AZP Eschpoort) and Zorggroep Sint Maarten location Oldenhove (ZGS Oldenhove). We provide a detailed description of the integrated care process of hip fracture patients at MST and at the nursing homes, identify and analyze factors that influence the integrated care process and access time to follow-up care, and formulate recommendations.

Approach

We base our process description mainly on interviews with the involved employees. The performance analysis is based on data collection from four databases: X-care, Transferpunt database, and databases of the two nursing homes. The data spans the period January 2008 to August 2009. The process and performance analysis considers 8 phases: patient arrival at MST, admittance, treatment, post treatment, discharge from MST, admittance into nursing home, rehabilitation, and discharge from nursing home. From this process description we identify process factors that negatively influence the integrated care process. To predict medical treatment duration in the future, we describe characteristics of hip fracture patients that influence the integrated care process: functional decline, delirium, malnutrition by using three measuring instruments: Identification of Seniors at Risk (ISAR), Delirium Observation Scale (DOS), and Short Nutritional Assessment Questionnaire (SNAQ). We also describe the age of patients related to the medical treatment duration in MST and the length of stay in the nursing homes. To categorize the bottlenecks and the corresponding recommendations we propose a planning and control model that addresses three main areas of integrated care: demand planning, information and communication coordination and network coordination.

Results

287 (60% at the surgery- and 40% at the orthopaedic department) hip fracture patients are admitted in 2008, and 208 (66% at the surgery- and 34% at the orthopaedic department) in the period of January to august 2009.

Of the 287 admitted patients, 153 patients (53%) are applied for short term rehabilitation care after medical treatment in MST. Of the 208 admitted patients, 118 patients (57%) are applied.

Hip fracture patients are mostly elderly people with multiply care problems. According to the ISAR-score, 92% of the screened patients are regarded as vulnerable. The DOS-score shows that for 26% of the screened patients symptoms of delirium are present. Malnutrition, tested by SNAQ-score, is present for 21% of the screened patients. All those percentages of the hip fracture patients are higher than the percentages of other patients treated by the surgery and orthopaedic department.

MST strives to apply patients within 2 days after arrival at the hospital. The time to apply a patient for short term rehabilitation care from the moment of admittance takes too long. The average registration time is 8.05 days in 2008 and 6.23 days in the first eight months of 2009 for all hip fracture patients applied for short term rehabilitation, due to lack of routine for nurses.

MST strives for medical treatment duration of 6 days. In 2008, the average medical treatment for all hip fracture patients applied for short term rehabilitation takes 12.13 days. In 2009, this takes 10.02 days. MST has no univocal criteria to assess whether a patient no longer needs medical treatment. The rehabilitation time in nursing homes varies highly from 11 days to 485 days. Patients at nursing home AZP Eschpoort in general need shorter rehabilitation time than patients at nursing home ZGS Oldenhove. However, patients from ZGS Oldenhove are mostly discharged to their home and patients from AZP Eschpoort are sooner transferred to other types of care.

For a proper information flow between the various caregivers a proper information system is required. In the integrated care process MST uses two main database systems: X-care and Transferpunt database. Transferpunt database is a separate system to arrange follow-up care for patients after medical treatment in MST. Unfortunately those systems cannot be linked, which results in evaluating problems when describing the whole process from admittance in the hospital till discharge to follow-up care. Within the Transferpunt database a total overview per diagnoses group is not available. One can only search per follow-up care type. The systems require manual data entry. As nursing homes are typed in many different ways, analysis becomes very difficult.

There are insufficient beds for patients who need short term rehabilitation care at a nursing home. During the writing of this report, MST and AZP Eschpoort have been negotiating about reserving a number of beds especially for hip fracture patients discharged from MST. Only the number of required beds is not known. We have proposed a simulation model that can be used to analyze the optimal number of beds.

Recommendations

- Hip fracture patients face high variability in the duration of medical treatment as a result of age, physical condition, and other health problems. Creating homogeneous sub groups by evaluating and monitoring the characteristics of patients following the clinical pathway can lead to a better prediction of the duration of medical treatment in the hospital as well as the rehabilitation time in nursing homes.

- To use criteria to determine what type of follow-up care a patient needs.
- To determine rules for the moment a patient needs to be applied for follow-up care.
- To use control instruments to determine whether application of a patient for follow-up care is actually applied and as a result reduces the time for registration.
- To implement drop-down-lists to create an overview per patient group and reduce manual input of data. This improves the possibility to evaluate and monitor the data.
- We propose a simulation model to analyze the optimal number of beds that must be reserved for hip fracture patients discharged from MST. We have implemented two strategies: with blocking and no blocking
    - With blocking, in case no bed is available, the patient will be directly applied to another care organization. Reserving 33 beds for hip fracture patients at AZP Eschpoort leads to a bed occupation of 81.47% for AZP Eschpoort, and only 3.72% of the patients are refused and must be discharged to other follow-up care organizations.
    - No blocking, regardless of availability of beds, all patients wait for discharge to AZP Eschpoort. Reserving 36 beds for hip fracture patients at AZP Eschpoort leads to a bed occupation of 78.08% for AZP Eschpoort and only 4.4% of the patients must wait for an available bed.
- To use a planning and control model to determine at what management level and management area bottlenecks are present. Management action is first of all mainly required on the tactical level and the decision made on the tactical level must be followed-up on the operational level. This concerns medical, demand and information coordination planning. Network coordination planning is an important management area in the future, when collaboration between MST and AZP Eschpoort is started.

PREFACE

I am proud to present my master thesis: Optimization of the integrated care process of hip fracture patients at Medisch Spectrum Twente (MST). Before starting this master thesis, I was not familiar with business processes in a health care setting. Redesign and improvement of business processes is always a challenge, but within health care it is even harder, because business processes are only supportive. I became very interested in this new dimension and I enjoyed the project, like doing relevant research aspects that are applied partly within practice. Although writing academic English was my personal struggle, I am satisfied with the final result.

I specially thank Erwin Hans from the University of Twente for his great enthusiasm and positive feedback. I thank Jeannette van Manen from the University of Twente for her concrete and practical suggestions. I thank Elles Stijnen from MST for her guidance and the many meetings which inspired me to think also on a practical level. Also, I thank Els Hullegie, nurse practitioner of MST, for being my personal (medical) helpdesk!

Special thanks to Miranda van den Dries and my brother Jurriaan van Swinderen, who helped and stimulated me to improve my English writing. And last but not least, I thank my parents and Wouter Schreuder for keeping me smile!

I hope my research project will help to improve the integrated care pathway hip fracture patients live through!

Enschede, April, 2010

Marjolein van Swinderen

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1 INTRODUCTION

One of the major problems in healthcare is the lack of coordination between hospitals and follow-up care organizations, which is a consequence of separate organizational and financial systems. They work independently, which results in fragmentation and inefficiency (van der Linden, et al., 2000). In practice, patients deal with high waiting times in hospitals before they are treated. After treatment, patients have to wait again before they receive follow-up care. The use and improvement of integrated care is a hot topic. Medisch Spectrum Twente (MST) wants to reduce the access time to follow-up care by creating more collaboration between the hospital and the follow-up care organizations. One of the striking questions hereby is how to strengthen the integrated care process by collaboration between hospitals and follow-up care in order to gain positive results for both organizations while sustaining a high care quality level.

The relevance of this research is twofold: *social* and *scientific*.

This research will contribute to *actual* problems in the society. We provide detailed information about integrated care processes. As a result, the collaboration between hospitals and follow-up care organizations can be strengthened. This might result in a reduction of unnecessary stays in hospitals. By describing and analyzing the process of a specific patient group at MST, the outcome of this research can be used to collect an integrated care path for a specific patient group in the future. The *scientific* importance of this study relates to the knowledge gap that exists for integrated care processes. Integrated care processes are a novel perspective in healthcare and there is – to the best of our knowledge - no clear use and description of these processes yet.

In summary, the detailed description of the integrated care processes will give insight in the collaboration and use of these processes for specific patient groups.

1.1 BACKGROUND: MEDISCH SPECTRUM TWENTE

MST is one of the largest non-academic hospitals in the Netherlands. It consists of two main departments in Enschede and Oldenzaal and two substitute departments in Haaksbergen and Losser. The following numbers give an overview of the hospital's main characteristics:

- 1070 available beds
- 29.500 clinical stays per year
- 440.000 outpatient visits per year
- 4000 employees, included 200 medical specialists
- Total of 6100 registrations for follow-up care by '*Transferpunt*' MST per year

MST is engaged in primary medical tasks, but several departments of MST (Such as 'Staff Managment Care (Stafdienst Zorg) and Staff Management ICT (Stafdienst ICT)) are also highly involved with innovative and change management projects. Within Staff Management Care there are several projects, for example the project "first line" and project "discharge management". The project first line focuses on the improvement between MST and primary care. The project discharge management focuses mainly on the realization of an optimal through put of patients to follow-up care organizations. This study contributes to the two main goals of the project discharge management: a decrease of length of stays in the hospital and a decrease of access time to follow-up care organizations.

1.2 PROBLEM FORMULATION

Many patients experience long access times for follow-up care in nursing homes, rehabilitation centres, care homes or domiciliary care. In 2008, an average of 19 patients a day was waiting for follow-up care in MST. These patients have to wait an average of 6 days before they can get their follow-up care. These delays are causing unnecessary stays in the hospital. MST cannot give these patients the required care and this stay influences the circulation in the hospital. This entails considerable costs for the MST. Besides, within MST and the follow-up care organizations there exists no clear description of the integrated care processes for various patient groups, which results in an inadequate throughput of patients from MST to follow-up organizations.

We thus formulate the problem as follows:

Patients have to deal, after medical treatment in the hospital (MST), with long access times to follow-up care.

1.3 GOAL OF THE STUDY

We focus in this research on one specific patient group: hip fracture patients. Hip fracture patients form a large group, and the perception exists that this group is dealing with high access times for follow-up care. We focus on the throughput and outflow of these patients to two follow-up care organizations: AriënsZorgpalet location Eschpoort (AZP Eschpoort) and Zorggroep Sint Maarten location Oldenhove (ZGS Oldenhove). The hip fracture patient group deals with high urgency when they enter the hospital and these patients are always treated in the hospital. As a result, the inflow phase of patients is of less importance in this study.

The main goal is threefold:

We provide a detailed description of the integrated care processes for hip fracture patients at MST and the follow-up care organizations, where problems are identified and recommendations are determined.

To *describe* the integrated care process of hip fracture patients at MST, we first describe the actual situation, so called zero measurement by describing the process and performance. In addition, we describe the desired

situation. By *analyzing* the factors influencing the high access time to follow-up care, we give some *recommendations* to improve the integrated care process.

Ultimately, MST will develop an integrated care path for hip fracture patients. This care path can be used for the development of care paths of other patient groups.

1.4 RESEARCH QUESTIONS

We derive some research questions from the problem formulation:

1. What is the current situation of the hip fracture integrated care pathway at MST and the follow-up care organizations?

a. How is the hip fracture integrated care pathway organised?
b. What is the current performance of the hip fracture integrated care pathway?

Chapter 2 contains a process description and a performance analysis of the current situation. Paragraphs 2.1 to 2.9 describe chronologically the flow of a patient through the integrated care process: Arrival patient into the hospital, admittance patient, treatment patient, post-treatment patient, discharge of a patient from the hospital, admittance patient in nursing home, reactivation patient, and discharge patient from nursing home.

2. What is the desired situation of the hip fracture integrated care pathway at MST and the follow-up care organizations?

a. How will the clinical hip fracture care pathway be organized at MST?
b. Which performance indicators will be used in the clinical hip fracture care pathway?
c. How will the integrated hip fracture care pathway be organized with MST and the follow-up care organizations?
d. Which performance indicators will be used in the integrated hip fracture care pathway?

Besides the present situation, chapter 2 contains a description of the desired situation by describing the new clinical care pathway and the corresponding performance indicators and by describing the integrated care pathway developed until now (paragraph 2.10).

3. Which paradigms in the literature can be used to deal with the high access time?

Chapter 3 develops an integrated care model with the aim to divide and categorize problems on different management levels. Paragraph 3.1 starts with a short literature review on supply chain management to get insight in the operation of these types of chains. Paragraph 3.2 describes supply chain management in service context. Paragraph 3.3 applies the previous paragraph to a health care setting. Supply chain management is dependent on the collaboration between organizations. Paragraph 3.4 describes network relationships regarding different management levels. Paragraph 3.5 analyzes the network relationships in the situation of

MST. There exist different kinds of network relationships and paragraph 3.6 discusses one network relationship: integrated care. With the use of the literature in the previous paragraph in paragraph 3.7 we develop a framework for management planning and control in an integrated care setting.

4. What are the factors that influence the access time to follow-up care?

a. Which patient characteristics predict a longer medical treatment/length of stay in hospital?
b. Which patient characteristics predict a longer time of rehabilitation in nursing homes?
c. What are factors in the way of working in hospital and in nursing homes? (based on Chapter 2)
d. How can the previous factors be classified into managerial and hierarchical areas?

In chapter 4, we analyze the factors leading to the access time for follow-up care. To categorize the factors into different managerial and hierarchical areas, we use the developed model of chapter 3. In paragraph 4.1 we analyze patient characteristics to get insight in the characteristics of the patient group and the corresponding demand predictability in hospital and in the different nursing homes which results in a different medical treatment durations/length of stays. Based on the findings in paragraph 2.1 to 2.9 we further analyze in paragraph 4.2 the way of working in the care pathway.

5. Which interventions shorten the access time to follow-up care?

In chapter 5, we formulate several interventions to improve the integrated care process. Paragraph 5.1 describes an intervention for the patient variability based on classifying patient into sub groups. Paragraph 5.2 describes standardization of work processes to improve the way of applying patients for follow-up care. Paragraph 5.3 describes measurement, registration, and information services as interventions for use and storage of data. Paragraph 5.4 shows a simulation technique to predict the bed capacity in nursing home *AZP Eschpoort*. Paragraph 5.5 describes at what management level and management area the bottlenecks of chapter 4 occur by using the planning and control model developed in chapter 3.

1.5 METHODS

We base the analysis of the present situation at MST and the follow-up care organizations in chapter 2 on qualitative as well as on quantitative data. The process description is mainly based on interviews with the concerning employees. For example to describe the internal process at MST interviews are held with a nurse practitioner, nurses, head managers, Transferpunt coordinators, and Transferpunt mediators. To describe the integrated process at the follow-up care organizations interviews are held with the head manager of the reactivation department, manager 'treatment and care', and the admittance manager. Next to this, we observe the inpatient department at MST and the Transferpunt department. The performance analysis is mainly based on data collection. The first three steps, arrival in hospital, admittance and operation are based on data from the general data warehouse at MST, X-care, because X-care contains data of the total amount of hip fracture patients at MST. The last two steps in hospital, post-operative and discharge are based on data from the

database of the *Transferpunt*, because in these steps it is highly important to focus only on those patients who will receive follow-up care. The steps at the follow-up care organizations are based on two organizations: AriënsZorgpalet location Eschpoort (AZP Eschpoort) and Zorggroep Sint Maarten location Oldenhove (ZGS Oldenhove). Data from the Transferpunt database and the databases at the two nursing homes are combined to analyze the process of the specific patients who are treated at MST and receive follow-up care in these two nursing homes. All data analysis is from 2008 and the first eight months of 2009.

Chapter 3 is mainly based on literature research. The literature is coming from the management fields: operations management, (service) supply chain management, and integrated care management.

The results in chapter 4 are based on quantitative and qualitative data, and results from chapter 2. The quantitative data is limited because MST place data into a storage device just since 2008 and the patient files are not electronic recorded. Consequently the quantitative data is combined with interviews with different experienced employees at MST and the two nursing homes.

Chapter 5 is based on the results in chapter 4. We formulate several recommendations and discuss those interventions with employees at MST and the two nursing homes.

2 CONTEXT ANALYSIS

This chapter describes the present situation of the integrated care process of acute hip fracture patients at MST. This integrated care process is divided into eight steps; arrival patient at the hospital (Paragraph 2.2), admittance patient at the hospital (Paragraph 2.3), treatment patient (Paragraph 2.4), post-treatment patient (Paragraph 2.5), discharge patient from the hospital (Paragraph 2.6), admittance patient into nursing home (Paragraph 2.7), rehabilitation patient (Paragraph 2.8), and discharge patient from nursing home (Paragraph 2.9). Figure 1 displays these process steps. All these steps are discussed in paragraphs 2.2 to 2.9. These paragraphs are divided into a process description and a performance analysis. We base the performance analysis on data from January to December 2008 and January to August 2009.

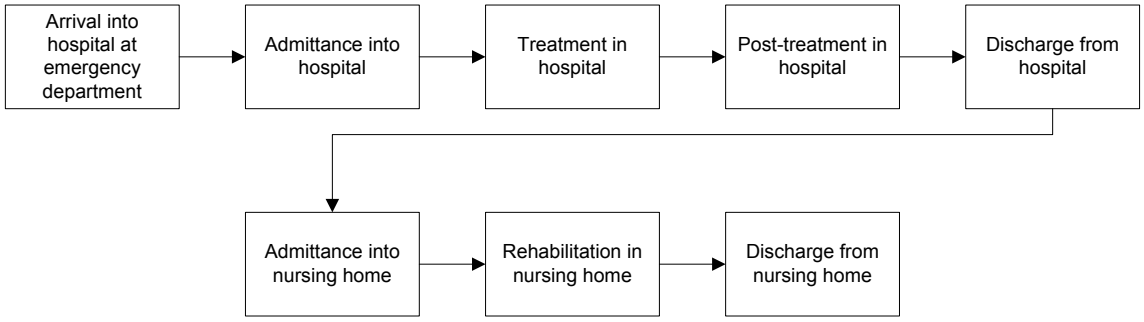


Figure 1: Research Structure

2.1 INFORMATION GATHERING

The data used for this research is mainly obtained through two data systems: *X-care MST* and *Database Transferpunt MST*. X-Care MST is a data system that is used for an adequate patient registration with administrative, planning, and invoicing functions, while Database Transferpunt MST is a data system that contains all patients applied for follow-up care. We use *X-care MST* for the first three steps of the integrated care process (arrival patient at the hospital, admittance patient at the hospital, and treatment patient). And we use *Database Transferpunt MST* for the following steps of the integrated care process (post-treatment patient, discharge patient from the hospital, and admittance patient into nursing home). Data for the last two steps (rehabilitation patient and discharge patient from nursing home) is used and complemented by data we obtained from the databases of *nursing home AZP Eschpoort* and *nursing home ZGS Oldenhove.*

From *X-care MST* we obtain the total number of hip fracture patients arrived, admitted, and treated at MST. An information financial specialist at MST has sent us an overview including a division between the surgical department and the orthopaedic department. This overview contains various descriptions of diagnosis and

treatment related groups (DRG). Patients are administrated with a certain care type. Patients whom arrive at the hospital are administrated with a new DRG code, care type 11. Care type 11 indicates the entire care of a patient from first arrival to final control appointment. Some patients need some long term controls. This type of care is administrated as care type 21. Care type 21 is open for 365 days, unless the patient is discharged from control before. When a patient needs a longer period of control a new care type 21 is administrated as long as the patient is under control. Only at the surgical departments patients are administrated with a care type 11. At the orthopaedic department no patients are administrated with a care type 21.

The total number of patients at the surgical and orthopaedic department is used for the amount of hip fracture patients that arrived at MST in 2008 and January to August 2009. The total number of patients admitted at the hospital is derived from all patients administrated for clinical treatment. Patients administrated with a poli-clinical treatment are regarded as patients who are only treated at the outpatient department. The treatment of hip fracture patients is administrated as operative or conservative. Operative patients get surgery and conservative patients are only observed or get a diagnostic research. Next to these numbers of patients, we requested the previous overviews specified in months, age, and gender. [1]

We use the *Database Transferpunt* to obtain data for the paragraphs post-treatment patient, discharge patient from the hospital, and admittance patient into nursing home. We select those patients who are applied for short term rehabilitation in the first, second, third or fourth registration. Short term rehabilitation includes follow-up care for patients to rehabilitate in a nursing home after medical treatment in the hospital with the aim a return to the patients' home situation. In most of the times the rehabilitation takes three months.

In 2008, 535 patients are applied for short term rehabilitation. From these patients, 153 patients (29%) have a broken hip. In 2009 (January to August) 424 patients are recorded for short term rehabilitation and 118 patients (28%) have a broken hip. Each patient has his own file. To select only the hip fracture patients, we read the treatment description of each patient to see if a patient was diagnosed with a broken hip or another illness.

In the paragraphs about admittance patient into nursing home, rehabilitation patient, and discharge patient from nursing home, we use the databases of nursing home *AZP Eschpoort* and *ZGS Oldenhove* to complement the data from database Transferpunt.

[1] Another overview provided by the information financial specialist contains different data on the total number of patients arriving at MST. In this research we use the data from the most recent overview

2.2 ARRIVAL PATIENT AT THE HOSPITAL

In this paragraph we describe the arrival of hip fracture patients at the hospital.

2.2.1 PROCESS DESCRIPTION

Acute hip fracture patients often enter the hospital through the emergency department. A nurse performs a diagnosis and determines the urgency of the disorder(s). As a rule the medical doctor will examine the patient within 1,5 hours after arriving at the hospital. Hip fracture patients can be treated by an orthopaedic doctor as well as by a surgical doctor. At the emergency department the medical doctors are available for trauma services. At any time, an orthopaedic doctor or a surgical doctor is present. The orthopaedic doctor is scheduled every Wednesday and once a month during the weekend. The surgical doctor is scheduled on all other days. The medical doctor decides whether a patient needs to be admitted and operated. A large part of the acute hip fracture patients are admitted into the hospital. Finally, if an operation is needed, the nurse requests for an acute operation via the admissions office.

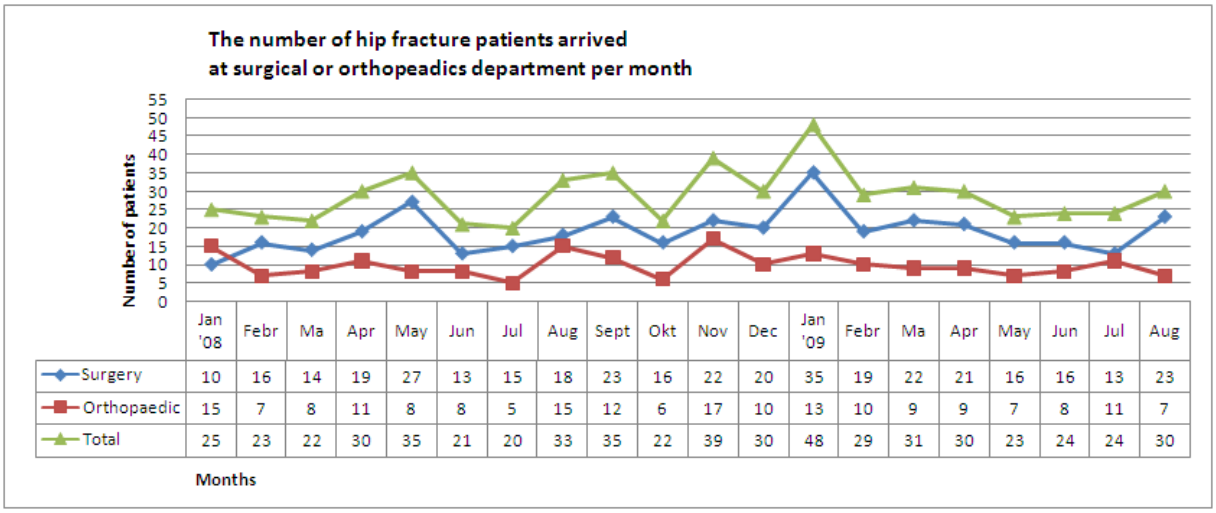
2.2.2 PERFORMANCE

In this paragraph we provide insight in the number of hip fracture patients arriving at MST. In 2008, a total of 335 patients arrived with a hip fracture. In the first eight months of 2009, a number of 239 hip fracture patients arrived at MST. This is an average of 28 patients per month in 2008 and 30 patients per month in 2009. These patients are divided between the surgical and the orthopaedic department. The surgical department treats most of the patients. In 2008, 213 patients (64%) were treated by the surgical department and 122 patients (36%) by the orthopaedic department. From January to August 2009, 165 patients (69%) were treated by the surgical department and 74 patients (31%) by the orthopaedic department. The differences between the number of patients treated by the surgical and orthopaedic department are due to the planning of trauma services at the emergency department. Due to a higher necessity at the emergency department a surgical doctor deals with much more trauma services than an orthopaedic doctor.

Figure 2 displays the number of hip fracture patients that arrive at the hospital per month and indicates whether they are treated by a surgical or an orthopaedic doctor. We expect to see some fluctuations in the number of patients arriving per month due to weather influences. November 2008 and January 2009 show a high amount of hip fracture patients arrived at the hospital. The peak in January is due to the extreme cold weather in that period.

The first eight months of 2009 compared to the first eight months of 2008 displays a higher number of hip fracture patients arriving at MST, 30 patients more arrived at the hospital. Compared to the same months in 2008 in January 2009 71 percent, in February 2009 24 percent, in March 52 percent, in June 14 percent, and in July 20 percent more patients arrived at MST. Only in April, May, and August fewer patients, respectively 3, 34,

and 9 percent, arrived. An explanation for the increase in the number of patients arriving in 2009 may be the extreme cold winter period and the increasing obsolescence. In January 2009, 15 patients under the age of 65 year arrived with a hip fracture reasonable due to the ice skating weekend on nature ice, 27 percent of all patients under the age of 65 year arrived in January 2009.



	Jan '08	Febr	Ma	Apr	May	Jun	Jul	Aug	Sept	Okt	Nov	Dec	Jan '09	Febr	Ma	Apr	May	Jun	Jul	Aug
Surgery	10	16	14	19	27	13	15	18	23	16	22	20	35	19	22	21	16	16	13	23
Orthopaedic	15	7	8	11	8	8	5	15	12	6	17	10	13	10	9	9	7	8	11	7
Total	25	23	22	30	35	21	20	33	35	22	39	30	48	29	31	30	23	24	24	30

Figure 2: The number of hip fracture patients arrived at surgical or orthopaedic department per month.

(Source: X-care MST, Jan-Dec 2008, Jan-Aug 2009, N=335 (2008), N=239 (2009))

The literature describes that weather influences are not the main cause of a higher amount of hip fracture patients. Research of Lord et al. (1993) and Bath and Morgan (1999) verify that the place of a fall is also determined by age. With increasing age, independent living elderly people fall more often inside than outside. Also elderly people in nursing and care homes fall more often inside than outside (Graafmans, et al., 1996). Figure 3 and figure 4 displays the age of hip fracture patients in 2008 and 2009. A minimum of 77 percent of the hip fracture patients in 2008 and 2009 are aged over 65 years.

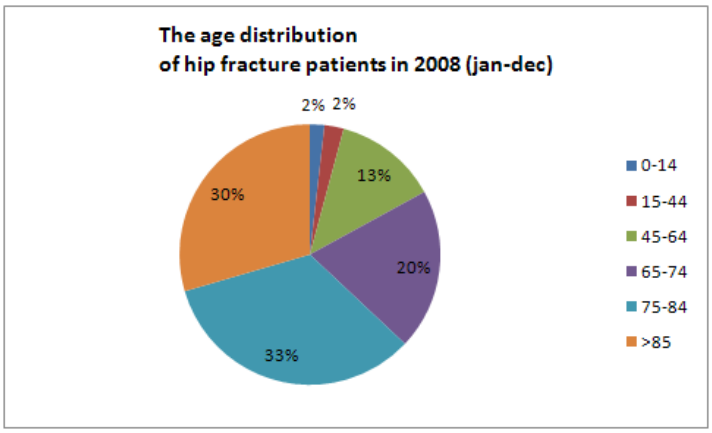


Figure 3: The age distribution of hip fracture patients

(Source: X-care MST, Jan-Dec 2008, N=335)

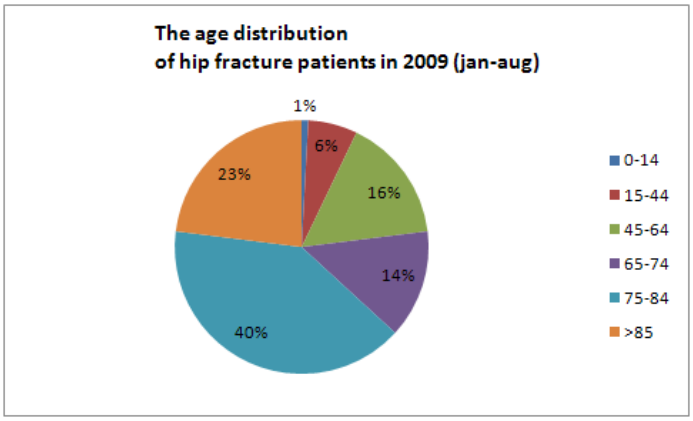


Figure 4: The age distribution of hip fracture patients

(Source: X-care MST, Jan-Aug 2009, N=239)

Because of the obsolescence the number of elderly people will grow the following years. Circa 30% of all independent living elderly people and half of the elderly people living in a nursing or care home fall once a year and 2% of these falls results in a broken hip ("Letsel informatie systeem," 1998-2001). But figure 3 and figure 4 do not show this expected obsolescence. The group patients of 65 years of age and older is decreased in 2009 in comparison with 2008, 83% to 77% of the total number of hip fracture patients arrived at the hospital.

Table 1 displays the corresponding percentages of patients treated by a surgical or an orthopaedic doctor per month. We expect a high amount of patients treated by a surgical doctor due to the planning of trauma services at the emergency department. In total, the surgical department treats 64 percent or more of all the patients. This percentage is lower than expected due to patient transfers from a surgical doctor to an orthopaedic doctor. A patient is treated by an orthopaedic doctor when the patient is already known by this doctor, the patient will be treated with a total hip prosthesis, or the operation is complex due to other pathological affections.

2008	Surgery	Orthopaedic	2009	Surgery	Orthopaedic
January	40%	60%	**January**	73%	27%
February	70%	30%	**February**	66%	34%
March	64%	36%	**March**	71%	29%
April	63%	37%	**April**	70%	30%
May	77%	23%	**May**	70%	30%
June	62%	38%	**June**	67%	33%
July	75%	25%	**July**	54%	46%
August	55%	45%	**August**	77%	23%
September	66%	34%			
October	73%	27%			
November	56%	44%			
December	67%	33%			

Table 1: Percentages arriving patients treated by a surgical or orthopaedic doctor

(Source: X-care MST, Jan-Dec 2008, Jan-Aug 2009, N=335(2008), N=239(2009))

2.3 ADMITTANCE PATIENT AT THE HOSPITAL

The previous paragraph describes the arrival of all hip fracture patients at MST. After arrival at the hospital the medical doctor decides whether a patient is treated at the outpatient department or is admitted into the hospital. In this paragraph, we analyze only those patients who are admitted into the hospital (inpatient department). The patients treated at the outpatient department are excluded from this research.

2.3.1 PROCESS DESCRIPTION

When a patient is admitted during daytime (7.30 to 16.00 hour) the emergency department contacts admission office to check whether a room is available at the surgical department (D3) or the orthopaedic department (A5). As a rule, a maximum of eight hip fractures is allowed on the D3 department otherwise the care the nurses need to provide will become too burdensome. The orthopaedic department (A5) has generally less patients anyhow. If a patient cannot enter the D3 or A5 department, one of the three other surgical departments (A3, B3, and C3) is checked for availability of beds. Only in a few cases these departments are also full, which leads to the patient being admitted to another department. All patients admitted to other departments are transferred to the D3 or A5 department as soon as beds are available. A short transfer of information is made by the emergency department and it is clarified if the patient can be placed in a four person-room depending on his state of confusion. The nurse picks up the patient from a special surgery room and brings the patient to the specific nursing department. The nursing department equipped all beds with a special 'primo' mattress to overcome bedsores. At the emergency department, the emergency assistant hands over the transfer papers to the responsible inpatient nurse. After the transfer of the patient from the emergency department to the inpatient ward, the nurse makes an anamnesis of the patient to obtain desired information about allergies, pain medication, previous diseases and treatments, medicines, and other relevant information. The nurse also checks the patient's vital functions like blood pressure, pulse rate, temperature and breathing. This is done to be able to compare these values before and after the surgery. The nurse processes this information into the health record of the patient and includes the transmission forms; agreement form, medicine form, and medical status form. In the next step, the nurse informs the patient and his family about the treatment and the follow-up care possibilities. After these steps the patient, who are operated, wait for surgery in this department. When a patient is not operated on immediately, the doctor sees the patient during his daily round.

2.3.2 PERFORMANCE

In this paragraph we give insight in the number of hip fracture patients admitted at MST and the division of these patients per specialism: surgical or orthopedic. Of the 335 patients that arrived at MST in 2008, 287 patients (86%) were admitted to the hospital. Of the 239 patients that arrived at MST in 2009, 208 patients (87%) were admitted to hospital. The remainder of the patients (14% and 13%) consists of patients who are not

admitted at the hospital. This number includes patients with hip complaints who have one or more poli-clinical visits

Of the 287 patients admitted in 2008, 171 patients (60%) were admitted to surgery and 116 patients (40%) to orthopaedics. Of the 239 admitted patients in 2009, 138 patients (66%) were admitted to surgery and 70 patients (34%) to orthopaedics. This is an average of 24 patients admitted per month in 2008 and 26 patients admitted per month in 2009. Of the 287 patients admitted in 2008, 204 (71%) patients are female and only 83 (29%) are male. In 2009, 134 patients are female (64%) and 74 patients are male (36%).

2.4 TREATMENT PATIENT

The previous paragraph describes the admittance of hip fracture patients. In this paragraph, we analyze the patients admitted at the hospital related to the different treatments they get.

2.4.1 PROCESS DESCRIPTION

Various types of hip fractures can be classified: column fracture, pertochaintaire fracture, and subtrochantaire fracture depending on the place of the fracture. Figure 5 displays the type of hip fractures.

Collum fracture **Petrochaintaire fracture** **Subtrochantaire fracture**

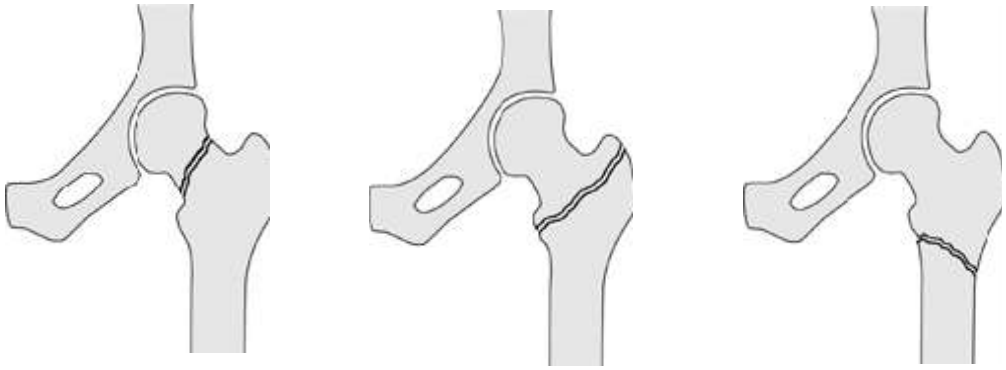


Figure 5: Types of hip fractures

A column fracture is at the upper part of the thighbone. A petrochantaire fracture occurs between the upper part of the thighbone ('neck') and the lower bone. A subtrochanteric fracture occurs further down the bone. Patients admitted at the hospital can be treated in two ways; operative and conservative. When a patient is operated on, this treatment is dependent of the type of fracture, age, condition, mobility, and bone condition. However treatment is also related to preference and skills of the specific medical doctor. Orthopaedic doctors more often use a total hip replacement than surgical doctors who more often repair the bones with screws and pins. If patients are admitted, but they are not operated on this is called a conservative treatment. These patients are observed or get a diagnostic research.

After surgery the patient goes to the recovery room where blood pressure, pulse rate, temperature and breathing are checked. When the patient is awake and all vital functions are normal, the nurse transfers the patient back to the inpatient ward.

2.4.2 PERFORMANCE

In this paragraph, we give insight in the number of patients that are treated operative or conservative divided per specialism. As stated before, respectively 86% and 87% of the patients arrived at the hospital in 2008 and 2009 are treated at the inpatient department. Of the 287 patients (171 at Surgery, 116 at Orthopaedic) admitted in 2008, 254 patients (89%) are operated on and only 33 patients (11%) are treated conservative. In 2009, of the 208 patients (138 at Surgery and 70 at Orthopaedics), 196 patients (94%) are operated on and 12 patients (6%) get conservative treatment.

The surgical department operates on hip fracture patients with the use of pins and screws and the orthopaedic department use pins and screws as well as prosthesis. Figure 6 and figure 7 displays the number of hip fracture operated by a surgical or orthopaedic doctor. We expect to see more operations by a surgical doctor than an orthopaedic doctor due to the higher amount of patients admitted by a surgical doctor. In 2008, more than half (59%) of the patients are operated on by a surgical doctor and 41% are operated on by an orthopaedic doctor. In 2009, 68% of the patients are operated on by a surgical doctor and 32% are operated on by an orthopaedic doctor. Almost all patients operated on by an orthopaedic doctor are operated on with the use of a total hip prosthesis. The operation method is dependent on the skills and preferences of the medical doctor.

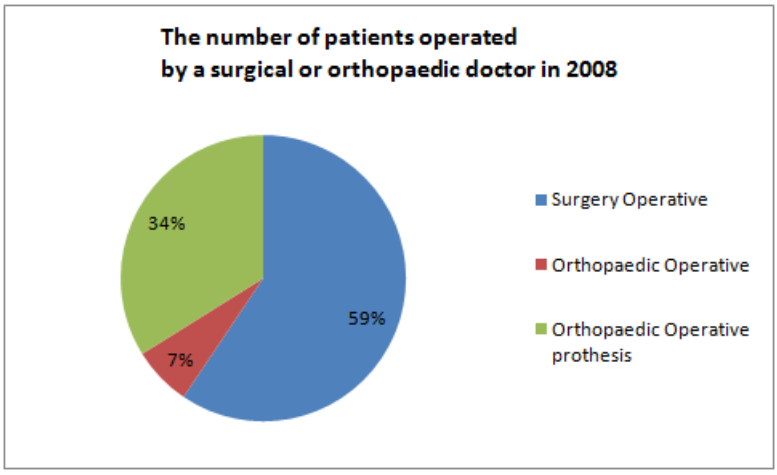


Figure 6: The number of patients treated by a surgical or orthopaedic doctor

(Source: X-care MST, Jan-Dec 2008, N=254 (only operative patients))

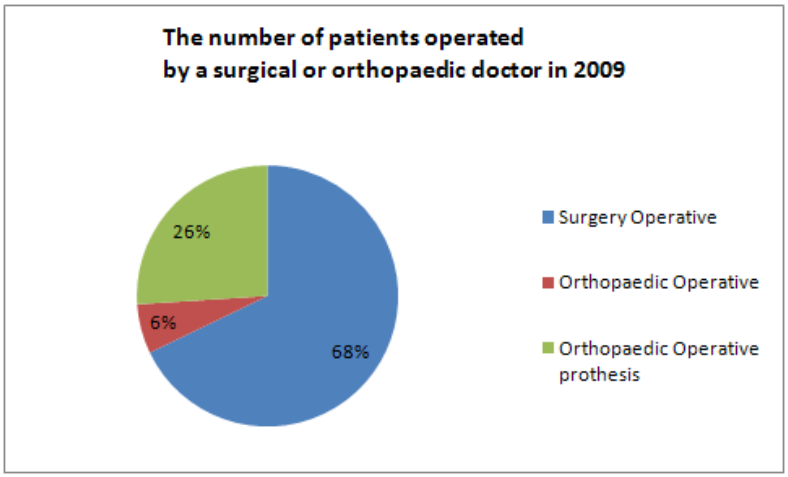


Figure 7: The number of patients treated by a surgical or orthopaedic doctor

(Source: X-care MST, Jan-Aug 2009, N=196 (only operative patients))

2.5 POST-TREATMENT PATIENT

The previous paragraph describes the treatment of patient at the hospital. In this paragraph we describe the process of recovery at the inpatient department and the process of arranging follow-up care. The process description is divided into 2 parts: recovery at the inpatient ward and arranging follow-up care. The performance description is divided into 4 parts: registration follow-up care, medical treatment, access time short term rehabilitation, and length of stay at the hospital. In this paragraph we focus on those patients who need follow-up care and especially need short term rehabilitation care after medical treatment at the hospital. Both operative and conservative patients may need short term rehabilitation care.

2.5.1 PROCESS DESCRIPTION RECOVERY INPATIENT WARD

One day after surgery, the physiotherapist starts to improve the patient's mobility. The nurse checks the vital functions and gives the patient the desired medicines every day. The nurse plans the type of rehabilitation for the patient in cooperation with the relevant medical doctor. For short term rehabilitation, the nurse in cooperation with the patient fills in a specific *Transferpunt* form. The nurse gives the patient and his family a specific *Transferpunt information brochure* about follow-up care after medical treatment. The nurse explains the 'first choice, second best' principle, which means that patients can give their first choice for a follow-up organization, but when the first choice is not available, another solution will be sought out, the second best. This means the first choice of the patient is not guaranteed.

Transferpunt nurses collect the *Transferpunt* forms at the departments every Monday till Friday at eleven am. The medical doctor plans the end date of the medical treatment. The medical doctor checks the patient on his daily round. The medical doctor decides the end date of medical treatment and confers this with the nurse. Then contact with Transferpunt is made by telephone or physically by the nurse.

2.5.2 PROCESS DESCRIPTION ARRANGING FOLLOW-UP CARE

Within MST a specific department is arranged, Transferpunt, with the aim to arrange follow-up care for those patients who need professional care and treatment after their stay at the hospital. They give support to the nurses of the inpatient department. Because *Transferpunt* plays an important role in the discharge of patients to follow-up care organizations, it is helpful to describe the way of working in this department.

As stated previously, *Transferpunt* nurses visit the different departments every Monday to Friday at 11 am. They pick up the registration forms and discuss with the relevant nurse patient applications such as end date of medical treatment, and discharge possibilities. If there is no chance to see the nurse, the *Transferpunt* nurse calls the department later that day. Back at the *Transferpunt* department, they *Transferpunt* nurse hands over the registration forms at the secretary and she inserts the forms into the *Transferpunt* database. After this, the *Transferpunt* nurse divides their list in high and low priority patients. She starts arranging all settlements for follow-up care for the high priority patients. First the *Transferpunt* nurse discusses with the patient which provider of care is preferred. After this, she applies a request at the 'Centrum Indicatie stelling Zorg' (CIZ) by e-mail. If a patient needs care, you can make an appeal to the 'Algemene Wet Bijzondere Ziektekosten' (AWBZ). CIZ judges if a patient has legal right for AWBZ-care. AWBZ consists of five parts; personal care, nursing, guidance, stay at for example nursing home, and treatment. Sometimes a patient already has a CIZ-indication. The *Transferpunt* nurse archives the CIZ-request in the MST database and she inserts the information about the requested care into the *Transferpunt* database. After all these steps are completed, the *Transferpunt* nurses contacts the relevant inpatient department to discuss the CIZ indication. Starting with a list of applications the following day, they judge each case on its own merits and decide which applications have high priority. Next to this, they define which cases need some explanation the following day.

2.5.3 PERFORMANCE DAY OF REGISTRATION

In this paragraph, we give insight in the number of patients applied for short term rehabilitation and how long it takes to apply at Transferpunt for follow-up care. The duration of registration is measured by the admission date related to the registration date at Transferpunt. Transferpunt nurses pick up the registration forms every Monday to Friday morning and apply this date at the database.

This research focuses on hip fracture patients who need short term rehabilitation after medical treatment in MST. Therefore, we give insight in the number of patients applied for short term rehabilitation. We expect a relative high percentage of hip fracture patients applied for this type of follow-up care, because in general most patients need short term rehabilitation after medical treatment in hospital. Many hip fracture patients correspond with these criteria. Of the 287 patients admitted and treated in 2008, 153 patients (53%) are applied for short term rehabilitation. Of the 208 patients admitted and treated in 2009, 118 patients (57%) are applied for short term rehabilitation. Thus, circa half of the patients admitted are also applied for short term

rehabilitation and these percentages are lower than expected. As a result of the discharge of patients to long term care.

To shorten the throughput time within the hospital it is important to get insight in the duration of registration for short term rehabilitation by *Transferpunt*. Table 2 shows the duration of follow-up care registration using the average and standard deviation for all patients recorded for short term rehabilitation. If a patient is applied for short term rehabilitation it is not a guarantee that these patients are actually discharged to this type of after care. Therefore, we distinguish between the patients who are actually discharged to short term rehabilitation and the patients who are applied but are not discharged to short term rehabilitation. In 2008 the registration time was one of the problems with regard to the long stay of hip fracture patients in the hospital. This is not consistent with statements of different people at different inpatient wards. They state that patients always are applied for short term rehabilitation just one or two days after admittance at the inpatient ward. According to their statements it is, having some experience, relative easy to determine a demand of care for a patient in an early stage. In 2009, the necessity of early registration is communicated within the inpatient departments. We expect to see a decrease of registration time in 2009. Table 2 shows that there is an average of 8.05 days for registration for all the patients applied for short term rehabilitation in 2008. There is almost no difference between the patients who are discharged to short term rehabilitation and patients who are discharged to other forms of rehabilitation. In 2009, the average is decreased to 6,23 days. The registration time is improved in 2009, but it still takes too long. This is due to the lack of routine for nurses. Nurses are not cautious enough, information transfer between nurses occurs not always correct, and in the weekens less experienced employees are available.

2008	N	Average	St.Dev
Total discharge	153	8,05	4,93
KR discharge	115	8,17	5,14

2009	N	Average	St.Dev
Total discharge	118	6,23	3,62
KR discharge	78	5,81	2,65

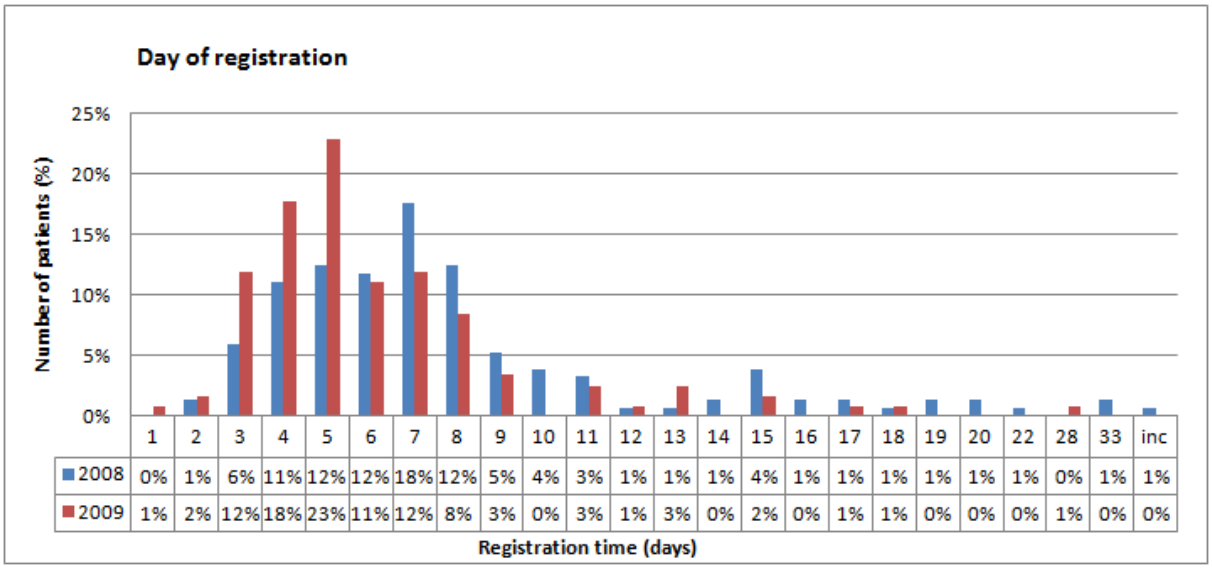
2008	N	Average	St.Dev
No-KR discharge	38	7,68	4,19
• Temporary care home	2	3,5	1,5
• Permanent care home	4	9,5	5,5
• Permanent nursing home	2	4,5	1,5
• Permanent nursing home (Schakel)	7	7,14	5,54
• CRU	0	-	-
• Other	23	8,17	3,27

2009	N	Average	St.Dev
No-KR discharge	40	7,05	4,89
• Temporary care home	1	11	0
• Permanent care home	5	11,4	7,47
• Permanent nursing home	0	-	-
• Permanent nursing home (Schakel)	7	6,43	4,46
• CRU	1	15	0
• Other	26	5,92	6,75

Table 2: Day of registration

(Source: Database Transferpunt MST, Jan-Dec 2008, Jan-Aug 2009)

The high standard deviations point out a high range of distribution. Figure 8 displays an overview of all hip fracture patients applied for short term rehabilitation and their corresponding duration of registration. We expect to see many different days of registration with high outliers. 57% of the patients in 2008 and 35% of the patients in 2009 are applied for follow-up care almost a week or more after admittance to the hospital.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	22	28	33	inc
2008	0%	1%	6%	11%	12%	12%	18%	12%	5%	4%	3%	1%	1%	1%	4%	1%	1%	1%	1%	1%	1%	0%	1%	1%
2009	1%	2%	12%	18%	23%	11%	12%	8%	3%	0%	3%	1%	3%	0%	2%	0%	1%	1%	0%	0%	0%	1%	0%	0%

Figure 8: Day of registration of short term rehabilitation

(Source: Database Transferpunt MST, Jan-Dec 2008, Jan-Aug 2009, N=153 (2008) N=118 (2009))

We also observe a reduction of the day of registration in 2009 in comparison with 2008. Figure 9 displays the percentage of patients applied regarding to their registration time. The red line of 2009 is situated left of the blue line of 2008, which shows the reduction of registration time in 2009. Especially in 2009 less outliers are presented. In 2009, 55% of the patients are applied within 5 days after admittance into the hospital in comparison with 55% of the patients in 2008 in more than 6 days. But the differences are visible by 90% of the patients. In 2009, 90% of the patients are applied within 9 days after admittance into the hospital, and in 2008 in more than 15 days.

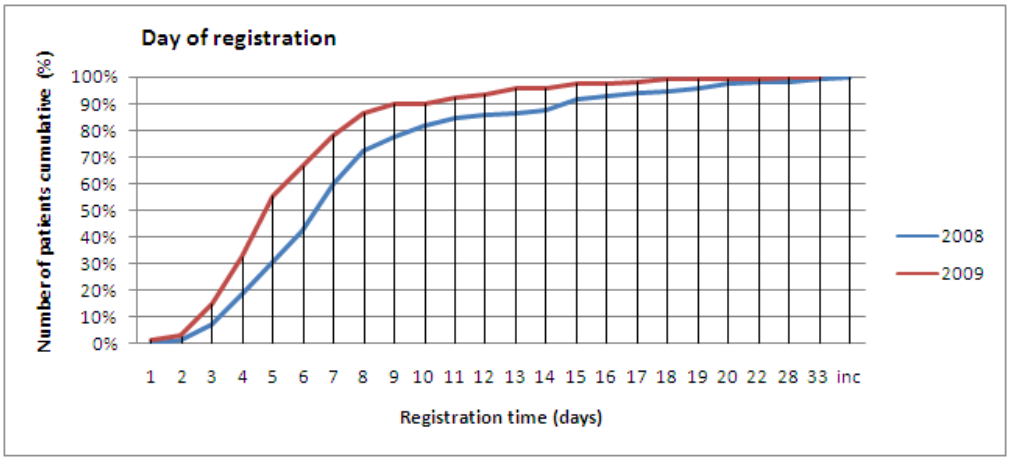


Figure 9: The percentage of patients applied for short term rehabilitation versus the registration time

(Source: Database Transferpunt MST, Jan-Dec 2008, Jan-Aug 2009, N=153 (2008) N=118 (2009))

2.5.4 PERFORMANCE DURATION MEDICAL TREATMENT

In this paragraph we give insight in the duration of the medical process a patient endures at the hospital. The duration of medical treatment is measured from the admission date to the end date of medical treatment.

Medical treatment consists of all medical activities within the hospital. A medical doctor decides when a patient does not need any medical treatment in the hospital anymore. A report of discharge management (2008) states there is no univocal use of the finishing point of medical treatment among medical doctors. This may influence the data, but we take this into account in the next chapters.

The duration of medical treatment in the hospital is important for analyzing the integrated care process, because from that moment on the focus of cure in the hospital should be transferred to care in follow-up care organizations. Table 3 shows the duration of medical treatment using the average and standard deviation for all patients applied for short term rehabilitation with different discharges. The aim is to discharge a patient within 6 days (5 days post-operative).

Table 3 displays an average of 12.13 days in 2008 to complete the medical treatment. There is a small difference for short term rehabilitation patients and other discharges. This is consistent with the statements of different people. In the first instance patients are applied for short term rehabilitation, but patients often have complications in a later phase. As consequence patients stay at the inpatient department for a longer period of time and this changes the demand of care. In 2009, the average decreased to 10.02 days. The patients who are applied for short term rehabilitation, but in a later phase are discharged to other forms of follow-up care also have a longer medical treatment, because of medical complications as delirium, pneumonia, and urinary tract infection.

2008	N	Average	St.Dev
Total discharge	153	12,13	8,24
KR discharge	115	11,55	8

2009	N	Average	St.Dev
Total discharge	118	10,02	8,05
KR discharge	78	9,03	7,29

2008	N	Average	St.Dev
No-KR discharge	38	14,06	9,29
• Temporary care home	2	10,5	5,5
• Permanent care home	4	13,5	5,41
• Permanent nursing home	2	5	1
• Permanent nursing home (Schakel)	7	16,86	9,48
• CRU	0	-	-
• Other	23	14,47	9,94

2009	N	Average	St.Dev
No-KR discharge	40	11,95	9,06
• Temporary care home	1	14	0
• Permanent care home	5	15,8	7,47
• Permanent nursing home	0	-	-
• Permanent nursing home (Schakel)	7	12	6,44
• CRU	1	50	0
• Other	26	9,65	11,56

Table 3: Duration of medical treatment

(Source: Database Transferpunt MST, Jan-Dec 2008, Jan-Aug 2009)

The high standard deviations point out a high range of distribution. Figure 10 displays an overview of all hip fracture patients recorded for short term rehabilitation and their corresponding duration of medical treatment. MST strives for a medical treatment of 6 days from admittance to finish of medical treatment. In 2008, only 20% of the patients are treated within these 6 days. In 2009 40% of the patients are treated within 6 days due to more attention to the prevention of complications. For example: removing the catheter quickly, fast mobilization after surgery, and early recognition of delirium. Besides the temporary and definite end date of medical treatment are used mistaken.

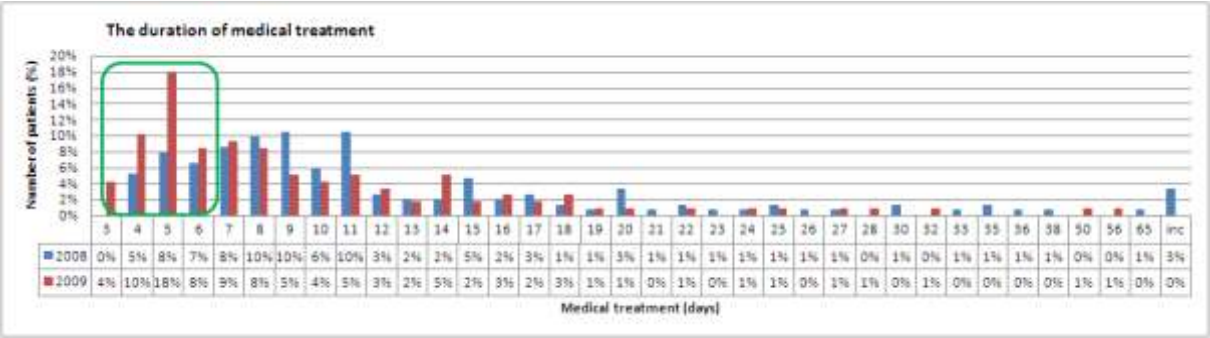


Figure 10: Duration of medical treatment

(Source: Transferpunt database MST, Jan-Dec 2008, Jan-Aug 2009, N=153 (2008) N=118 (2009))

We also observe a reduction in the duration of the medical treatment in 2009 in comparison with 2008. Figure 11 displays the percentage of patients treated in the hospital regarding to the duration of the medical treatment. In 2009, 40% of the patients are treated within the 6 days after admittance into the hospital, and in 2008, 40% of the patients is treated within 8 days. But in 2009, also many outliers are presented.

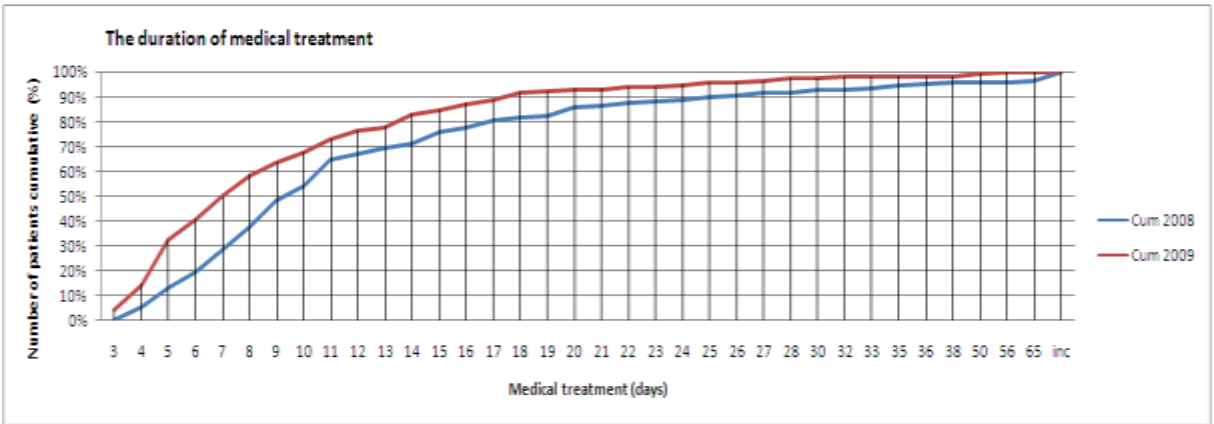


Figure 11: The percentage of patients treated in the hospital versus the duration of medical treatment

(Source: Transferpunt database MST, Jan-Dec 2008, Jan-Aug 2009, N=118 (2008) N=118 (2009))

2.5.5 PERFORMANCE ACCESS TIME FOLLOW-UP CARE

In this paragraph we give insight in the access time from hospital to follow-up care organizations. The access time for follow-up care is measured by the end date of medical treatment related to the day of discharge from the hospital.

One of the main problems at MST is the access time to follow-up care organizations, but the exact access time for hip fracture patients is not clear. Table 4 shows the access time for follow-up care using the average and standard deviation for all patients recorded for short term rehabilitation with different discharges. In 2008, there was an average access time of 10.51 days for all hip fracture patients applied for short term rehabilitation, and in 2009 this has increased to 11.02 days. The No-KR discharge group average is lower in both years due to more easily arranging of discharge to other forms of care. For example, home care is arranged much easier than rehabilitation in nursing homes.

2008	N	Average	St.Dev
Total discharge	153	10,51	7,41
KR discharge	115	10,89	7,46

2009	N	Average	St.Dev
Total discharge	118	11,02	6,73
KR discharge	78	12,36	6,41

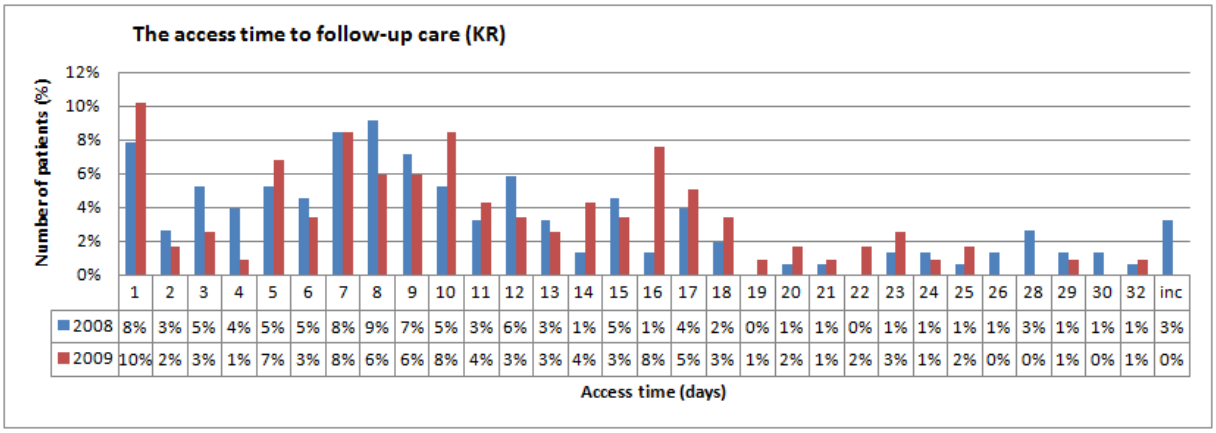
2008	N	Average	St.Dev
No-KR discharge	38	9,21	7,1
• Temporary care home	2	12	0
• Permanent care home	4	21,25	7,82
• Permanent nursing home	2	24,5	10,5
• Permanent nursing home (Schakel)	7	22,43	10,05
• CRU	0	-	-
• Other	23	9,32	7,64

2009	N	Average	St.Dev
No-KR discharge	40	8,4	6,56
• Temporary care home	1	5	0
• Permanent care home	5	5,2	4,92
• Permanent nursing home	0	-	-
• Permanent nursing home (Schakel)	7	12,43	3,16
• CRU	1	3	0
• Other	26	8,27	7,14

Table 4: Access time to follow-up care

(Source: Database Transferpunt MST, Jan-Dec 2008, Jan-Aug 2009)

The high standard deviations point out a high range of distribution. Figure 12 displays an overview of all patients applied for short term reactivation and their corresponding access time to short term rehabilitation expressed in percentages to compare 2008 with 2009. 8% of the patients in 2008, and 10% in 2009 is discharged the day medical treatment is finished. But most of these patients are applied to short term rehabilitation but are discharged to other types of follow-up care: in 2008, 4 patients are discharged to home care, 3 patients to a care home, one to 'overbrugginsafdeling" Bascule, 2 patients died at the hospital, and only 2 patients are discharged to short term rehabilitation in a nursing home. In 2009, 4 patients are discharged to home care, 2 patients to a care home, 1 patient died at the hospital, 2 patients are booked out for short term rehabilitation, and only 3 patients are discharged to short term rehabilitation in a nursing home.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	28	29	30	32	inc
2008	8%	3%	5%	4%	5%	5%	8%	9%	7%	5%	3%	6%	3%	1%	5%	1%	4%	2%	0%	1%	1%	0%	1%	1%	1%	1%	3%	1%	1%	1%	3%
2009	10%	2%	3%	1%	7%	3%	8%	6%	6%	8%	4%	3%	3%	4%	3%	8%	5%	3%	1%	2%	1%	2%	3%	1%	2%	0%	0%	1%	0%	1%	0%

Figure 12: Access time to follow-up care

(Source: Transferpunt database MST, Jan-Dec 2008, Jan-Aug 2009, N=153 (2008) N=118 (2009))

We also observe an increase of the access time to follow-up care in 2009. Figure 13 displays the percentage of patients treated in the hospital regarding to the access time to follow-up care. In 2008 is the access time to follow-up care in general shorter than in 2009. 80% of the patients in 2008 wait less long than 80% of the patients in 2009. But in 2008, there exist high outliers as result that 20% of the patients wait longer for follow-up care than the remaining 20% in 2009.

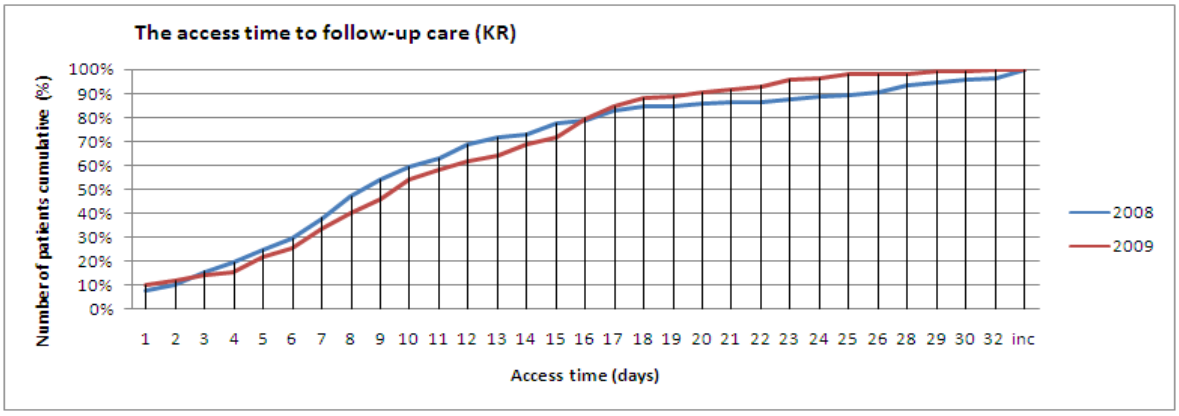


Figure 13: The percentage of patients treated in the hospital versus the access time to follow-up care

(Source: Transferpunt database MST, Jan-Dec 2008, Jan-Aug 2009, N=153 (2008) N=118 (2009))

2.5.6 PERFORMANCE LENGTH OF STAY

In this paragraph we give insight in the length of stay of patients at MST. The length of stay consists of the duration of medical treatment and the access time to follow-up care. The length of stay is measured by the day of admission related to the day of discharge.

As consequence of the duration of medical treatment in the hospital and the high access time, the length of stay for patients is high. The desired situation of stay in hospital is 6 days. Table 5 shows the length of stay of patients at the hospital using the average and standard deviation for all patients applied for short term rehabilitation with different discharges. Table 5 shows an average of 21.60 days of all patients applied for short term rehabilitation in 2008 and an average of 20,03 days in 2009. The duration of total hospital days is for almost every sub group the same. The length of stay is far above the defined level of 6 days in hospital.

2008	N	Average	St.Dev
Total discharge	153	21,6	11,28
KR discharge	115	21,45	11,34

2009	N	Average	St.Dev
Total discharge	118	20,03	9,33
KR discharge	78	20,26	8,49

2008	N	Average	St.Dev
No-KR discharge	38	22,05	11,09
• Temporary care home	2	21,5	5,5
• Permanent care home	4	21,25	7,82
• Permanent nursing home	2	24,5	10,5
• Permanent nursing home (Schakel)	7	22,57	9,93
• CRU	0	-	-
• Other	23	21,91	12,2

2009	N	Average	St.Dev
No-KR discharge	40	19,35	9,87
• Temporary care home	1	18	0
• Permanent care home	5	20	8,81
• Permanent nursing home	0	-	-
• Permanent nursing home (Schakel)	7	23,43	5,58
• CRU	1	52	0
• Other	26	16,92	8,67

Table 5: Length of stay

(Source: Database Transferpunt MST, Jan-Dec 2008, Jan-Aug 2009)

The high standard deviations point out a high range of distribution. Figure 14 displays an overview of all patients applied for short term reactivation and their corresponding length of stay expressed in percentages in 2008 and 2009. Figure 14 shows a high variation in length of stay for patients, from 4 days to 76 days at hospital. The two patients with a length of stay of 4 days at the hospital in 2009 are discharged to a nursing home, but they stayed before treatment in MST already in this nursing home. The patient with a length of stay

of 5 days at the hospital in 2008 is due to the patient has died. The patient with a length of stay of 7 days at the hospital is however discharged to a nursing home with rehabilitation care.

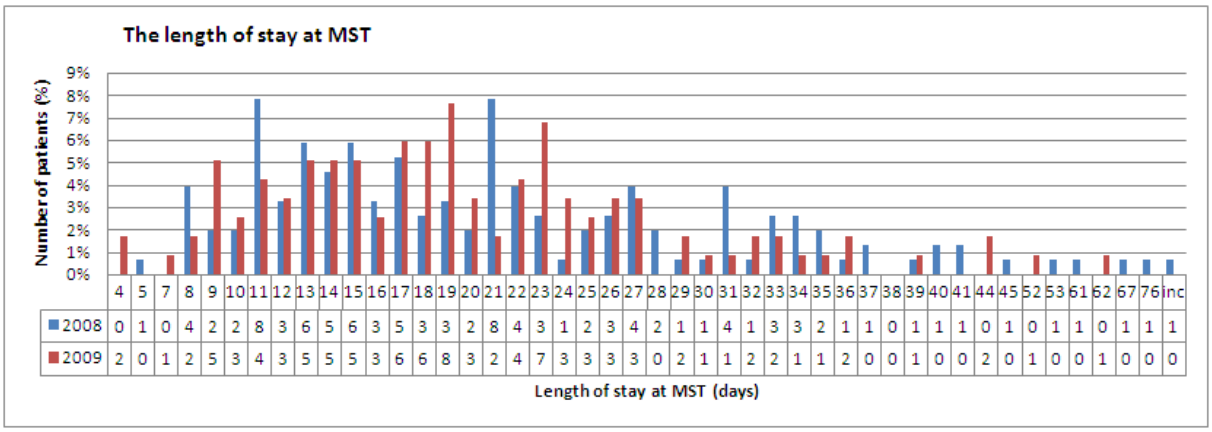


Figure 14: Length of stay at MST

(Source: Transferpunt database MST, Jan-Dec 2008, Jan-Aug 2009, N=153 (2008) N=118 (2009))

We also observe a small reduction in the length of stay in 2009 in comparison with 2008. Figure 15 displays the percentage of patients treated in the hospital regarding the length of stay. The red line of 2009 corresponds almost with the blue line of 2008, but in 2009 less outliers are occurred.

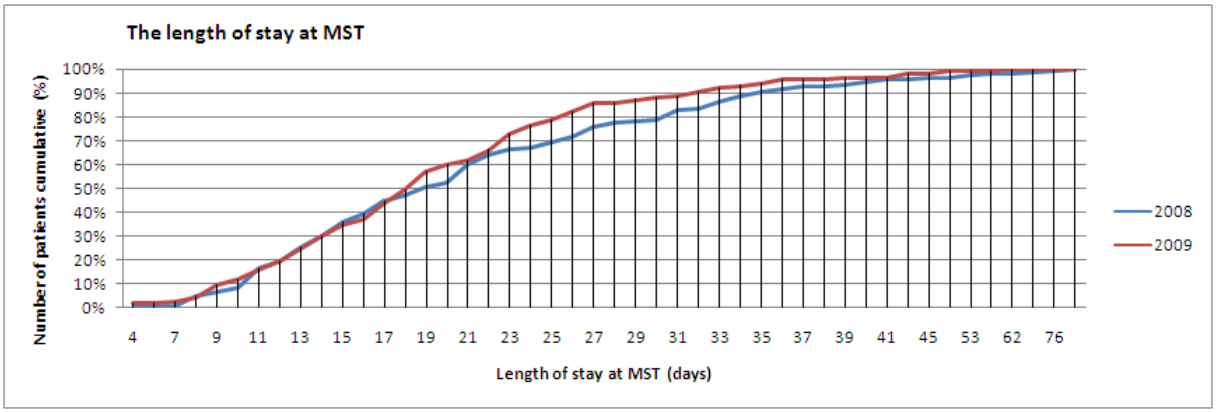


Figure 15: The percentage of patients treated in the hospital versus the length of stay

(Source: Transferpunt database MST, Jan-Dec 2008, Jan-Aug 2009, N=153 (2008) N=118 (2009))

2.6 DISCHARGE PATIENT FROM THE HOSPITAL

The previous paragraph describes the process of recovery after medical treatment at the inpatient department and the process of arranging follow-up care by *Transferpunt.* In this paragraph, we analyze the patients discharged from the hospital and which types of care they need after medical treatment at the hospital.

2.6.1 PROCESS DESCRIPTION DISCHARGE

Transferpunt contacts the specific inpatient department when there is a place available in a nursing home. This may be the first choice of the patient, but if this is not available, the second choice is hand over. The nurse at

the inpatient department arranges the three transfer forms; medical transfer, physiotherapist transfer, and inpatient department transfer form.

2.6.2 PERFORMANCE DISCHARGE

In this paragraph we give insight in the number of patients discharged to a nursing home with short term rehabilitation and other types of care.

From the 153 patients who are applied for short term rehabilitation in 2008, 115 patients (75%) actually go to a nursing home for short term rehabilitation care. The remainder 38 patients (25%) received other forms of after care. Two patients are discharge to temporary care homes, 4 patients to permanently care homes, 9 patients to permanently nursing homes, 9 patients are going home with home care, 5 patients are going home without care from an authority, 1 patient is signed off for short term rehabilitation, and 8 patients died at the hospital. In 2009, 118 patients were applied and 78 patients (66%) are discharged to a nursing home for short term rehabilitation care. The remainder 40 patients (34%) received other forms of care: 21 patients are going home and 20 of them receive home care, 3 patients are signed of, 6 patients are discharged to a care home and 5 of them are permanently, 7 patients are discharged definitely to a nursing home, and 1 patient is discharged to a nursing home with a higher need of care, and 2 patients died at the hospital.

2.7 ADMITTANCE PATIENT INTO NURSING HOME

The previous paragraph describes the discharge of patients from the hospital to follow-up care organizations. In this paragraph, we analyze the patients admitted to nursing homes with a CIZ indication for short term rehabilitation. When patients need follow-up care after treatment in the hospital, a CIZ indication is required. Hip fracture patients often obtain a CIZ indication of ZZP9. ZZP9 includes rehabilitation care for a short period of time. In most cases, 3 months is the maximum duration of the CIZ indication. Table 6 displays the 115 patients actually discharged to several nursing homes in 2008 and the 40 patients discharged in 2009. In this research, we analyze nursing homes AriënsZorgpalet location Eschpoort (AZP Eschpoort) and Zorggroep Sint Maarten location Oldenhove (ZGS Oldenhove) in further detail. While writing this research, MST deliberates with nursing home *AZP Eschpoort* for agreements about the discharge of hip fracture patients directly after medical treatment at the hospital to shorten the access time to follow-up care. Paragraph 2.10.3 and 2.10.4 describes these agreements in further detail. In this paragraph we take the points of view of MST and nursing home *AZP Eschpoort* into consideration.

Nursing homes 2008	N	Nursing homes 2009	N
AZP Bascule, Enschede	4	AZP Eschpoort, Enschede	13
AZP Eschpoort, Enschede	25	AZP Glanerbrug, Enschede	6
AZP Glanerbrug, Enschede	1	De Posten, Enschede	2
De Posten, Enschede	5	Livio Cromhoff, Enschede	23
Livio Cromhoff, Enschede	35	Livio Wiedenbroek, Haaksbergen	16
Livio Wiedenbroek, Haaksbergen	13	ZGSM Oldenhove, Losser	12
ZGSM Oldenhove, Losser	16	ZGSM Sint Josef, Weerselo	1
ZSSM Gerardus Majella, Denekamp	2	Bruggerbosch, Enschede	1
ZGSM Sint Josef, Denekamp	2	Zg. Plantein, Bolward	1
ZGSM schakel, Oldenzaal	5	Marga Klompe, Winterswijk	3
ZGSM Sint Josef, Weerselo	2	**Total**	**78**
Trivium Meulenbelt, Almelo	1		
ST Elizabeth, Delden	1		
Stichting SHDH, Haarlem	1		
Aveant Rosendael, Utrecht	1		
Zorgfederatie Oldenzaal, Oldenhove	1		
Total	**115**		

Table 6: Nursing homes 2008 and 2009

(Source: Database Transferpunt MST, Jan-Dec 2008, Jan-Aug 2009, N=115 (2008), N=78 (2009))

2.7.1 PROCESS DESCRIPTION *AZP ESCHPOORT*

Nursing home *AZP Eschpoort* has one department specially equipped for patients who need rehabilitation care for a short period with the goal of returning to their home situation. This department is divided into two sub-departments, *Singraven* and *Warmelo*. Each sub-department has 15 beds, which makes a total capacity of 30 reactivation beds. A multi-disciplinary consultation is scheduled every week to review the patients at one of the departments. Every patient is discussed every other week. Allocation of new patients is arranged by "*Clientadvies*" of *AZP Eschpoort.* They discuss with Transferpunt at MST the patients who need reactivation care and decide which patients and how many patients can be admitted at *AZP Eschpoort*. Another 10 beds for rehabilitation care are available at *AZP*, department *Glanerburg* in the future. These beds are only available for those patients who do not need multidisciplinary treatment. For example, the patient only needs physiotherapy treatments instead of multidisciplinary treatments like physiotherapy and psychology.

2.7.2 PROCESS DESCRIPTION *ZGS OLDENHOVE*

Nursing home *ZGS Oldenhove* also has one department specially equipped for patients who need rehabilitation care for a short period with the goal of returning to their home situation. In this department 22 beds are available. ZGS Oldenhove can also use another 6 beds for busy periods, so that makes a total capacity of 28 beds for rehabilitation care. Agreements regarding planned/elective patients with a new hip or knee, for a

quick recovery after surgery are arranged between MST and *ZGS Oldenhove*. These patients have priority over other patients for available beds. The agreement includes the admittance of two or three patients per month, but in practice more patients are admitted. A multi-disciplinary consultation is scheduled every week to review part of the patients. All patients are discussed atleast every three weeks. Most of the time, every patient is discussed every other weeks. Allocation of new patients is arranged by "*Maatschappelijk werk*" of *ZGS Oldenhove*. They organize the admittance of new patients. She analyzes the occupancy rate and discusses it internally. All recorded patients at *ZGS Oldenhove* are visited in MST by "*Maatschappelijk werk"* to obtain a better overview of the situation of a patient. So, the capacity can be better predicted.

2.7.3 PERFORMANCE

In this paragraph we analyze all patients discharged to nursing homes to get insight in the number of patients admitted to which of the nursing homes. While writing this research, MST enters into negotiation with nursing home *AZP Eschpoort* to make agreements about the discharge of hip fracture patients to decrease the access time to follow-up care. Nursing home *AZP Eschpoort* would like to admit most of the hip fracture patients treated at MST, who need short term rehabilitation. In this paragraph we analyze the possibilities for *AZP Eschpoort* to admit all hip fracture patients. As stated previously, of the 115 patients discharged to nursing homes for rehabilitation, 25 patients (22%) are admitted to nursing home *AZP Eschpoort* in 2008. Of the 78 patients discharged in 2009 to nursing homes for rehabilitation, 13 patients (17%) are admitted to nursing home *AZP Eschpoort*. Figure 16 displays the number of patients discharged from MST to the various nursing homes per month. We expect to see a high amount of patients discharged to *AZP Eschpoort*, because of their intentions to admit all hip fracture patients discharged from MST. Nursing home *AZP Eschpoort* is the second largest follow-up care organization with 38 patients admitted in the period of January 2008 to August 2009. Nursing home *Livio Cromhoff* is the organization with the most patients discharged from MST, 58 hip fracture patients are admitted, and ZGS Oldenhove is the fourth largest follow-up care organization with 28 patients admitted. Striking is December 2008 when only one patient is discharged to a follow-up care organization.

Nursing home *AZP Eschpoort* has not admitted patients in every month. We wonder if nursing home *AZP Eschpoort* has the capacity to treat all patients discharged from MST. Because of this doubt, we analyze the number of patients discharged to the various nursing homes per week to get a more detailed view over the present situation. Figure 17 displays the number of patients discharged to the various nursing homes per week. To get a better overview nursing home *AZP Eschpoort* is compared with all other nursing homes. The detailed overview of all nursing homes by itself is set out in appendix 1. In the weeks when patients are discharged to a nursing home, nursing home *AZP Eschpoort* has admitted patients in only 16 of these weeks (38%) in 2008 and 13 of these weeks (39%) in 2009. Further, nursing home *AZP Eschpoort* has a minimum of 0 or 1 patients and a maximum of 3 patients per week. The maximum of patients discharged per week from MST to follow-up care organizations is 7.

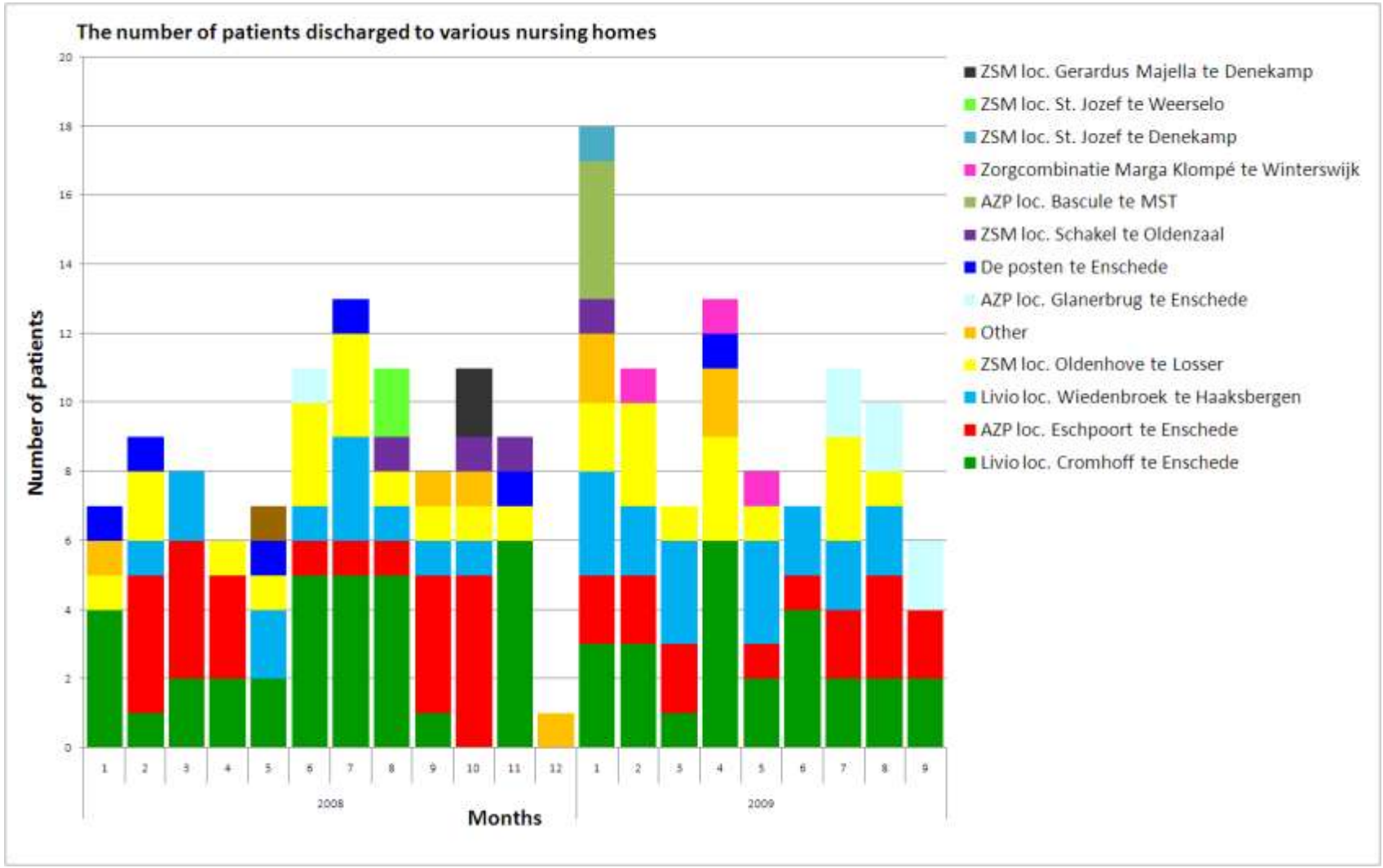


Figure 16: The number of patients discharged to various nursing homes.

Source: Transferpunt database MST, and database *AZP Eschpoort*, Jan-Dec 2008, Jan-Aug 2009, N=115 (2008), N=78(2009)

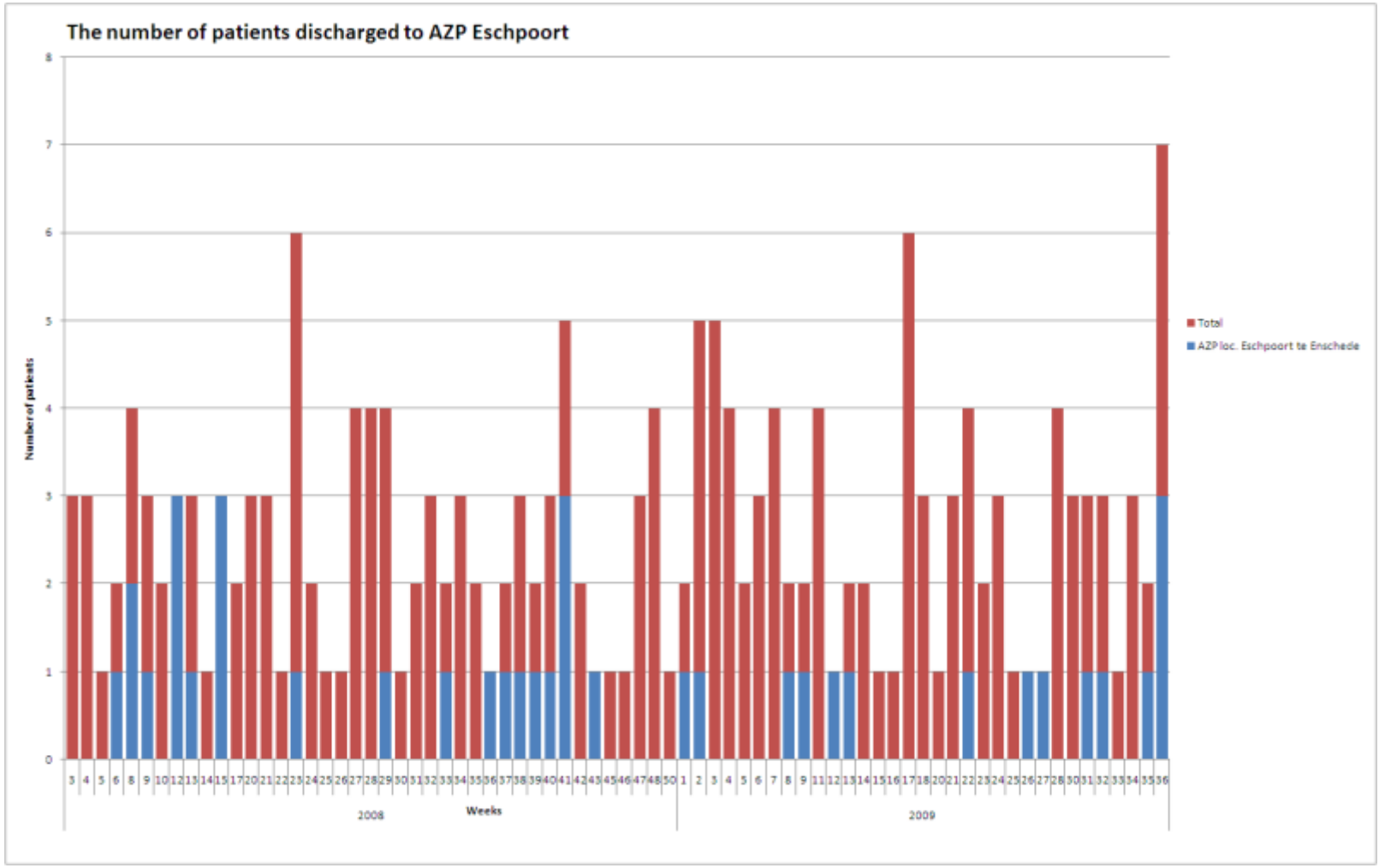


Figure 17: The number of patients discharged to AZP Eschpoort.

Source: Transferpunt database MST, and database *AZP Eschpoort*, Jan-Dec 2008, Jan-Aug 2009, N=115 (2008), N=78(2009)

(In the missing weeks no patients are discharged from MST to follow-up care organizations)

2.8 REHABILITATION PATIENT

The previous paragraph describes the admittance of patients into the nursing homes. In this paragraph we analyze the rehabilitation of patients in these nursing homes.

2.8.1 PROCESS DESCRIPTION *AZP ESCHPOORT* AND *ZGS OLDENHOVE*

In general, hip fracture patients obtain a ZZP9 indication of CIZ to reactivate in a nursing home for a maximum of 3 months. The goal is to reactivate the patients in these 3 months with the goal of returning to their home situation. Because every patient is unique and has different needs, reactivation is adjusted to their personal needs and possibilities. A multidisciplinary team is available with medical and paramedical physicians.

2.8.2 PERFORMANCE AZP ESCHPOORT AND ZGS OLDENHOVE

In this paragraph we analyze the rehabilitation of patients in the nursing homes *AZP Eschpoort* and *ZGS Oldenhove*. As stated in the previous paragraph, 25 patients were admitted in *AZP Eschpoort* in 2008, and 13 patients in 2009. 16 patients were admitted in *ZGS Oldenhove* in 2008 and 12 patients in 2009.

Figure 18 displays the duration of rehabilitation for the 38 patients treated in *AZP Eschpoort* in 2008 and 2009. Figure 19 displays the same for *ZGS Oldenhove*. As stated previously, a ZZP9 indication of CIZ is obtained for a period of 3 months. The average rehabilitation time in *AZP Eschpoort* for those 36 patients is 68 days, and for *ZGS Oldenhove* 101 days. However, patients treated at *AZP Eschpoort* are discharged earlier to other types of care than patients treated at *ZGS Oldenhove*.

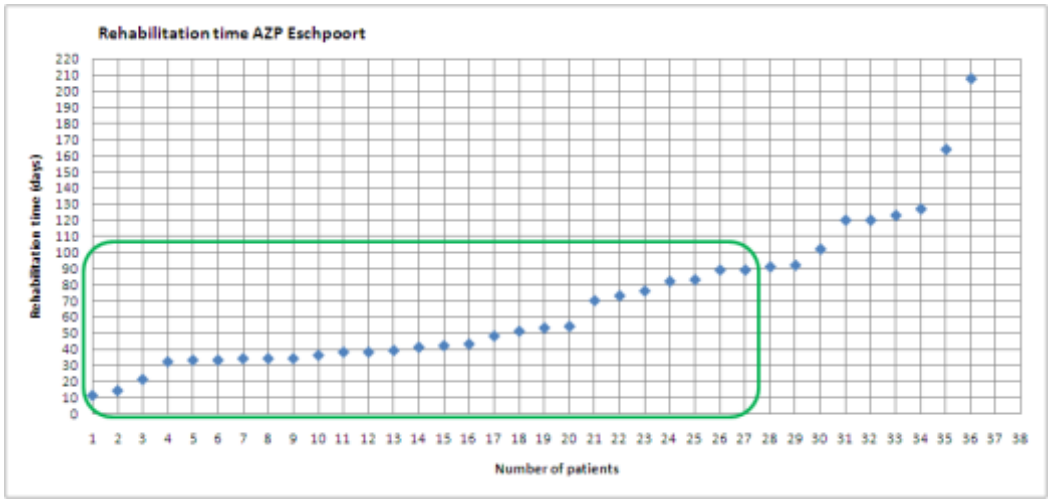


Figure 18: Rehabilitation time at nursing home AZP Eschpoort

(Source: Database AZP Eschpoort, Jan-Dec 2008, Jan-Aug 2009, N=38 (2008+2009))

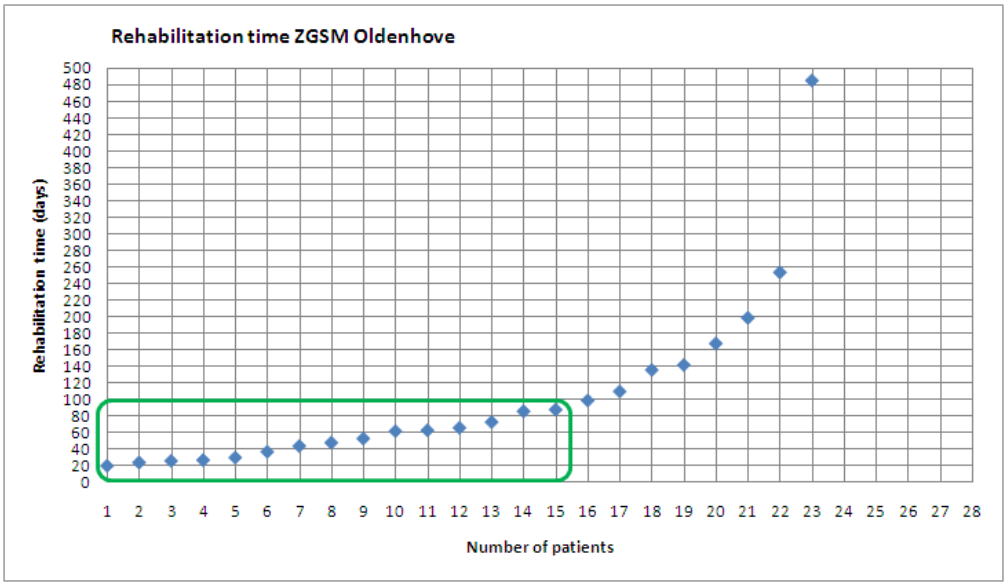


Figure 19: Rehabilitation time at nursing home ZGS Oldenhove

(Source: Database ZGS Oldenhove, Jan-Dec 2008, Jan-Aug 2009, N=26 (2008+2009))

2.9 DISCHARGE PATIENT FROM NURSING HOME

The previous paragraph describes the rehabilitation in a nursing home. In this paragraph we analyze the discharge of patients after rehabilitation.

2.9.1 PROCESS DESCRIPTION *AZP ESCHPOORT* AND *ZGS OLDENHOVE*

The hip fracture patients are multidisciplinary treated in the nursing homes with short term rehabilitation care. This multidisciplinary team decides in cooperation with the medical doctor if the patient needs no rehabilitation anymore or need another type of care. If the CIZ indication is too short, a new CIZ indication is requested for duration of three or six months.

2.9.2 PERFORMANCE AZP ESCHPOORT AND ZGS OLDENHOVE

Patients are treated at MST and rehabilitate in various nursing homes. Short term rehabilitation has the purpose of returning the patient to their home situation. Figure 20 and 21 display the type of discharge for patients treated at nursing home *AZP Eschpoort* and *ZGS Oldenhove*. Of the 38 patients treated at *AZP Eschpoort* in January 2008 to August 2009, 17 patients (45%) return to home to their home situation. Of the 28 patients treated at *ZGS Oldenhove* in January 2008 to August 2009, 18 patients (64%) return to their home situation.

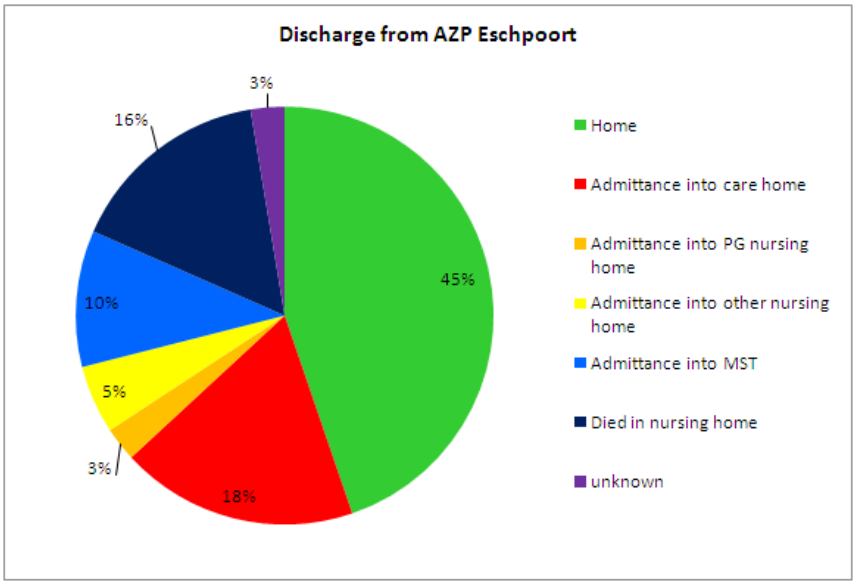


Figure 20: The discharge possibilities from AZP Eschpoort

(Source: Database AZP Eschpoort, Jan-Dec 2008, Jan-Aug 2009, N=38 (2008+2009))

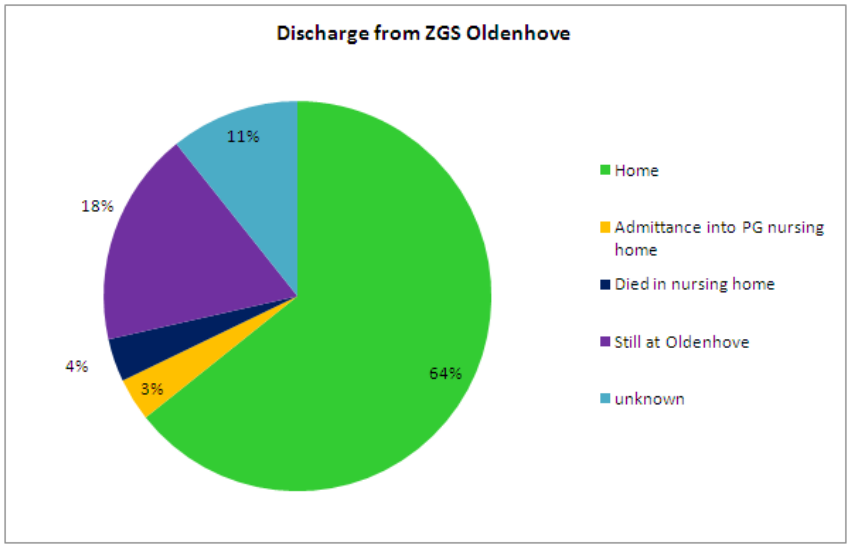


Figure 21: Discharge possibilities from ZGS Oldenhove

(Source: Database ZGS Oldenhove Jan-Dec 2008, Jan-Aug 2009, N=28 (2008+2009))

2.10 DESIRED SITUATION

Within MST, no protocol is available to structure the process that hip fracture patients experience yet. A patient deals with different departments, different disciplines, and different employees. Each department or discipline has its own protocols and rules. MST is developing a clinical pathway to reduce these problems in the future. A clinical path way is an instrument to organize a multi-disciplinary care process with a central focus on the patient (MST, 2004)

2.10.1 PROCESS DESCRIPTION CLINICAL PATHWAY MST

MST started with the development of a clinical pathway for all acute hip fracture patients in the beginning of 2009. It has a multi-functional character where the patient is central in the whole process. The logistics of the process are tuned in to the patient. The clinical pathway is divided into 8 phases; admittance at emergency department, admittance at inpatient department, day of operation, first day post-operative, second day post-operative, third day post-operative, fourth day post-operative, and day of discharge.

Admittance at emergency department is the first contact with the patient. The patient enters the emergency department of the hospital by an ambulance. The nurse takes over the patients and starts with an anamneses and observation of the patient. The nurse also accomplishes a number of measurements about the diagnostic findings of the patient. The doctor assistant contacts the medical doctor to deliberate about an operation. Besides, the nurse informs the patient and the family about medical tests and admittance at the hospital. The medical doctor informs the patient and family about the results of the measurements from the diagnostic findings of the patient at the emergency department, treatment, risks, and the importance of fast mobilization after treatment. This results in a treatment agreement between patient and medical doctor.

Admittance into the inpatient department is done on the same day as admittance at emergency department. The nurse at the inpatient department takes complementary anamneses and checks vital functions like blood, temperature, weight, and applies medicines. The nurse practitioner, doctor assistant or medical doctor checks the blood clump. The nurse informs the patient and family about the operation, admittance duration, and discharge possibilities. The patient gets a brochure about admittance as a result of a hip fracture. The nurse applied the patient at Transferpunt provided that discharge to the home environment within 5 days after surgery is not possible. And the nurse prepares the patient for the operation.

Within 24 hour after admittance the patient will be operated. After operation starts the post-operative trajectory.

At the first day after surgery the patient starts with physiotherapy. The nurse informs the patient that quick mobilization is in the patients' interest and discusses the temporary day of discharge. This temporary date is written on the whiteboard at the inpatient department. On the second day after surgery the nurse checks the discharge trajectory. The patient learns with the help of the physiotherapist to walk again. On the third day after surgery the patient perform with the help of the physiotherapist the general daily vital functions. On the fourth day after surgery the nurse holds a discharge conversation with the patient. The nursing transfer form, medical transfer form, and physiotherapy transfer form are filled in by the nurse, medical specialist, and physiotherapist. The patient is able to walk under supervision of the physiotherapist and rise with the help of the nurse. The day of discharge is the last day at the hospital. The nurse checks the condition of the patient for the last time. If a patient has no fever, injury is stable, and if the patient independent mobilizes, the patient is discharged from hospital.

2.10.2 PERFORMANCE INDICATORS CLINICAL PATHWAY MST

Performance indicators are measurable variables comparable with previously provided norms to determine in what extent a certain objective is attained. In addition performance indicators create a foundation for realization, working method, and pointing out early bottlenecks (MST, 2009).

We divide the performance indicators in this research into two parts: process related indicators and patient related indicators.

Process performance indicators:

1. The patient is within 1.5 hours after contact with a medical doctor at the emergency department admitted at the inpatient department.
2. The patient is applied by *Transferpunt o*n the first day at inpatient department*,* if discharge to their home situation within 5 days after surgery is not possible.
3. The patient is operated within 1 calendar day (ASA 1,2).
4. The nurse at the inpatient department writes down the day of discharge on the whiteboards on the first day post-operative
5. The nurse at the inpatient department checks the discharge trajectory on the second day post-operative.
6. The nurse at the inpatient department writes the *Transfer* forms are on the fourth day post-operative

Patient performance indicators:

1. The nurse at the emergency department and the medical doctor informs the patient and family about diagnose, treatment, and risks. The patient agrees with the proposed treatment.
2. The nurse at the inpatient department informs the patient and family about surgery and discharge possibilities.
3. The nurse at the inpatient department hands over an Information brochure to the patient and family.
4. The medical doctor informs patient and family about surgery.
5. The nurse at the inpatient department informs the patient and family about discharge data and trajectory on the first day post-operative.
6. The patient starts with chair mobilization and ADL on the first day post-operative
7. The patient starts with walking around with an expedient on the second day post-operative
8. The patient accomplishes ADL activities by supervision on the third day post-operative
9. The patient rises with some help out of bed and walks by supervision on the fourth day post-operative
10. The nurse at the inpatient department holds a discharge conversation with the patient and family on fourth day post-operative.
11. The patient mobilizes independent on the day of discharge

During this research project, MST is developing an integrated care pathway for hip fracture patients. This care pathway is specialized on the medical treatment in MST and the follow-up care in nursing home *AZP Eschpoort*. We describe in paragraph 2.10.3 the integrated care pathway developed until now.

2.10.3 PROCESS DESCRIPTION INTEGRATED CARE PATHWAY MST AND *AZP ESCHPOORT*

Within the integrated care pathway MST cooperates with nursing home AZP Eschpoort. With this nursing home MST made agreements about available beds for hip fracture patients. The patient may always apply for a follow-up care organization of their preference, but the principle of first choice second best is MST policy.

Hip fracture patients are admitted into the hospital and are operated within 24 hour. From admittance patient and his family are informed about the consequences of the integrated care pathway for the patient. When patients need short term rehabilitation after medical treatment in the hospital, the first day after surgery the patient is applied by Transferpunt. If the first day after surgery is in the weekend, the patient will be applied Monday morning before 10 o'clock am. Transferpunt applies the patient at AZP Eschpoort also the first day after surgery. The second day after surgery Transferpunt requests for a CIZ indication. In case of a SIP indication, the indication is send to AZP Eschpoort by e-mail. The fifth day after surgery, the patient is discharged to the follow-up care organization. On this day, the information transfer is arranged: medical transfer, nursing transfer, physiotherapeutic transfer, and medicine transfer. A covenant is concluded between MST and AZP Eschpoort.

2.11 CONCLUSION

In this chapter we described the process which a hip fracture patient live through during the stay in the hospital and in a nursing home to rehabilitate after medical treatment in the hospital. Further, we analyzed the performance of this process. Table 7 and table 8 summarize the amount of patient in the different phases of the integrated care process for hip fracture patients in 2008 and 2009.

2008 (jan-dec)	Arrival	Admittance	Surgery	Registration SR	Discharge SR
Surgery	213 (64%)	171 (60%)	151 (59%)	-	-
Orthopaedic	122 (36%)	116 (40%)	103 (41%)	-	-
Total	335 (100%)	287 (100%)	254 (100%)	153 (100%)	115 (100%)

Table 7: The number of patients in the different phases of the integrated care process for hip fracture patients in 2008

(Source: X-care MST, Database Transferpunt, Jan-Dec 2008

2009 (jan-aug)	Arrival	Admittance	Surgery	Registration SR	Discharge SR
Surgery	165 (64%)	138 (60%)	133 (68%)	-	-
Orthopaedic	74 (31%)	70 (34%)	63 (41%)	-	-
Total	239 (100%)	208 (100%)	196 (100%)	118 (100%)	78 (100%)

Table 8: The number of patients in the different phases of the integrated care process for hip fracture patients in 2009

(Source: X-care MST, Database Transferpunt, Jan-Aug 2009

- The number of hip fracture patients arrived per month at MST varies highly.
- No high increase of arrived hip fracture patients into the hospital is fulfilled from the data.
- Almost all arriving hip fracture patients are admitted at MST.
- Different treatment possibilities exist as a result of the two specialisms: Surgery and Orthopaedic. The treatment is dependent on the type of the fracture, the skills, and the preferences of the medical doctor.
- The duration of registration for follow-up care at Transferpunt takes too long.
- There exist no univocal use of the end date of medical treatment among specialists and the temporary and definitive date of medical treatment is used mixed up.
- The duration of medical treatment is high dependent on the prevention of complications.
- Not every hip fracture patient applied for short term rehabilitation is actually discharged to that type of follow-up care.
- Hip fracture patients are discharged to many different nursing homes. Nursing home AZP Eschpoort is negotiating with MST for agreements about the discharge of those patients.
- The time of rehabilitation varies highly between individual patients from 11 days up to 485 days.
- After rehabilitation patients are discharged to their former home situation, but also other types of care are required.
- Improvements can be made regarding to the data facility, the transfer of information between the inpatient department and Transferpunt, and between MST and the nursing homes.

At least, MST is developing a clinical and integrated care pathway to reduce the above stated problems. MST is collaborating with *AZP Eschpoort* in Enschede to strengthen the link between the medical process in the hospital and the follow-up care process in the nursing home.

3 MODEL DEVELOPMENT

In this chapter, we provide a theoretical framework to divide and categorize problems related to the delayed patient flows between the hospital and follow-up care organizations on different management levels. Figure 22 displays the structure of this chapter. Paragraph 3.1 starts with a short literature review on supply chain management to get insight in the operation of these types of chains. Paragraph 3.2 describes supply chain management in a service context. Paragraph 3.3 applies the previous paragraph to a health care setting. Supply chain management is dependent on the collaboration between organizations. Paragraph 3.4 describes network relationships in combination to different management levels. Paragraph 3.5 analyzes the network relationships in the situation of MST. There exist different kinds of network relationships and paragraph 3.6 discusses one network relationship: integrated care. With the use of the literature in the previous paragraph in paragraph 3.7 we develop a framework for management planning and control in an integrated care setting.

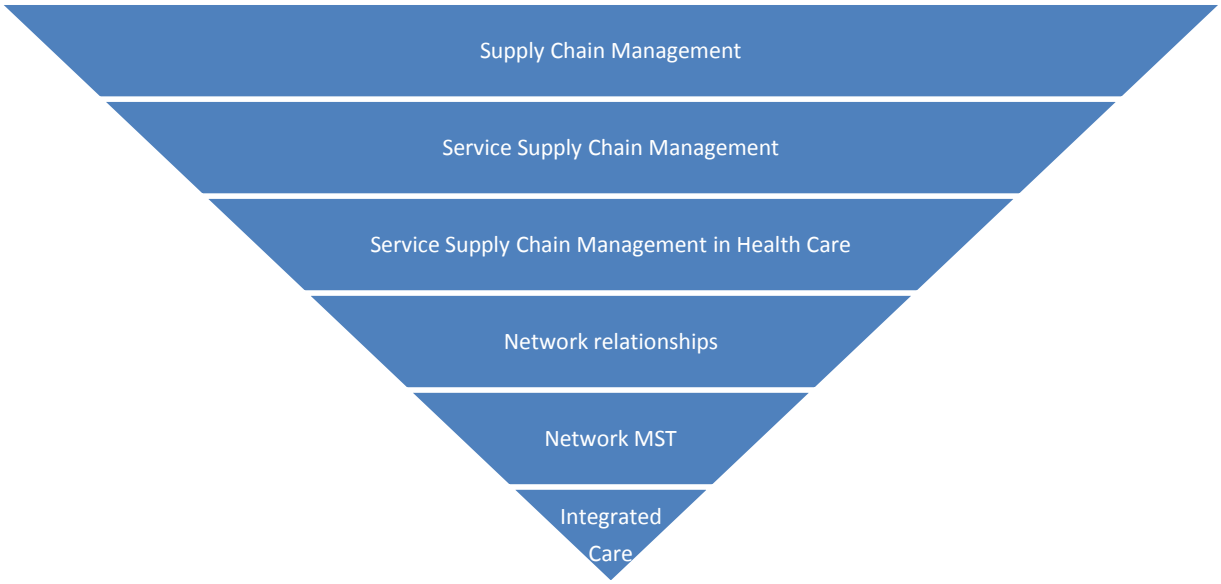


Figure 22: Structure of Chapter 3

3.1 SUPPLY CHAIN MANAGEMENT

Supply chain management (SCM) refers to the management of information, processes, goods, and funds from the earliest supplier to the final customer, including disposal (Ellram, et al., 2004). Stadler and Kilger (2004) introduced *the house of SCM*. Figure 23 displays this framework of Stadler and Kilger.

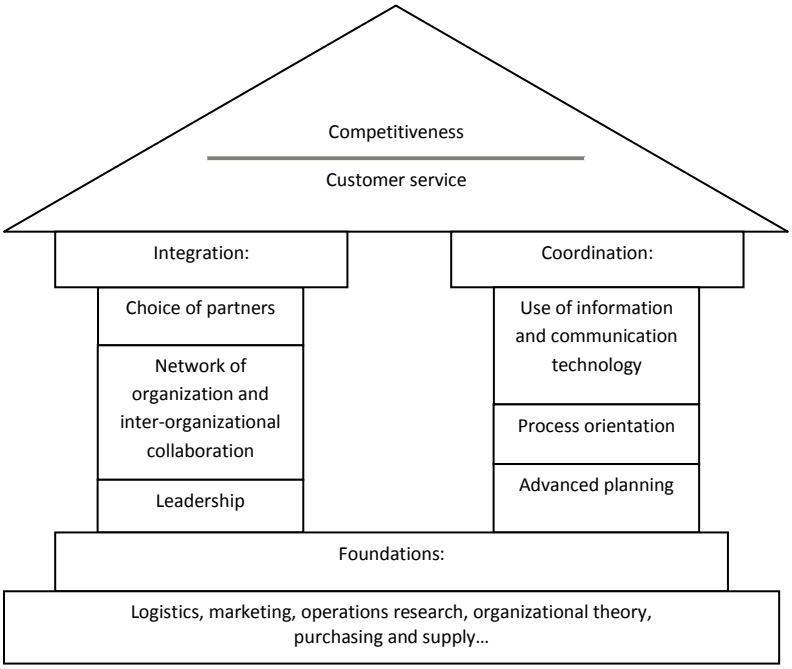


Figure 23: Framework of Stadler and Kilger (2004): House of Supply Chain Management

The top of the building displays the ultimate goal, *competiveness* which is obtained by means of *customer service*. The top of the building rests on two pillars, representing the main components of SCM: *integration* and *coordination*. Integration is necessary for the network of organizations and coordination addresses information, material, and financial flows.

Integration includes the choice of partners, network organizations and inter-organizational collaboration, and leadership. *The choice of partners* starts by analyzing the activities associated with the production of a product or service. In an integrated care setting, the care pathway of patients crosses the hospital boundaries. As a result, hospitals have to choose partners for follow-up care outside the hospital. *Inter-organizational collaboration* is necessary for an effective supply chain. Organizations try to combine the possibilities of the other firms. Information and know-how is shared between the members. There always exists a chance that the collaboration is cancelled however. As long as a win-win situation exists for all members, the supply chain will remain stable. Furthermore, *leadership* is an important issue by integration in a supply chain. Related to integrated care within hospitals and follow-up care organizations, there must be equal leadership, because the ultimate goal is to serve the patients best. The main goal for both organizations is not to create a highly profitable organization, but to set the needs of the patient central.

Coordination thereby, consists of the utilization of information and communication technology, process orientation, and advanced planning. *Information and communication* are highly important in a supply chain. Information technology made it possible to process information at different locations in the supply chain and thus enables advanced planning. Information can be stored and used for process analysis. Communication can be electronic to arrange a fast and standard communication facility. *Process orientation* aims at coordinating all the activities involved in customer order fulfillment in the most efficient way. The existing supply chain can be analyzed and problems and bottlenecks can be revealed. *Advanced planning* incorporates long-term, mid-term and short-term planning levels.

3.2 SERVICE SUPPLY CHAIN MANAGEMENT

In the previous paragraph supply chain management is discussed from a manufacturing point of view, because the existing frameworks for SCM are mainly focused on manufacturing organizations. However, service organizations have so many differences with manufacturing that a specific SCM tool for the service sector is needed. In this paragraph, we discuss supply chain management in a service context.

One of the important differences with manufacturing organizations is the human element in the total value delivered, which makes management and control difficult. Another factor is the high diversity among services and the lack of uniformity in reporting services. Manufacturing supply chains have the common link of managing the physical flow of goods. Service organizations do not have this link. Ellram, et al. (2004) modified the SCM definition for professional service organizations as *the management of information, processes, capacity, service performance, and funds from the earliest supplier to the ultimate customer*. Capacity replaces the place of goods in the manufacturing definition and refers to the level of production to respond to customer demand. Service performance refers to an effective supply chain management to make sure that the customer gets what the service organization is contracted for.

Based on the above definition various processes need to be managed: information flows, capacity and skills, demand, customer relationship, supplier relationship, service delivery, and cash flows. The management of these processes is highly important. Figure 24 displays the framework of the service supply chain model (Ellram, et al., 2004).

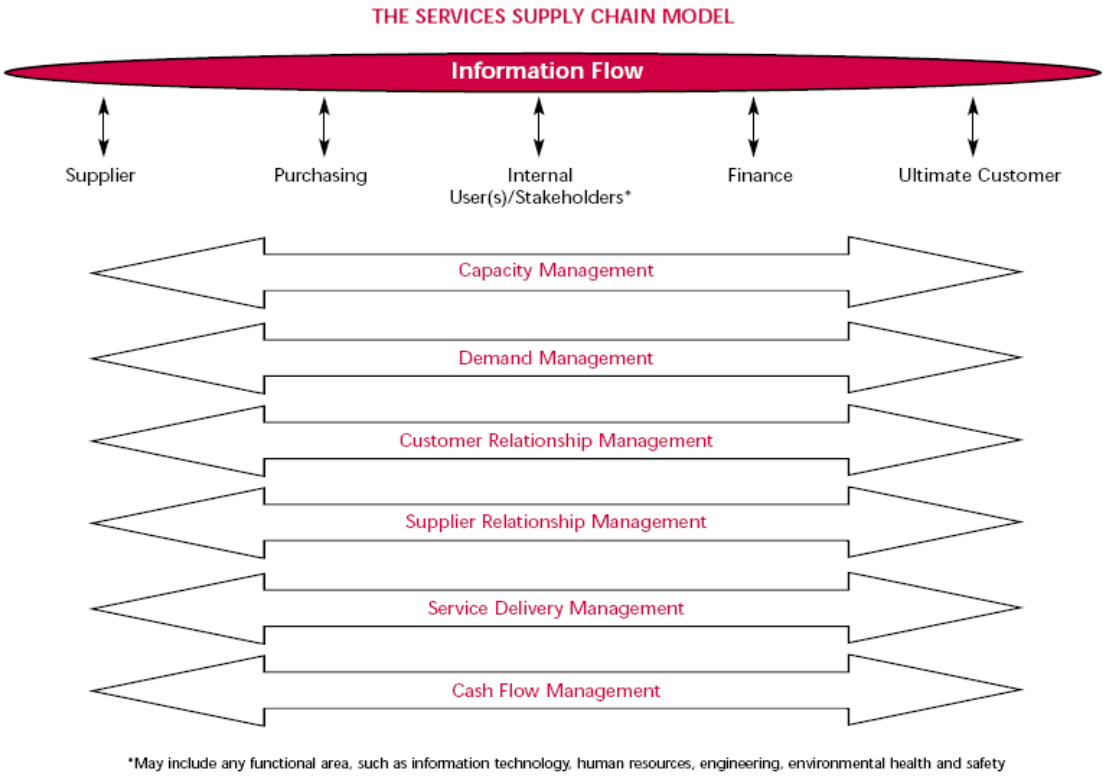


Figure 24: Framework of Ellram et al. (2004): The services supply chain model

Information management is the foundation of an effective supply chain. It is important in terms of identifying demand, sharing information, establishing expectations, defining the scope and the skills of the work, monitoring performance, and determining payment requirements. Effective information management reduces the uncertainty in a supply chain (Lee & Billington, 1995). *Capacity management* refers to the availability and quality of staff in the service organization. Labor is the element an organization can differentiate themselves (Bitner, 1995). *Demand management* focuses on managing the impact of demand variation. Due to the inability of an inventory less flexibility is available to deal with changing demands. Therefore, a service organization must understand its own capacity and productivity (Lee & Billington, 1995). *Customer relationship management* (CRM) focuses on the needs of the customer and meeting these needs (Bitner, 1995). Trust and communication are important factors, because CRM is the mirror image of the process of service delivery management for the customer (Ellram, et al., 2004). *Supplier relationship management* ensures that contractual demands and service level agreements are met. This decreases uncertainty. After identifying the needs, suppliers are selected and contracts and service agreements are established. *Service delivery management* entails making promises to the customer and meeting those promises. It includes monitoring the process of supplier relationship management (Bitner, 1995). Finally, *cash flow management* entails the management of flow of funds between parties in the supply chain (Ellram, et al., 2004). Overall, the customer is a major source of uncertainty. Customers have impact on information flows, capacity, demand, and needs. However, the customer is also the central focus of the supply chain.

Baltacioglu et al. (2007) developed a new framework (IUE-SSC model) for service supply chains, which is built on existing knowledge derived from Ellram et al. (2004) and others. Figure 25 displays the framework of Baltacioglu et al. (2007).

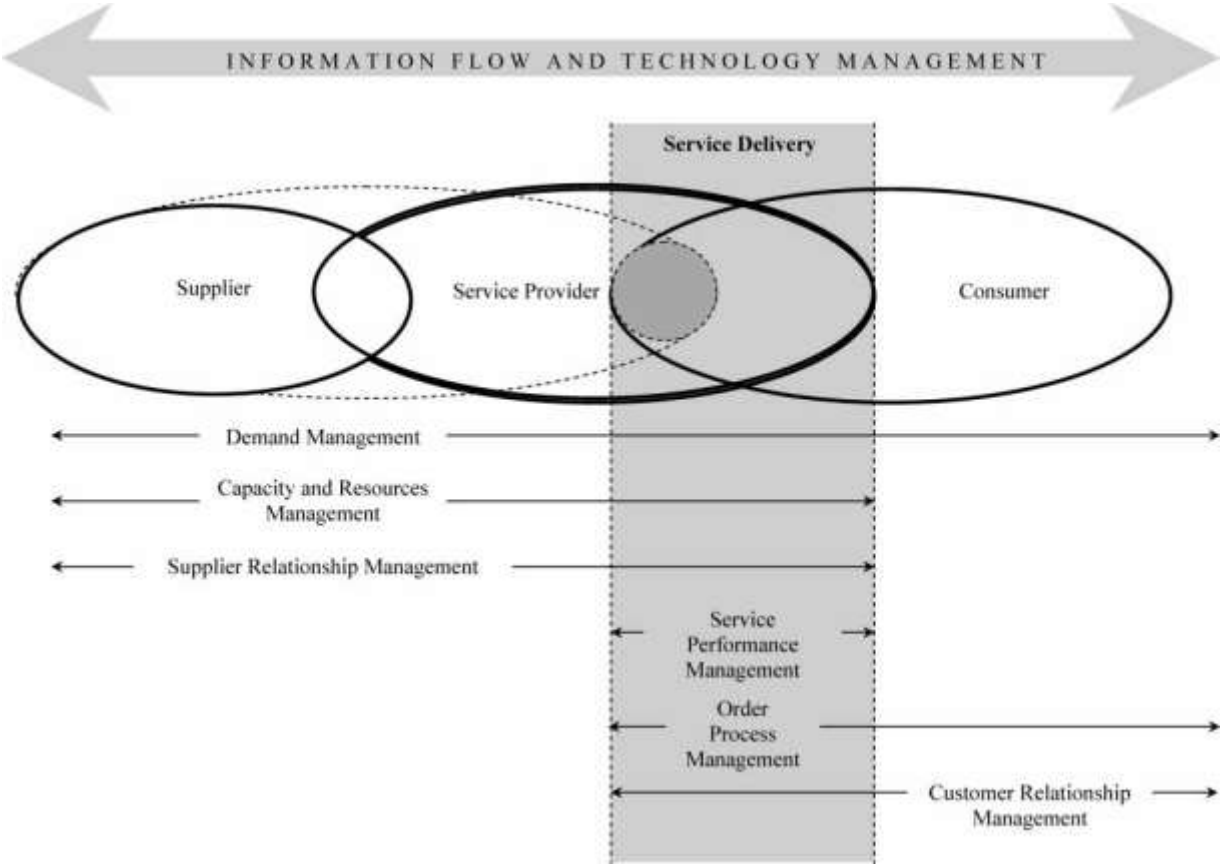


Figure 25: Framework of Baltacioglu et al. (2007): Service supply chains

Ellram et al. (2004) present a professional service supply chain management definition, but a definition of a service supply chain is missing. Baltacioglu et al. (2007) propose that the service supply chain *is the network of suppliers, service providers, consumers and other supporting units that perform the functions of transactions of resources required to produce services, transformation of these resources into supporting and core services, and the delivery of these services to customers*.

Baltacioglu et al. (2007) define three basic units in the chain: the service provider, the supplier, and the customer. The *service provider* is the central company in the supply chain. The *supplier* is the company which supplies additional services to the service provider and/or directly to the service providers' customer where these additional services contribute directly to the production of the core service in the chain. The *customer* is the end user. The customer and the service provider are presented at the same time. They are both involved in the production process due to the simultaneity of services. Just like Ellram et al. (2004), Baltacioglu et al. (2007) provide some managerial activities that are essential to service supply chain management. They add the process of *order management*, which includes the system an organization has for getting orders from customers, checking on the status or orders and communicating to customer about them, and actually filling

the order and making it available to the customer (Lambert, et al., 1998). Some of the managerial activities exist through the whole chain, while others may only be fulfilled in certain phases. *Demand management* is the preliminary function of supply chain management. However it includes the whole process from supplier till consumer. Because it not only contains forecasting of demand, but also generating forecasts, managing forecasts, reconciling new information, and keep forecasts up to date by analyzing new customer data. *Capacity and resources management* starts at the beginning of the supply chain and ends after the service delivery. The same is for *supplier relationship management*. Until the point of service delivery demand and capacity fluctuates, thus this influences capacity management and supplier relationship management. *Service performance management* is the key function in the supply chain. It only contains the service delivery phase, because performance or service production and consumption occurs simultaneously. Human resources are of high importance, because of the extensive involvement of the human factor. *Order process management* and *customer relationship management* starts with the service delivery phase where contact with service provider as well as the consumer is and ends after the consumer phase. These managerial activities are dependent on an effective flow of information. Information systems benefit from advances in technology.

3.3 SERVICE SUPPLY CHAIN MANAGEMENT IN HEALTH CARE

The previous paragraph discusses the supply chain management in a service context. The health care industry is a specialized domain, so in this paragraph we narrow our focus to service supply chain management in health care.

Baltacioglu et al. (2007) applied their framework to the health care industry. *Demand management* includes controlling patient demand and managing patient flows. Hospital can use data analysis to discover patterns. *Capacity and resources management* are closely connected to demand management, because capacity can be planned using demand forecasts. *Customer relationship management* practices are relative new in health care. It includes obtaining information about patient needs and satisfaction. *Communication and information management* are of high importance for the management of the internal process as well as for meeting the needs of the patient. *Supplier relationship management* is also a vital function of the chain. Suppliers may directly contribute to the service delivery and usually come into contact with patients. *Order process management* is responsible for translating patient requirements into actual orders and they fulfill the whole process of admittance of a patient till discharge. Finally, *service performance management* is about the core delivery to the patient. The other activities are the basis for success in this core activity.

Cohen et al. (2006) compare two chains: the manufacturing supply chain and the after services supply chain with the use of some parameters. To get insight in the health care supply chain, we analyze the health care supply chain in comparison with the two other chains and add some more parameters to get a more detailed view of the health care supply chain. Table 9 displays the three chains compared. The health care supply chain distinguishes itself by an unpredictable demand, the need of patients. The care/cure of these patients cannot always be scheduled and not be stocked and is always different, because of the unique situation of every

patient. The service delivery of a patient is of human nature, and patient contact is due to the simultaneity of the service. The quality of the service is patient dependent. Performance indicators are for example equity, safety, patients' preferences, low waiting lists and length of stays, response time, and profit. Information management is of high importance, but is most of the time complex by nature due to the many different parties and database systems involved.

Parameter	Manufacturing supply chain	After-sales supply chain	Health care supply chain
Nature of demand	Predictable, can be forecast	Always unpredictable, sporadic	Broad range predictable (elective patients) to unpredictable (urgent patients), about *need* not *want* (demand cannot be refused)
Required response	Standard, can be scheduled	As soon as possible	Elective patients: can be scheduled, urgent patients: as soon as possible, fair / equitable
Number of SKUs	Limited	15 to 20 times more	Product is mostly a service, cannot be stocked
Product portfolio	Largely homogeneous	Always heterogeneous	Largely homogeneous, but with much uncertainty (complications)
Delivery network	Depends on nature of product; multiple networks necessary	Single network, capable of delivering different service products	Multiple care networks
Inventory management aim	Maximize velocity of resources	Pre-position resources	Maximize availability
Reverse logistics	Does not handle	Handles return, repair, and disposal of failed components	Return visits of patients are avoided by striving to maximize quality of care
Performance metric	Fill rate	Product availability	Equity, patient preferences, quality of care, minimize access time and length of stays, safety, profit
(extent of) Information management	Relative low, standard agreements	Relative high, but standard agreements	High, local systems, complex transfer of information. Level of access often restricted, privacy important, patient approval required for information transfer
Product	Tangible	Various degrees of tangibility	Various degrees of tangibility
Quality	Measurable, pre-specified	Response time	Quality of service, access time, waiting time, patients preferences, safety
Customer contact	End of the chain (sales)	After sales	Continuously
Customer order decouple point	Production to stock		More towards Engineer to order

Chain planning	One leading manufacturing	Contact with suppliers	Not existing yet
Duration	Lead time	Repair time	Medical treatment
Error/default margin	Waste (Unsaleable)	Returning products during guarantee	No margin
Intention/goal	Making profit	High service level	High service level

Table 9: Adapted framework of Cohen et al. (2006): Three chains compared

As stated before, integration and coordination are the two main elements of (service) supply chain management. The shift in today's health care from a service oriented (the availability of services to define the kind of care that will be provided) health care system to a more patient central (the actual needs of the patient define the kind of care that will be provided) focus and personalization of care may have impact on the need of coordination. Also the integration of care is a crucial element in the patient's evaluation of the quality of care (Roberts, 1999). Further, major increases in diseases and disorders results in disabilities influencing daily activities of living. That is why a different form of care is needed. Care is not longer based on individualistic care professionals, but on multi-professional teamwork in different care organizations (Kodner & Spreeuwenberg, 2002). Furthermore, because of technological innovations increasing possibilities are available to organize specialized care outside the hospital. This implies that professionals need to cooperate with others in other settings (van der Linden, et al., 2000). Thus the provision of care should be organized around the needs of the patients, which requires specific coordinating activities between different care providers.

According to Leutz (1999), three levels of integration exist related to the degree or intensity of connections between services or organizations: linkage, co-ordination in networks, and full integration. *Integration by linkage* consists of existing organization that helps the patient through the whole system by good communication between the professionals involved. The continuity of care from service to service is important. Costs and responsibilities are not coordinated. *Integration by coordination* in networks is more structured, but the organizations operated by existing organizational systems. Coordination includes sharing clinical information in a planned manner, managing transitions between different services, assigning primary responsibilities for coordinating care, and coordinating benefits and the use of services. Points of failure are identified and structures are discussed and implemented to address these problems. At least, *full integration* consists of close cooperation between organizations with the aim to develop comprehensive care programs attuned to the needs of specific client groups. This is managed by one-to-one management with close intervention and communication and knowledge transfer between the different services.

3.4 NETWORKS

The previous paragraph explained the service supply chain in health care and discusses the managerial areas involved. Integration and coordination are the two main elements and influence the way of working. In this

research we focus on the level of integration coordination by networks, because MST is situated in this stage nowadays. In this paragraph we describe this type of collaboration.

The different financial arrangements and the fragmentation of the delivery of care in the Netherlands result in the integration of care, mainly through networks of managers and professionals from different organizations (van Wijngaarden, 2006). According to Lowndes & Skelcher (1998) a network can be defined as *more or less stable patterns of social relations between different actors who depend on each other to reach their goals without the presence of a dominant actor*. There exists also the tension of actors who want to preserve their autonomy, but at the same time they must coordinate their actions because they depend on each other to reach their goals (interdependency). A network relationship implies that coordination between actors takes place on the basis of mutual benefit, reciprocity, and trust (Lowndes & Skelcher, 1998). The difficulty according to service organizations is a high level of differentiation between organizations as well as between professionals within these organizations (S. Glouberman & H. Mintzberg, 2001).

For the integration of care, different organizational levels are involved to cooperate in networks: *strategic*, *tactical,* and *operational*. According to (van Wijngaarden, 2006) the focus towards integrated care on the strategic level is on horizontal steering. Horizontal self-steering is defined by Wijngaarden (2006) as *the collective activity of organizations in a network to stimulate and direct their cooperation towards coordination*. So, the management of a hospital must cooperate and stimulate medical doctors, nurses, and other departments to be involved in the cooperation with other care institutions to provide multi-disciplinary care for their patients. At tactical level the focus is on coordination, because procedures and structures are introduced to achieve integrated care. Coordination focuses on managing interdependencies between actors. The operational level focuses on learning. Medical professionals have their own values, practices, procedures, and methods. Learning expands insights and skills, and enables integrated care.

Strategic level

The strategic level becomes more and more important for health care organizations due to the decreasing role of the central government. The regulatory authority decreased his power and the management of health care organizations is more dependent on the willingness and ability of different actors. Horizontal self-steering is a method to coordinate the different actors in network relationships. Wijngaarden, de Bont et al. (2006b) provide instruments for collective steering based on the classification of government steering instrument of de Bruin & Heuvelhof (1991): multi-sided instruments, communicative instruments, incentives, performance indicators, and personal based instruments. *Multi-sided instruments* can be used for setting out a joint structure and direction for the future. A common vision, mission, and convent can be used. Parties are induced to be decision-minded. *Communication instruments* are mostly used for stimulating the collaboration between the organizations. The information must be consistent with the perceptions of the different parties. *Incentives* encourage the parties to reach agreements. They can jointly release funds for their integrative programs. *Performance indicators* enable that results of agreements can be discussed and where necessary adapted.

Finally, p*ersonal-based instruments* can be used to create independence. For example a chairperson steers on behalf of the various parties. A combination of these instruments can lead to more effective steering.

Tactical level

At the strategic level is steering and control of all levels required, at the tactical level the management must harmonize all different parties to create coordination. Glouberman & Mintzberg (2001) describe several coordination mechanisms: task assignment, direct supervision, standardization, and mutual adjustment. Glouberman & Mintzberg (2001) describe the coordination mechanism in a hierarchic and formal way. Wijngaarden, Scholte op Reimer, et. al., 2006) are of the opinion that coordination mechanism also can be used in a non-hierarchical (lateral) way and besides of formal forms of coordination informal forms exist. *Hierarchical coordination* is imposed by one of the actors and *lateral coordination* is based on different actors. *Formal coordination* is about official, structured agreements and *informal coordination* is more about unofficial agreements.

Task assignment refers to defining which activities are done by which actor. This can be hierarchical as well as by mutual (lateral) adjustment, and can be informal or formal. *Direct supervision* focus on the responsibility for coordinating the work of others by giving them instructions and monitoring. This form of coordination can only be hierarchical, because someone has the responsibility and control over someone else. It can be used formal or informal. *Standardization* can have different forms: standardization of the work process, of the output, and of skills and knowledge. Standardization of the work process involves defining and specifying the content of work by using procedures. Standardization of output involves agreements about the gained output in a certain period. Standardization of skills and knowledge involves that different people learn about the activities of others to know what to expect of each other. These three forms can be only formal in nature, but hierarchical or mutual (lateral) coordination can exist. At least, *mutual adjustment* refers to dependency of people from each other usually by informal communication. This definition only contains *informal coordination*, and it excludes all other forms. *Lateral adjustment* refers to both informal and formal forms of communications. In this context we use lateral adjustment (S. Glouberman & H. Mintzberg, 2001).

Operational level

Integrated care involves coordination at a tactical level which is complex because of the various professionals involved. Learning in networks can support this coordination at operational level. Learning in integrated care networks can be defined as *the capacity or processes within the network to acquire, share, and utilize knowledge as to maintain or improve performance* (Dibella, et al., 1996). Wijngaarden, de Bont et al. (2006a) set out seven enablers for learning: a shared image of what a better functioning looks like, procedures for generating information about performance, communication channels for diffusion and (collective) interpretation of information, decentralized responsibilities for implementing changes and experimentation, learning skills, incentives for innovative actions and improvements, and a learning culture. A *shared vision* gives a general direction for the future and inspires people to participate. The different parties involved will have different interpretations, because of the different consequences in the organizations. But a shared direction

will inspire people to learn. *Procedures for generating information about performance* are not just like that available, but when this is a part of the learning process, hard clinical information about outcomes and length of stays must be available as well as more informal information about the care process. *Communication channels for diffusion and interpretation of information* play a part in the learning process of integrated care. This can be through information systems, but also by informal or formal meetings to know what happens in the other organizations. In these meetings there must be *decentralized responsibilities* for implementing *changes and experimentation*. In health care organizations learning is mostly based on individual base. Learning in multidisciplinary meetings stimulates common goals. *Incentives* can be used to stimulate these forms of learning. Overall, the management can create a *learning culture*, where they emphasize the previous discussed learning enablers.

3.5 NETWORK OF MST

The previous paragraph described the type of integration: coordination of networks. In this paragraph we analyze the network of MST and the corresponding network partners.

In this research, the hospital and nursing homes are the main partners and must collaborate to decrease the access time for patients to follow-up care. A hospital is not a homogeneous organization. Referred to Glouberman & Mintzberg (2001a) a hospital consists of four worlds: community, control, cure, and care. A hospital is owned by trustees of the hospital, the *community*. These are not directly connected to the hospital. Managers, in the world of *control*, are responsible for the organization. But these managers do not accomplish any medical treatments. Medical treatments are handled by the specialists. The world of *cure* is supported by the world of *care*. Nurses and lower specialists provide basic care requirements to support the medical treatment. These different worlds have to collaborate with follow-up care institutions, which also have their own hierarchies and practices.

The main partners in this research, the hospital and nursing homes, are not the only network partners. They are dependent on the government, care insurers, “Centrum Indicatie Stelling (CIZ), care administration office, and the patient and his family. The *government* has an overall position. The Dutch health care system is a combination of public responsibility, the government, market forces, and private responsibility of hospitals and insurers for implementation with a focus on performance costs. The government delegates the responsibility of planning and financing to *care insurers* and health care providers. The financing of medical treatments is arranged by the so called diagnoses related groups (DRG). DRGs determine a fixed prices for every disease of a patient regarding the total delivered care. Care insurers and hospitals make agreements about price, volume, and the quality of the care. The Dutch Healthcare system influences the financing of medical treatments by rules such as ‘Algemene Wet Bijzondere Ziektekosten’ (AWBZ), ‘Wet Maatschappelijk Ondersteuning’ (WMO), and ‘Zorgverzekeringswet’ (Zvw). The Zvw includes that everyone is obliged to have a basic insurance in the Netherlands. This insurance entails that one insurance by the government is formulated with an acceptance duty for care insurers. For example, the Zvw compensates medicines and visits of a general practitioner. In

spite of the basic insurance, a complementary insurance is available for those who require more care. Patients who need care for a long period are considered to AWBZ-care. To receive AWBZ-care, an indication from CIZ is required. This indication entails the specification and amount of care. Some major changes were established in the AWBZ in January 2009 with the aim to improve the quality of the care and to focus on the patient. Two measures must accomplish these goals. The 'persoonsvolgende bekostiging', the money is no longer distributed among the amount of beds of an organization, but is distributed among the choice of a patient. Further, rehabilitation care is racked to the Zvw. This will be implemented in 2012[2]. When a CIZ indication is arranged, the CIZ sends this indication to the *care administration office*. The care administration office is engaged with the realization of the AWBZ. Overall, the *patient* is the central focus of the service.

3.6 INTEGRATED CARE

The previous paragraph analyzed the different network relationships for MST. The different actors must collaborate in a network to meet the multiple care demands of the patient. To meet these demands, integrated care is a solution. In this paragraph we focus directly on the subject of integrated care.

The National Council for Public Health stated a definition of transmural or integrated care that has been accepted since then: *care attuned to the needs of the patient, provided on the basis of cooperation between primary and specialized caregivers, with shared overall responsibility and the specification of delegated responsibilities* (National council for public health & National board for hospital facilities, 1995).

Types of integrated care

According to (van der Linden, et al., 2000) integrated care can be grouped into seven categories, which are related to the content of the care provided: specialized nurses, guideline development, home care technology, discharge planning, consultation by medical specialists, rehabilitation wards, and pharmaceutical transmural care. Integrated care provided by nurses is a common type. These *specialized nurses* are working in a hospital, home care institution or in another care organization. Originally this type of care was owned by the medical doctors but is transferred to the work of these trained nurses. They provide care to specific patient groups. *Guideline development* can be used to provide specialized care outside the hospital in *home care* settings. For example: the use of infusion systems for pain medication. *Discharge planning* is often transferred to specialized transfer nurses, who are responsible for organizing discharges from hospital to follow-up care institutions. Another type is the *consultation by medical doctors* to primary care providers like general practitioners. So, the collaboration between the general practitioner and the medical doctors is within the hospital. Another type is the *rehabilitation* after medical treatment in hospital. These patients are discharged from hospital to follow-up care institutions like nursing or care homes with the aim to rehabilitate and return to home or to wait for a permanent nursing home admission. This type of integrated care is the focus in this research. *Pharmaceutical*

[2] www.minvws.nl

transmural care is a type of medication prescription and delivery for post-discharge patients. For example: medication facilities at the home situation.

Integrated care strategies

Kodner & Spreeuwenberg (2002) describe five interrelating domains that influence integrated care and the corresponding strategies to overcome these barriers. The five domains are: funding, administrative, organizational, service delivery, and clinical.

First, separate *funding streams* exist in cure and care institutions, which affect the structure of integrated care. Two strategies to overcome this barrier are pooling of funds or prepaid capitation where a fixed amount is paid for each patient served per time without regard to the number or nature of services provided to each patient.

Second, different *administrative functions and structures* within the different organizations involved create complexities and communication problems. Strategies to solve this barrier are consolidation or decentralization of responsibilities or functions, inter-sectoral planning, needs assessment or allocation of the chain, and joint purchasing.

Third, different organizations results in different *organizational structures*. To integrate these organizations structures several possibilities are available: co-location of services, discharge and transfer agreements, inter-agency planning/budgeting, service contracting, jointly managed programs or services, strategic alliances or care networks, and common ownership.

Fourth, a patient-centred view results in an integrated *service delivery* from all participating organizations. Service delivery includes the training of staff, the division of tasks and responsibilities and the focus on the needs of the patient. To overcome this barrier, organizations can establish joint trainings, centralized information, referral and intake, case management, multidisciplinary teamwork, and integrated information systems.

At least, different organizations result in different *clinical opinions*. Shared understanding of patient needs, common professional language and criteria, agreements about practices, and feedback and communication are of high importance. This can be supported by standard diagnostic criteria, uniform procedures, joint care planning, shared clinical records, continuous patient monitoring, common decisions support tools and regular patient/family contact.

In conclusion, these strategies and domains are relevant at integrated care programs, but still every patient is unique.

Managing integrated care

Linker (2008) describes criteria for managing integrated care. Figure 26 shows the different elements regarding the managing of integrated care. The central focus is the ability to cooperate. There must be a reason to cooperate with another organization. Eight elements are important in chain management: *structure and*

management, strategy, steering instruments, trust, human capital, processes, pressure, information management and resources. S*tructure and direction* contains leadership, division of tasks and responsibilities, financial and supervision agreements. *Strategy* includes as stated previously common goals and interpretation of problems. To implement these goals there are several *steering instruments*: performance management, financial management, risk management, and quality management. *Trust* is important in every collaboration or interrelationship. Trust is based on knowledge and skills, willingness, and integrity. *Human capital* is the central element of a service. This includes availability of employees, recruitment and maintenance, training programs, and knowledge and information sharing. *Processes* contain a connection between the different organizations, for example transfer agreements. Finally, *information transfer* across the different actors can be used.

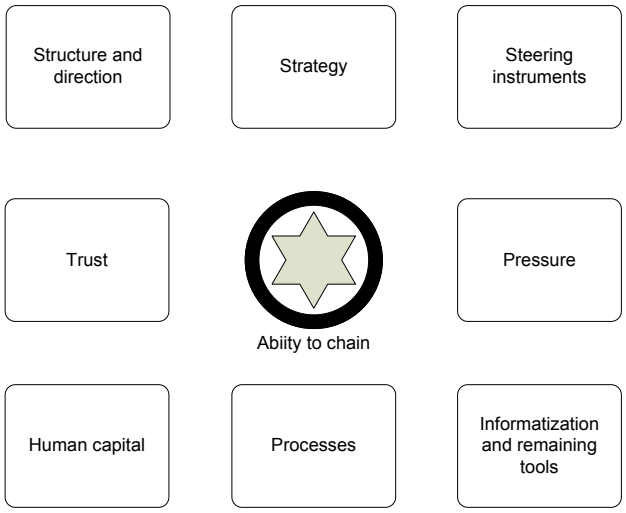


Figure 26: Framework of Linker (2008): Criteria for managing integrated care

3.7 MODEL DEVELOPMENT

In paragraphs 3.1 to 3.3 we had describe supply chain management from a broad to a more narrowed point of view. In paragraph 3.4 one level of integration is chosen: network coordination. Paragraph 3.5 specifies this type of integration to the situation of MST. To meet the needs of the patient in the whole chain integrated care is a solution and the subject of integrated care is discussed in paragraph 3.6. In this paragraph the lessons learned out of the previous are combined. We provide a framework to categorize problems in managerial areas regarding the level of control.

According to Van Houdenhoven et al. (2007) hospital planning and control address four planning areas: medical planning, resource capacity planning, material coordination, and financial planning. These areas of planning interact with different managerial levels of control: strategic, tactical, operational offline, and operational online. *Medical planning* addresses decisions about diagnoses and treatments by specialists. *Resource capacity planning* deals with decisions about the use of hospital resources like people, tools, rooms et cetera. *Material coordination* contains decisions about the distribution of materials to support the primary process. *Financial planning* addresses decisions about hospital finances. These levels of planning are combined with the four

managerial levels of control. *Strategic planning* addresses the long term objectives of the hospital. *Tactical planning* translates the strategic decisions into medium objectives. *Operational offline planning* deals with day-to-day decisions. These decisions are taken in advance. *Operational online planning* deals with unexpected day-to-day decisions. Figure 27 displays the framework of Houdenhoven et al. (2007).

Framework hospital planning and control				
	Medical planning	**Resource capacity planning**	**Material coordination**	**Financial planning**
Strategic	Research and treatment methods	Case mix planning, layout planning, capacity dimensioning	Supply chain and warehouse design	Agreements with insurance companies, investment plans
Tactical	Definition of medical protocols	Allocation of time and resources to specialties, rostering	Supplier selection, tendering	Determining and allocating budgets, annual plans
Operational offline	Diagnosis and planning of an individual treatment	Patient scheduling, workforce planning	Puchasing, determining order sizes	RNG billing
Operational online	Diagnosing emergencies and complications	Monitoring emergency coordination	Rush ordering	Billing complications

Figure 27: Framework van Houdenhove et al. (2007)

This framework is created for the planning and control of hospitals, but in the case of integrated care, the hospital has to deal with follow-up care organizations. In this research, we develop a planning and control model which also addresses three important areas for integrated care. Figure 28 displays the areas adapted within the model: demand planning, information and communication coordination, and network coordination. Kodner and Spreeuwenberg (2002) describes the meaning of integrated care as bringing together inputs, delivery, management and organization of services related to diagnosis, treatment, care, rehabilitation, and health promotion. To manage integrated care, controlling patient demand and managing patient flows is a prerequisite. Without adjustment and coordination of processes in the network it is impossible to control patient demand and manage patient flows. Demand management and network coordination are dependent on information and communication flows within the units of a single organization, but as well as between different organizations. Meeting the needs of the patient is obtained also by information and communication.

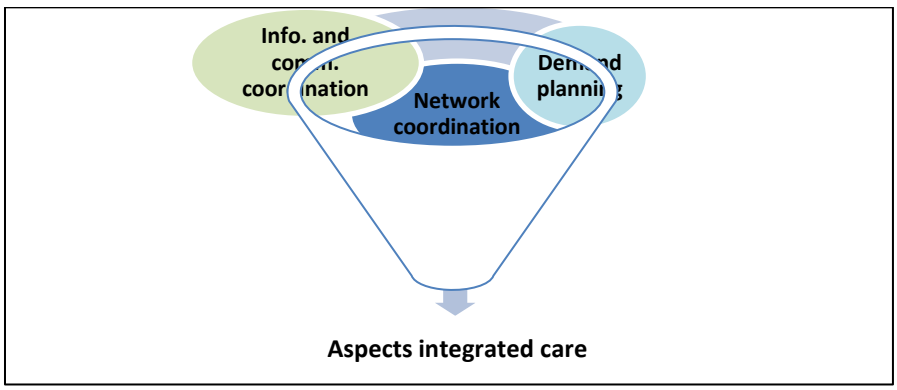


Figure 28: Aspects integrated care

1. Demand planning

In paragraphs 3.1 to 3.3 we had analyze some managerial areas that are related to the various processes in a service supply chain. One of these managerial areas is demand planning. One of the main uncertainties in the health care supply chain is the fluctuating demand over a year. There exist never a stable pattern of patients arrived at and discharged from the hospital to follow-up care organizations. *Demand planning* is the first added managerial area.

At strategic level the management must consider how they want to deal with demand variation of specific patient groups. An integrated care pathway defines most of the time specific objectives and length of stays at different departments, but this can be negatively influencing the patient flow of other patient groups. At tactical level, hospital and follow-up care institution must make agreements about the amount of patients discharged to these institutions. For example they can make agreements that always a certain amount of beds is available for patients discharged from the hospital. At operational offline level transfer nurses must work with waiting lists every day. They arrange which patient will be discharged to which care institution. It is a very complex process to meet the fluctuating demands with the fluctuating available beds. Patients have influence on their discharge care institution by indicating a first choice care provider. Operational offline contains the changes in demand. Patients can get complications and thus the discharge planning must be changed and adapted.

2. Information and communication coordination

Another managerial area we analyzed in paragraphs 3.1 to 3.3 is information management. Supply chain management is largely dependent on information flows within and between the different chain partners and is the foundation of an effective supply chain. In paragraph 3.6 we analyzed that different organizations result in different opinions. Shared understanding and agreements about the integrated care process is of high importance. *Information and communication coordination* is the second added managerial area.

At strategic level, information and communication coordination is obtained with decisions about which information systems can be used. At tactical level, the transfer between different phases can be obtained by transfer forms like medical, physiotherapy, and care forms. Also the information flows after discharge in hospital and admittance, in for example a nursing home, must be arranged with procedures and systems. Most of the time special discharge departments are available who arrange the outflow of patient from the hospital to follow-up care organizations. But these institutions must have fast and transparent information flows, because every day that a patient stays in the hospital after medical treatment is of great loss. At operational offline level, the day-to-day information flows must be planned. At the emergency department the medical doctors decided if a patient is admitted into the hospital and they plan the department on which the patient will stay. There must be information flows between the emergency department and the inpatient department about the incoming patient. At the inpatient department, the patient is treated and every day the situation of a patient can be changed. Between medical doctors, nurses, physiotherapists, and other care employees' constant information flows exist about the diagnostic findings of the patient. At operational online level,

departments must adapt to changes in the patient treatment and care pathway. The diagnostic findings of a patient can change which result in other or later discharge to or from follow-up care institutions. This must be communicated with the specific institutions.

3. Network coordination

In paragraph 3.4 the main elements for cooperation in networks in relation to integrated care are discussed. Each organization can strengthen the chain by using the instruments in the particular level of the organization. The third managerial area added is *network coordination*

According to Wijngaarden (2006) the focus of integrated care at strategic level is on horizontal self-steering. Every organization in a network must stimulate and direct their cooperation towards coordination. This means for the strategic level in hospital that they must stimulate other levels to cooperate with the defined objectives of the integrated care pathway. At tactical level, coordination between organizations is of great importance. This can be hierarchical or lateral be organized in a formal or informal way. The concept of learning is important at operational level. At operational offline level, learning enablers like shared image, procedures, learning skills, and a learning culture are useful. At operational online level, learning enablers like implementing changes, experimentation and incentives for those actions can be used.

We added three managerial areas to the framework of van Houdenhoven et al. (2007): demand planning, information and communication coordination, and network coordination. Table 10 displays the framework in an integrated care setting.

Managerial areas/ hierarchical decomposition	Demand planning	Information and communication coordination	Network coordination
Strategic	Priority for certain patient groups	Agreements about information systems	Horizontal steering
Tactical	Agreements and procedures with chain partners	Transfer forms, systems between discharge hospital and admittance follow-up care, common professional criteria and language	Coordination between organizations
Operational offline	Patient planning, discharge planning	Phase of treatment of a patient, diagnostic findings of a patient	Learning and participate with each other
Operational online	Changes in the (patient/discharge) planning	Calling offs	Learning by changes and experimentation

Table 10: Adapted framework of Van Houdenhoven et al. (2007): Planning and control of integrated care.

3.8 CONCLUSION

- We base the theoretical framework from a broad to a narrowed point of view on theory about supply chain management, service supply chain management, service supply chain management in health care, network relationships, and integrated care.
- We specified the characteristics of a healthcare supply chain
- We developed a planning and control model, based on the model of van Houdenhoven (2007), which addresses three important areas for integrated care: Demand planning, information and communication coordination, and network coordination.

4 BOTTLENECK ANALYSIS

In this chapter we investigate which factors influence the integrated care process and the access time for follow-up care for MST. The purpose is to analyze these factors in order to improve the integrated care process. We divide this chapter into two parts: patient related factors and process related factors. Paragraph 4.1, patient related factors, describes the characteristics of the patient group at MST that influence the integrated care process, namely functional decline, delirium, malnutrition, age. And at the two nursing homes: *AZP Eschpoort* and *ZGS Oldenhove*, namely age. It also analyzes if a connection exist between these factors and the duration of medical treatment. As a result the medical treatment duration partly can be forecast by means of the patient related factors. Paragraph 4.2, process related factors, describes the process characteristics that are known to influence the integrated care process and the access time to follow-up care, namely day of registration for follow-up care, use and storage of data, bed capacity nursing home, duration and criteria medical treatment, and patient information. In paragraph 4.3 we draw conclusions about the analyzed factors.

We base the analysis of the patient related factors on quantitative data from the project “Frail and Elderly” at MST and from data devices at the two nursing homes: *AZP Eschpoort* and *ZGS Oldenhove* where data about age and rehabilitation time of patients is assessed. We base the analysis of the process related factors mostly on qualitative data to describe the performance of the period January 2008 to August 2009. The process related factors are derived from the process and performance analysis in Chapter 2. We inquire about those factors with the related employees at MST.

4.1 PATIENT RELATED FACTORS

Most hip fracture patients are elderly people of 65 years and older and deal with other health problems as well. As a result high variability regarding the duration of medical treatment between patients exist.

This chapter focuses on the following patient related factors: functional decline (4.1.1), delirium (4.1.2), malnutrition (4.1.3), age MST (4.1.4), and age AZP Eschpoort and ZGS Oldenhove (4.1.5). The first three factors are assessed within the project “Frail and Elderly” that started at MST 1 January 2008 and is expanded at 1 October 2008. The project “Frail and Elderly” is developed to improve and specialize to the care for elderly patients, because most elderly people deal with multidisciplinary problems, which hinder the noticing and signaling of specific care problems. The first three patient related factors are obtained with the use of three screening instruments: Identification of Seniors At Risk (ISAR), Delirium Observation Scale (DOS), and Short

Nutritional Assessment Questionnaire (SNAQ). The screening instruments are dependent on the interpretation of the nurses and in some cases different nurses fill in the instruments. As a result inter-observation variation may exist. The last patient related factor is obtained by the use of the age of the patients in the project "Frail and Elderly". We discuss ISAR, DOS, SNAQ, and age in the following subparagraphs, 4.1.1-4.1.5.

4.1.1 FUNCTIONAL DECLINE: IDENTIFICATION OF SENIORS AT RISK (ISAR)

One of the instruments used in this project is Identification of Seniors at Risk (ISAR). ISAR measures the vulnerability of elderly patients (65 years and older) by determining the functional decline of these patients (Hoogerduijn, et al., 2006). In this project all admitted patients of 65 years and older should be measured at the moment of admittance. A score of 2 or more is an indication that nurses must be attentive for care problems like delirium, malnutrition, bedsore, and fall risks.

Of the 193 patients discharged to short term rehabilitation in January 2008 to August 2009, 106 patients were screened in the project "Frail and Elderly". Table 11 displays the ISAR-scores of the hip fracture patients screened in the project "Frail and Elderly". The surgery department (A3, B3, C3, and D3) and the orthopaedic department (A5) are added to compare the scores of the hip fracture patients with the scores of all patients treated and screened in these related departments. The ISAR scores are based on the period of October 2008 to August 2009, because the ISAR instrument started in October 2008.

ISAR-Vulnerability					
	Hip fracture	Surgery	Surgery	Orthopaedic	Orthopaedic
Score (intake)	2008 (oct-dec) 2009 (jan-aug)	2008 (oct-dec)	2009 (jan-aug)	2008 (oct-dec)	2009 (jan-aug)
0	3% (1)	30% (90)	34,3 % (318)	48,4% (31)	33,9% (56)
1	5% (2)				
2	92% (35)	70,0% (207)	65,7% (610)	51,6% (33)	66,1% (109)
Total	100% (38)	100% (297)	100% (928)	100% (64)	100% (165)
No score	68				

Table 11: ISAR scores

Source: Project Frail and Elderly, MST-dashboard, 2008 (oct-dec), 2009 (jan-aug)

Of the 106 patients that participated in the project "Frail and Elderly" 68 patients (64%) are not screened for vulnerability, due to the use of this instrument ever since 1 October 2008. Furthermore the nurse must fill in the screening on paper and digitally, and the digital version may be forgotten. Also some patients are not screened because they are under age of 65 years and these patients are not screened for functional decline.
Out of the 38 patients who are screened, 92 percent of the patients have a score of 2, which means that the patient is regarded as vulnerable and the nurse must be attentive for other care problems. The vulnerability of the hip fracture patients is much higher than vulnerability of patients treated at the two related departments. This shows that vulnerability is one of the characteristics of a hip fracture patient group. However, this patient group gets almost always a high score, because points are counted for using more than three different medicines, age above 75 year, need household work or daily care, binocular vision without classes, and problems with memory.

We would like to investigate whether the patients with a score of 2 need longer medical treatment than patients with no or other scores. Figure 29 displays the ISAR-scores related to the duration of medical treatment. Because of the high number of patients not screened and only three patients have other scores than patients with a score of 2 we recommend to investigate the relationship with the duration of medical treatment in a following research.

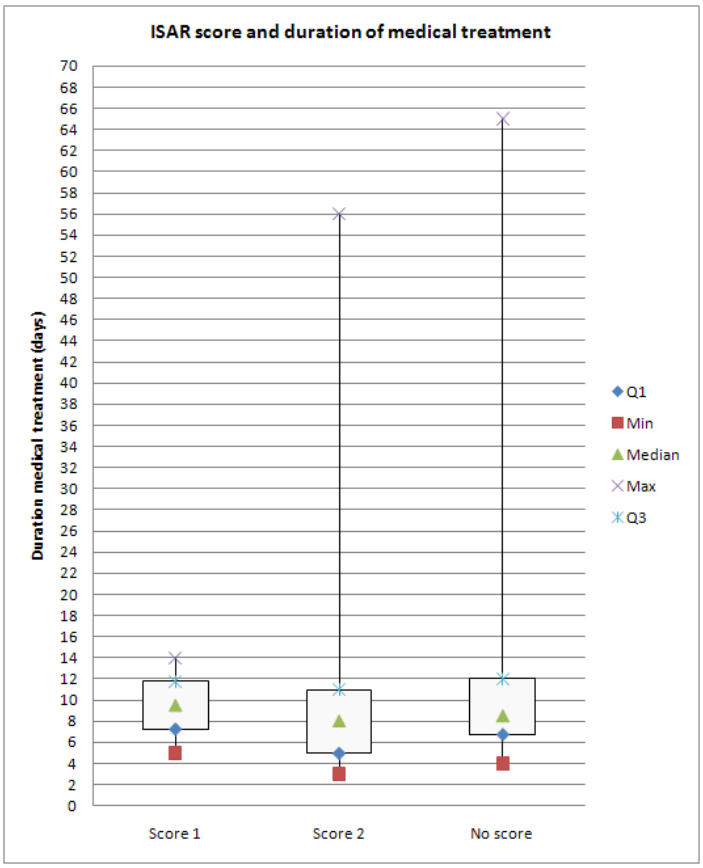


Figure 29: The ISAR-score related to the duration of medical treatment

(Source: Project Frail and Elderly MST: Oct 2008-Aug 2009

Score 0: N=1, Score 1: N=2, Score2: N=35, No score: N=68)

	Score 0	Score 1	Score 2	No score
Q1	6	7,25	5	6,75
Min	6	5	3	4
Median	6	9,5	8	8,5
Max	6	14	56	65
Q3	6	11,75	11	12
Average	6	12,5	10,93	11,2
SD	0	4,5	9,57	8,83

Table 12: Descriptive statistics

Source: Project Frail and Elderly MST

4.1.2 DELIRIUM: DELIRIUM OBSERVATION SCALE (DOS) INTAKE

A second measuring instrument in the project "Frail and Elderly" is the Delirium Observation Scale (DOS) which measures risks on mental disorders as a result of body changes. One of the main complications of hip fracture patients is a delirium. In this project all admitted patients should be measured at the moment of admittance. When a patient has a score of 3 or more a specialist and the nurse practitioner must be contacted and they discuss the patient and prescribe some medicines. Table 13 displays the DOS-scores of the patients screened in the project "Frail and Elderly".

Delirium					
	Hip fracture	Surgery (D3)	Surgery (D3)	Orthopaedic (A5)	Orthopaedic (A5)
Score (intake)	2008 (jan-dec) + 2009 (jan-aug)	2008 (jan-dec)	2009 (jan-aug)	2008 (jan-dec)	2009 (jan-aug)
0	34% (32)	95,2% (4474)	95,6% (2026)	94% (533)	94% (282)
1	18% (17)				
2	22% (21)				
3	26% (24)	4,8% (227)	4,4% (94)	6,0% (34)	6,0% (18)
Total	100% (94)	100% (4701)	100% (2120)	100% (567)	100% (300)
No score	12				

Table 13: DOS-scores

Source: Project Frail and Elderly, MST-dashboard, 2008 (jan-dec), 2009 (jan-aug)

As with the ISAR scores, not every patient is screened for this measuring instrument, but the amount of patients who are not screened are less than with the ISAR scores. Table 3 shows that more than a quarter of the patients (26%) have a score of 3 which means that the symptoms of a delirium are present. The risk of a delirium is much higher for hip fracture patients than for patients treated by the surgery and orthopaedic department. This shows that the risk of a delirium is a characteristic of the hip fracture patient group.

We investigate whether the patients with a score of 3 need longer medical treatment than patients with other scores. Figure 30 displays the DOS-scores related to the duration of medical treatment. Figure 30 shows that the distribution is right skewed with the mass of the distribution concentrated on the left and outliers on the right. We hypothesize that symptoms of a delirium negatively influence the medical treatment duration. Table 4 displays that these patients have in contrast with the other groups the lowest average duration of medical treatment, 9.13 days. The median shows that few outliers exist by patients with score 3. A reason may be that those patients get more attention, because in case of a score 3 intervention is started by the nurse. Patients with a score of 2, which means some symptoms but not enough for a score of 3, show the highest average duration of medical treatment, 13.71 days.

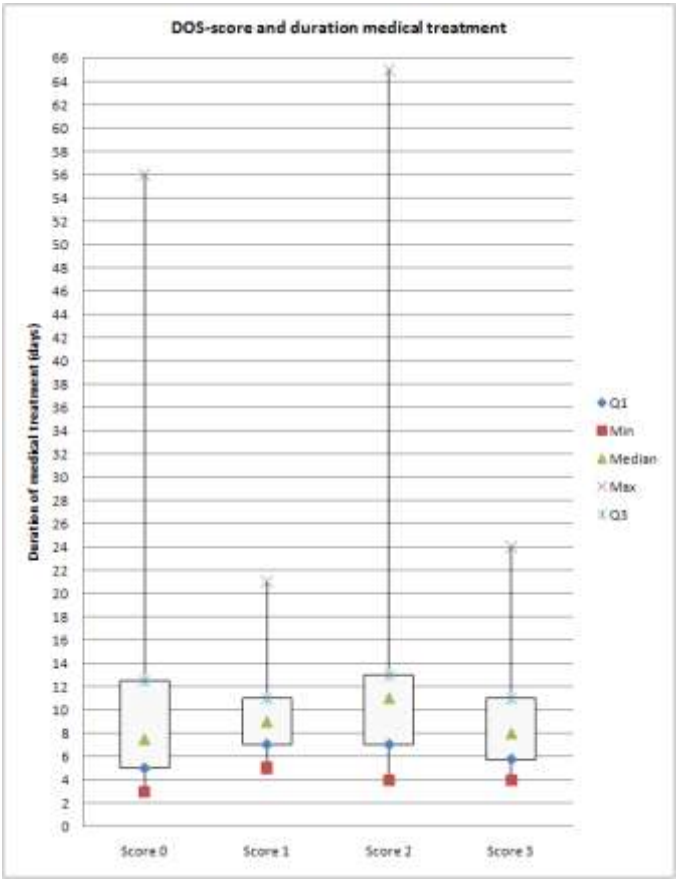


Figure 30: The DOS-score related to the duration of medical treatment

(Source: Project Frail and Elderly MST: Jan 2008-Aug 2009

Score 0: N=32, Score 1: N=17, Score 2: N=21, Score 3: N=24)

	Score 0	Score 1	Score 2	Score 3
Q1	5	7	7	5,75
Min	3	5	4	4
Median	7,5	9	11	8
Max	56	21	65	24
Q3	12,5	11	13	11
Average	10,84	10,18	13,71	9,13
SD	10,06	4,34	13,31	4,68

Table 14: Descriptive statistics

Source: Project Frail and Elderly MST

4.1.3 MALNUTRITION: NUTRITIONAL ASSESSMENT QUESTIONNAIRE (SNAQ)

A third measuring instrument is the Short Nutritional Assessment Questionnaire (SNAQ) which measures malnutrition at the moment of admittance into the hospital. Malnutrition can influence the medical treatment because of a negative effect on for example: heal over, immune response to infections or the total recovery of a patient. With a score of 2, the patient will get a snack that is rich in protein three times a day. With a score of 3, a medical consultation is given by the dietician, in addition to the three snacks a day. Table 15 displays the SNAQ-scores of the patients screened in the project "Frail and Elderly".

SNAQ - Malnutrition					
	Hip fracture	Surgery (D3)	Surgery (D3)	Orthopaedic (A5)	Orthopaedic (A5)
Score (intake)	2008 (jan-dec) 2009 (jan-dec)	2008 (jan-dec)	2009 (jan-aug)	2008 (jan-dec)	2009 (jan-aug)
0	79% (76)	82,4% (3832)	85,6% (2043)	91,3% (537)	92,4% (291)
1	0% (0)				
2	12% (11)	17,6% (818)	14,4% (345)	8,7% (51)	7,6% (24)
3	9% (9)				
Total	100% (96)	100% (4650)	100% (2388)	100% (588)	100% (315)
No score	10				

Table 15: SNAQ score

Source: Project Frail and Elderly, MST-dashboard, 2008 (jan-dec), 2009 (jan-aug)

Table 15 shows that 20 patients (21%) need a snack rich in protein and for 9 of these patients (9%) a dietician is consulted. The malnutrition is somewhat more common in the hip fracture patient group than for patients treated and screened by the surgery and orthopaedic department. This shows that malnutrition may influence the medical treatment of hip fracture patients and should not be undervalued.

We investigate whether the patients with a score of 2 or 3 need longer medical treatment than patients with a lower score. Figure 31 displays the SNAQ-scores related to the duration of medical treatment. Figure 31 shows that the distribution is right skewed with the mass of the distribution concentrated on the left and outliers on the right. We hypothesize that malnutrition negatively influence the duration of medical treatment. Table 6 displays that the patients were a dietician are consulted have lower average duration of medical treatment, 10.89 days than patients who only get an extra snack, 14.73 days. However the median is almost equal. A reason may be that as a result of the consultation by a dietician the patient are more watched out.

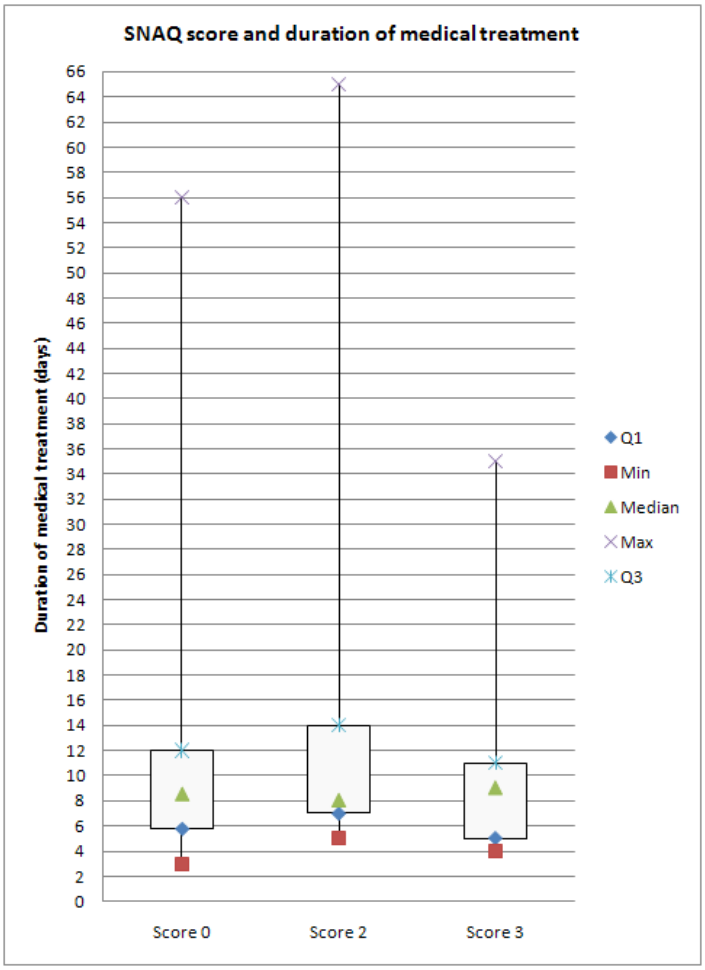


Figure 31: SNAQ scores

(Source: Project Frail and Elderly MST: Jan 2008-Aug 2009

Score 0: N=76, Score 2: N=11, Score 3: N=9)

	Score 0	Score 2	Score 3
Q1	5,75	7	5
Min	3	5	4
Median	8,5	8	9
Max	56	65	35
Q3	12	14	11
Average	10,3	14,73	10,89
SD	7,4	16,52	8,97

Table 16: Descriptive statistics

Source: Project Frail and Elderly MST

4.1.4 AGE: MST

Because hip fracture patients are mostly elderly people and these patients commonly have multidisciplinary problems, we hypothesize that age has an influence on the time that patients spend in the hospital for medical treatment. We compare the age of the patients with the corresponding medical treatment at MST.

Figure 32 displays the age of the admitted hip fracture patients for short term rehabilitation care in *AZP Eschpoort* and *ZGS Oldenhove* in January 2008 to August 2009 related to the duration of medical treatment at MST. It shows a variation between the two youngest groups (≤75) and the two oldest groups (≥76). The two youngest groups show a higher dispersal within the middle 50 percent of the data than the two oldest groups. Table 17 displays that the youngest group has a higher average duration of medical treatment and a higher median than the two oldest groups. Outliers exist from the age of 66 year.

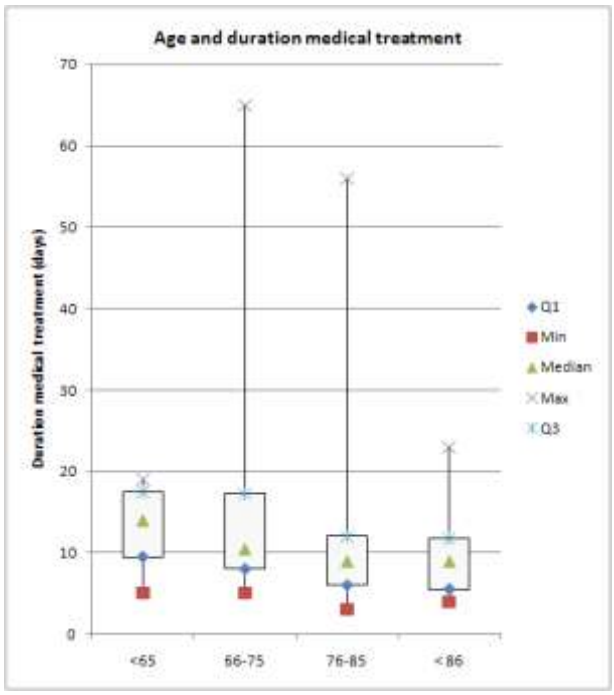


Figure 32: The age of patients related to the duration of medical treatment at MST ,

(Source: Project Frail and Elderly MST, database AZP and ZGS

<65, N=4, 66-75, N=12, 76-85, N=32, >85, N=18)

	<65	66-75	76-85	< 86
Q1	9,5	8	6	5,5
min	5	5	3	4
mediaan	14	10,5	9	9
max	19	65	56	23
Q3	17,5	17,25	12	11,75
Average	13	15,83	11,28	9,44
SD	5,48	15,52	10,14	4,72

Table 17: Descriptive statistics

Source: Project Frail and Elderly MST

4.1.5 AGE: NURSING HOMES

Paragraph 4.1.4 describes the influence of age on the time that patients need in hospital. This paragraph describes that influence in the nursing home. We hypothesize that the age has an influence on the time that patients spend in the nursing home for rehabilitation.

Figure 33 and 34 display the age of the patients related to the duration of rehabilitation in nursing home *AZP Eschpoort* and *ZGS Oldenhove*. We exclude the patients who died at the nursing home. Otherwise the rehabilitation time is negatively influenced. Without these patients we can describe the duration of short term rehabilitation care in the nursing home and otherwise the occupation of the beds is described.

It shows a high variation between the three groups and between the two nursing homes. The time that patients spend in nursing home AZP Eschpoort for short term rehabilitation reduces with the age of 66 years. This is in contrast with nursing home *ZGS Oldenhove* where all patients above the age of 65 have almost the same length of stay. Besides, patients at nursing home *AZP Eschpoort* stay in general less long than patients at nursing home *ZGS Oldenhove*. The low number of patients within the different groups may influence the outcomes.

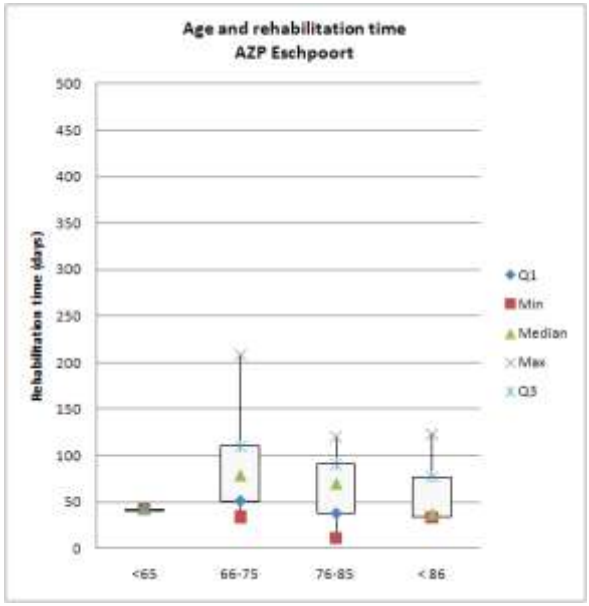


Figure 33: The age of patients related to the rehabilitation time At AZP Eschpoort

Source: Database AZP Eschpoort jan 2008-aug 2009.

<65, N=1, 66-75, N=8, 76-85, N=13, >85, N=8)

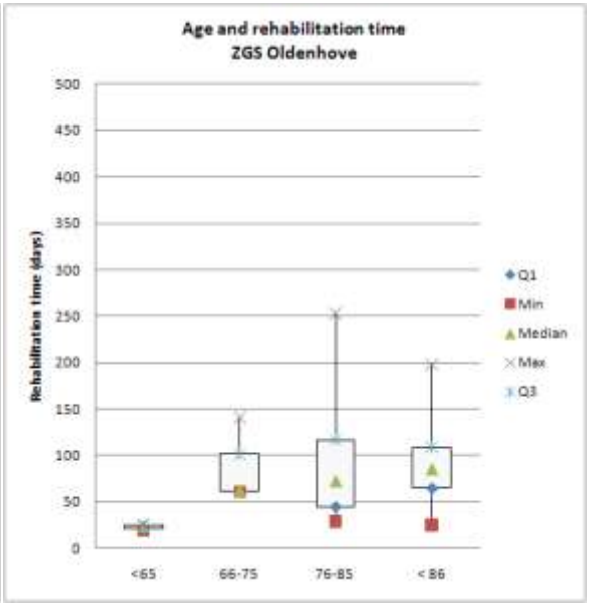


Figure 34: The age of patients related to the rehabilitation time at ZGS Oldenhove

Source: Database AZP Oldenhove jan 2008-aug 2009.

<65, N=3, 66-75, N=3, 76-85, N=11, >85, N=5)

	<65	66-75	76-85	> 86
Q1	42	51,25	38	33,75
min	42	34	11	33
mediaan	42	79	70	37
max	42	208	120	123
Q3	42	110	91	77
Average	42	94,13	59,4	38,25
SD	0	57,19	31,78	31,85

Table 18: Descriptive statistics

Source: Database AZP Eschpoort

	<65	66-75	76-85	>86
Q1	21	61,5	45	65
min	19	61	29	25
mediaan	23	62	72	85
max	26	141	253	198
Q3	24,5	101,5	116,5	175,75
Average	22,67	88	92,64	96,4
SD	2,87	37,48	65,35	57,78

Table 19: Descriptive statistics

Source: Database ZGS Oldenhove

One reason for the different length of stays in the two nursing homes can be the discharge place of patients out of the nursing home. Therefore, we investigate whether there exist differences within the discharge possibilities.

Figure 35, 37, and 39 display the discharge possibilities of the patients at *AZP Eschpoort* and figure 36, 38, and 40 display the same for *ZGS Oldenhove.* In the previous paragraph we conclude that the patients at AZP Eschpoort need shorter rehabilitation time than the patients at ZGS Oldenhove. Figure 35-40 display that the older the patients are, the less often they go home after being in AZP Eschpoort, but are discharged to other types of care. On the contrary, in ZGS Oldenhove almost all patients go home despite their age. So the shorter length of stay in AZP Eschpoort can be the reason that patients are discharged to different types of care sooner.

Besides, we concluded from chapter 2 that the length of stay varies highly between individual patients as a result of factors like cognition, physical conditions, ability to learn, and the extent of mobilization. And also the quantity of physiotherapy per week can influence the length of stay.

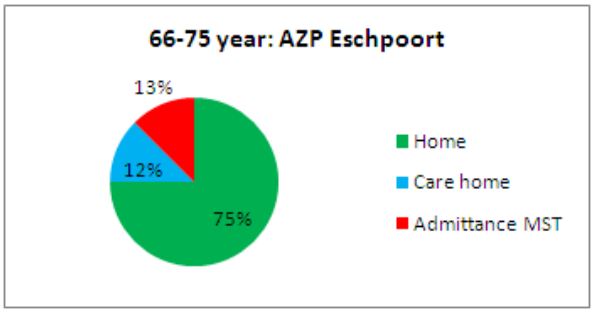


Figure 35: The age of the patients related to the discharge

(Source: Database AZP Eschpoort, Jan 2008-aug 2009, N=8)

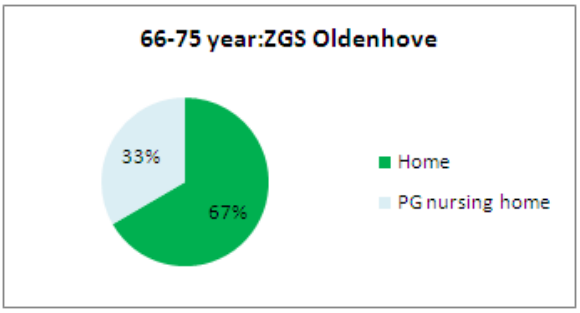


Figure 36: The age of the patients related to the discharge

(Source: Database ZGS Oldenhove, Jan 2008-aug 2009, N=3)

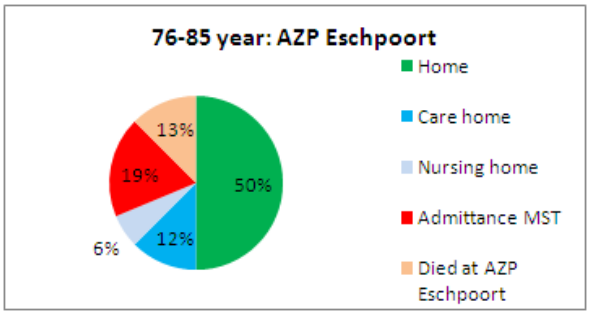


Figure 37: The age of the patients related to the discharge

(Source: Database AZP Eschpoort, Jan 2008-aug 2009, N=16)

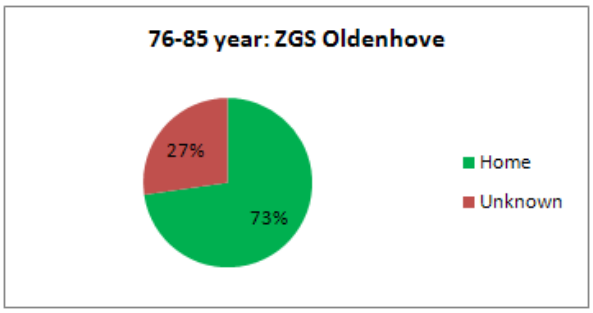


Figure 38: The age of the patients related to the discharge

(Source: Database ZGS Oldenhove, Jan 2008-aug 2009, N=11)

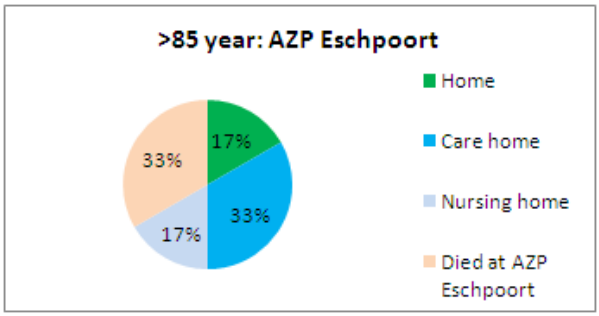


Figure 39: The age of the patients related to the discharge

(Source: Database AZP Eschpoort, Jan 2008-aug 2009, N=12)

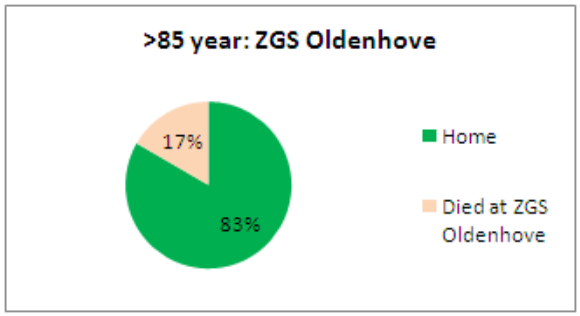


Figure 40: The age of the patients related to the discharge

(Source: Database ZGS Oldenhove, Jan 2008-aug 2009, N=6)

4.2 PROCESS RELATED FACTORS

In chapter 2 we described and analyzed the process a hip fracture patient endures in the hospital as well as in follow-up care organizations. In both organizations some process elements can be improved to shorten the access time to follow-up care. In this paragraph we describe process elements that can influence the integrated care process and the access time to follow-up care, namely: day of registration for follow-up care (4.2.1), use and storage of data (4.2.2), bed capacity nursing home (4.2.3), duration and criteria medical treatment (4.2.4), and patient information (4.2.5).

4.2.1 DAY OF REGISTRATION FOR FOLLOW-UP CARE

The patient registration for follow-up care at *Transferpunt* is an important task for nurses at the inpatient department. Within MST, nurses perform the role of coordinators of care. A nurse determines the type of follow-up care and applies patients for this type of care at *Transferpunt.* We conclude from chapter 2 that the registration for follow-up care of patients into the hospital takes too long and causes problems later in the treatment process. *Transferpunt* does not have enough time to find an available nursing home, and nursing homes are informed too late about new patient entries. This problem occurs at the operational offline level and concerns the medical planning. We can divide the problem of registration into three sub problems: no exact day of registration, estimation of care demand, and registration during weekends.

1. No exact day of registration

During the intake conversation at the inpatient department, a nurse asks the patient for his home situation to estimate the need for follow-up care or the discharge to their home situation. Currently no procedures exist with respect to the moment a patient is applied for follow-up care. The definitive registration for follow-up care at *Transferpunt* is made by the nurse at her own perception. As a result the registration for follow-up care is often forgotten or pushed forward. Within the new clinical pathway, it is agreed on that the nurse must apply patients for follow-up care at the same day as their surgery.

2. Estimation of care demand

A nurse estimates the type of care a patient needs after surgery. Most of the time, it is difficult to estimate the type of care in an early stage, especially for patients with mental diseases. Most of the patients with a hip fracture are elderly people, who have a higher chance of complications. Sometimes, a nurse observes the patient for a couple of days before applying at *Transferpunt* for follow-up care. No exact criteria are available for determining the type of follow-up care for a patient. Only unwritten rules, and mainly own knowledge and experience are used in practice.

3. **Registration during weekends**

Transferpunt nurses collect the registration forms every day at 11.00 am. *Transferpunt* is closed during weekends as a result follow-up care registration papers are not collected by Transferpunt nurses. A patient admitted at Thursday is operated within one day, at least on Friday. If a patient is operated after eleven o'clock am on Friday, the first possibility to apply for follow-up care is on Monday. As a result, five days from the moment of admittance a patient can earliest be applied for follow-up care. Table 20 specifies for all days in the week the minimal time between admittance and registration for follow-up care.

Day of admittance	Day of operation	Registration first day post-OK	Duration registration from moment of admittance
Monday	Tuesday	Wednesday	3 days
Tuesday	Wednesday	Thursday	3 days
Wednesday	Thursday	Friday	3 days
Thursday	Friday	Monday	5 days
Friday	Saturday	Monday	4 days
Saturday	Sunday	Monday	3 days
Sunday	Monday	Tuesday	3 days

Table 20: Duration of registration per day of admittance

Because of the restriction displayed in Table 10, we take a closer look at the number of patients admitted per day at the hospital. Table 21 displays the number of patients admitted in 2008 and 2009 specified per day of the week. At Thursday and Friday problems occur, because *Transferpunt* is closed during weekends. In 2008, 36 percent of the patients are admitted into the hospital at Thursday or Friday and in 2009, this number is 35 percent. This means that for one third of all patients a minimum duration of registration of four or five days after admittance into the hospital exists.

2008			2009		
Admittance	N	Percentage	Admittance	N	Percentage
Monday	21	14%	Monday	19	16%
Tuesday	29	19%	Tuesday	22	19%
Wedsnesday	15	10%	Wedsnesday	11	9%
Thursday	22	14%	Thursday	22	19%
Friday	33	22%	Friday	19	16%
Saturday	19	12%	Saturday	10	8%
Sunday	14	9%	Sunday	15	13%
Total	153	100%	Total	118	100%

Table 21: The number of patients admitted per day

(Source: X-care MST, N=153 (jan-dec 2008), N=118 (jan-aug 2009))

4.2.2 USE AND STORAGE OF DATA

Proper storage and transfer of information is required for an effective chain of organizations. Databases are valuable for analyzing and evaluating the performance of organizations. Regarding the integrated care processes, MST uses two main databases: X-care and the Transferpunt database. X-care is used for all care related actions within the hospital. The Transferpunt database is used to arrange follow-up care for patients after medical treatment in the hospital. These two separate databases unfortunately cannot be linked. Thereby, the Transferpunt database system uses manual applications, which result in input differences for repeating inputs which in turn cause searching problems. This type of problem obstructs the analysis and evaluation of integrated care processes. These problems occur at tactical level and concern the information coordination planning. We can divide the problem of the use and storage of data into two sub problems: X-care and the Transferpunt database.

X-care

The total numbers of arrived and admitted patients have been derived from the X-care database. Appendix 2 displays the X-care overview of 2008. We experienced three related problems.

First, the derived overview is specified for the patient group “hip fracture”. As a result of the high number of patients with only policlinic visits, we discover that the overview is influenced by patient with hip complaints. The DRG code for those patients is lacking, as a result those patients are administrated as hip fracture patients. Second, the overview contains the total number of DRG and the total number of patients specified for the surgery department and the orthopaedic department. The DRGs and number of patients are divided into different DRG descriptions, related to different treatment possibilities. Nevertheless, the number of patients per treatment possibility does not meet the total number of patients due to formulas used within the X-care system. Third, the surgery department contains two different care types; care type 11, and care type 21. The orthopaedic department uses only care type 11, because the control visit is included in care type 11. As a result, differences exist between the two department and they focus on their own process, without taking into

account the effect on the entire care chain. Due to the previous three features of the X-care system, the evaluation and monitoring of processes is hindered.

Transferpunt database

The total number of recorded patients for follow-up care can be derived from the Transferpunt database. We experienced three related problems.

First, within the Transferpunt database a total overview per patient group is not available. One can only search per follow-up care type, but the illness of the patient is not specified. To see the illness of a patient, one can find the patient by patient number and read the illness description. Second, Transferpunt data use manual applications. Transferpunt nurses must fill in the type of care required. As a result of the use of capital letters, dots, and abbreviations and so on, in 2009, 54 types of follow-up care are listed.

They must fill in also the follow-up care organization. In 2009, they listed 554 different follow-up care organizations, including 27 different possibilities for nursing home AZP Eschpoort. Table 22 displays the possibilities for nursing home AZP Eschpoort. Because of the many different written types of care or care organizations the use of the database is made more difficult.

Written types of one care organization	
Ariënszorgpalet loc de eschpoort	Ariënszorgpalet loc. de Eschpoort
Ariënszorgpalet loc de Eschpoort	Ariënszorgpalet loc. Eschpoort
Ariënszorgpalet loc de Espoort	Ariënszorgpalet loc. Espoort
Ariënszorgpalet loc de espoort	Ariënszorgpalet loc.Eschpoort
Ariënszorgpalet loc Eschpoort	Ariënszorgpalet loc.espoort
Ariënszorgpalet loc eschpoort	Ariënszorgpalet loc.Espoort crsisbed
Ariënszorgpalet loc Espoort	Ariënszorgpalet loc.espoort.
Ariënszorgpalet loc Espoort	Ariënszorgpalet loc.Espoort.
ariënszorgpalet loc Espoort	Ariënszorgpalet locc espoort
Ariënszorgpalet loc espoort	AZP loc Eschpoort
ariënszorgpalet loc espoort	azp loc Eschpoort
Ariënszorgpalet loc. De eschpoort	azploc eschpoort
Ariënszorgpalet loc. de eschpoort	De Eschpoort
Ariënszorgpalet loc. De Eschpoort	

Table 22: Manually written follow-up care organizations

(Source: Transferpunt database MST, Jan-Dec 2009)

Third, Transferpunt uses a new patient number for each new patient applied for follow-up care. This patient number is not the same patient number used in the other databases within MST. As a result linking of database system is lacking.

4.2.3 BED CAPACITY NURSING HOME

At the long term as well as the medium term, no synchronization exists between the supply of beds in the different nursing homes and the demand of care from the hospital. This problem occurs at strategic and tactical level at the nursing homes and concerns resource capacity planning. For MST this problem occurs also at strategic and tactical level, but concerns the demand planning for patients.

MST employees believe that inflow of hip fracture patients within MST is growing. This is confirmed by the data stated in chapter 2 of this research and the increasing access times to follow-up care. However, the increase is not as high as expected. But the increasing number of hip fracture patients and the high access times to follow-up care results in a higher need of nursing home beds. The capacity of nursing home must be adjusted. However, MST and nursing home AZP Eschpoort are negotiating during the writing of this research about the capacity of beds reserved for hip fracture patients from MST who need short term rehabilitation. It is a problem that the number of required beds is not known.

4.2.4 DURATION AND CRITERIA MEDICAL TREATMENT

In the new clinical pathway, MST strives for a medical treatment of five days post-surgery. We conclude from chapter 2 that the medical treatment in the hospital for hip fracture patients applied for short term rehabilitation takes too long. Further, within MST no univocal definition exists when a hip fracture patient does not need any medical treatment anymore. The medical specialist decides the end date of medical treatment. Due to this confusion it is not perfectly clear when a patient can be discharged to follow-up care. During the writing of this research, the project group 'Snel Herstel' has developed criteria for the end date of a medical treatment.

4.2.5 PATIENT INFORMATION

Patient information is of high importance for the value judgement of patients about the quality of care. We conclude from interviews about the current situation that the patient information provision is not optimal. This problem occurs at operational offline level and concerns the information coordination planning. We can divide the problem into three sub problems: information brochure, first choice, second best principle, and role of nurses.

1. Information brochure

Before the surgery each hip fracture patient receives an information brochure about the medical treatment in the hospital and the follow-up care possibilities after discharge from the hospital. After surgery, the patient receives another brochure about the Transferpunt. This Transferpunt information brochure is given when the nurse fills in the Transferpunt application. The consequence is that two moments of information distribution

are used. The first information brochure is in general always given to the patient, but the Transferpunt information is given too late or even not at all, as a result of the late Transferpunt registration.

2. First choice, second best principle

Within MST, the first choice, second best principle is used with aim to focus on the patient preferences. The principle includes that a patient can choose one care provider, but when this care provider cannot meet the demand from the hospital, the patient must accept another care provider, the second best. The principle is only explained by the nurse at the moment of registration for follow-up care. The patients are not always informed well about this principle and they presume they can choose only one care provider and that is a guarantee for their follow-up care.

3. Role of nurses

As stated before, nurses at the inpatient department are the coordinator of care within MST and as a consequence they also inform the patient and his family about the follow-up care possibilities. Nurses do not always have an accurate view of the access times for the different follow-up care organizations. As a result they cannot inform the patient optimal because of this lack of information. The Transferpunt nurses can perform this role easier, because they have a detailed overview of all access times and know more about the follow-up care possibilities than inpatient department nurses.

4.3 CONCLUSION

- Almost every screened hip fracture patient above the age of 65 year is regarded by ISAR as vulnerable.
- Symptoms of a delirium are more often present by hip fracture patients than by other patient treated by the surgical and orthopaedic department. Patients with a risk score show a relative shorter medical treatment than patients with other scores.
- Malnutrition is more common by hip fracture patient than by other patients treated by the surgical and orthopaedic department. Patients were a dietician is consulted show shorter medical treatment than patients who only get an extra snack.
- Hip fracture patients up to the age of 75 show longer medical treatment in MST than patients of 76 and older.
- The time that patients spend in nursing home AZP Eschpoort for short term rehabilitation reduces with the age of 65 year.
- The time that patients spend in nursing home ZGS Oldenhove for short term rehabilitation is for the patients 66 year and older almost equal.
- Patients at AZP Eschpoort need in general shorter rehabilitation time than patients at ZGS Oldenhove. However patients from ZGS Oldenhove are mostly discharged to their own home and patients from AZP Eschpoort are sooner transferred to other types of care.

- The process related factors are fivefold: day of registration for follow-up care, use and storage of data, bed capacity of nursing homes, duration and criteria medical treatment, and patient information.

5 RECOMMENDATIONS

In chapter 4 we described several bottlenecks in the integrated care process of hip fracture patients. In this chapter, we focus on recommendations for the main bottlenecks described in chapter 4: classifying patient groups (5.1), standardization of work processes (5.2), measurement, registration & information services (5.3), and simulation bed capacity AZP Eschpoort (5.4). Figure 41 displays the corresponding problems and interventions. Paragraph 5.5 describes management actions based on the framework developed in chapter 3. In paragraph 5.6 we draw conclusion about the described recommendations.

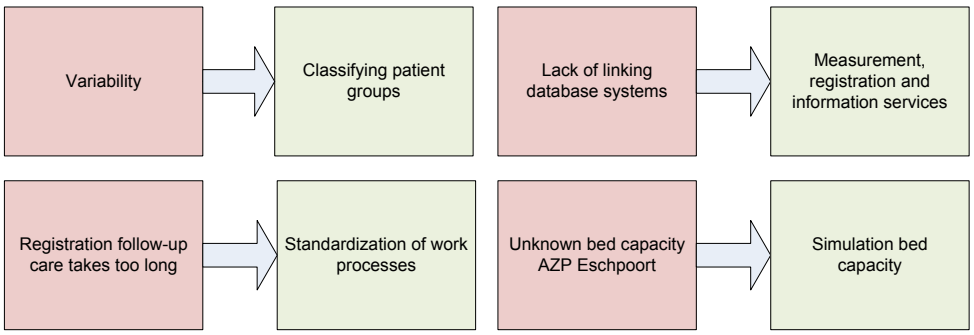


Figure 41: Problems and recommendations to solve these problems

5.1 PATIENT GROUP CLASSIFICATION

Chapter 4 explained the problem of variability between medical treatment duration of individual patients at MST and the length of stay in the nursing homes. Houdenhoven et al. (2007) describes a typology of a case mix approach, with three case mix characteristics: Intra clinical variability, inter clinical variability, and volume.

5.1.1 CASE MIX APPROACH

Inter clinical variability of patients concerns the variability of the duration or length of stay (van Houdenhoven, et al., 2007). For hip fracture patients the main treatment, a hip surgery, is fairly standard, but the physical condition of a patient varies highly between individual patients caused by differences age and other health problems. As a result, different complications can occur during their stay in hospital or nursing home.

Intra clinical variability concerns the variability in the pathway that is followed by an individual patient (van Houdenhoven, et al., 2007). MST is developing a clinical pathway specified for hip fracture patients. The clinical

pathway provides a predetermined protocol. Specialists and nurses do not need to make complex decisions regarding the care pathway of these patients.

Volume of a patient group is determined by strategic choices and demographic factors. Large patient groups offer possibilities to decrease uncertainty and variability (van Houdenhoven, et al., 2007).

In conclusion, hip fracture patients have high inter clinical variability caused by the physical condition of the patients as a result of high age of most patients. The intra clinical variability is expected to be low, as a result of the predetermined clinical pathway. But it remains uncertainty if all patients can follow the clinical pathway, as a result of the differences in physical conditions between the individual patients.

To manage the inter clinical variability and the intra clinical variability a pull system can be introduced in the hospital.

5.1.2 PULL SYSTEM

TPGrapport (2004) describes the current patient process in Dutch hospitals. The process is based on a push system, which means that patients are pushed through the care process depending on the urgency and based on the available capacity. It takes longer for a push based supply chain to respond to changes in demand and care processes are based on historical data. A pull system can be used for quality improvement and cost reduction in logistic processes within hospitals. Introduction of a pull system within care organizations means that the individual process of the patient is the central focus instead of available capacity in hospital or nursing homes. Care processes are made as much as possible predictable with the use of throughput times, availability and use of professional capacity, and availability of products and services. The arrival and discharge of a patient is based on the expected stay in hospital. Patients know their own care process exactly and are treated by a standardized manner, but with focus on the individual situation (TPGrapport, 2004). TPGrapport (2004) describes a number of preconditions which must be met to introduce a pull system successfully. One precondition is the classification of patients into sub groups based on the predictability of the treatment, for example: a sub group which follow the clinical pathway successfully, and a classification of sub groups who cannot meet the indicators in the clinical pathway. In this way homogeneous sub groups are formed and logistics of those sub groups can be standardized. The developed clinical pathway can be used to classify the homogeneous groups. It describes all activities and responsibilities for each phase of the care process within MST. It is established that patients need care for five days after surgery at the inpatient department. By analyzing the reasons why some patients need more or less than five days of medical treatment after surgery at MST, deviations can be classified. All deviations of the clinical pathway must be recorded at the variance report part of the medical file of each patient.

Within nursing homes they also face high variability between rehabilitation duration of individual patients. We recommend also introducing a clinical pathway, where the different phases of rehabilitation of a patient are determined. By means of this clinical pathway various homogeneous sub groups can be obtained. As a result

the treatment of the patient can be adjusted to these sub groups and the length of stay in the nursing home can be better forecasted. When short term rehabilitation care no longer meets the needs of a patient, the patient must be transferred to another type of care. LUMC Leiden has also started an integrated care project for hip fracture patients with two nursing homes. A special department is used for the rehabilitation of patients. Patients discharged to this department getting an intensive rehabilitation program: twice a day and five days per week physiotherapy. This department is based on a rehabilitation and discharge culture in contrast with the focus on admittance and caring of patients in general nursing homes.

5.2 STANDARDIZATION OF WORK PROCESSES

Chapter 4 showed that applying patients for follow-up care on time is a major bottleneck. Currently no procedures exist that regulate the time after which a patient is applied for follow-up care. Nurses at the inpatient department have to decide for themselves when a patient needs to be applied for follow-up care. Registration for follow-up care at *Transferpunt* is forgotten or pushed forward by nurses at the inpatient department. As a result registration for follow-up care is arranged too late. Standardization of work processes provides advantages for efficiency and scheduling (TPG rapport, 2004). The inpatient department which is concerned with the registration for follow-up care can provide standardization by making agreements about the way of registration. Table 23 displays the agreements made in the clinical pathway for hip fracture patients regarding the registration for follow-up care. All nurses working at the specific departments receive additional instructions how to work with the new clinical pathway. Registration is done by the nurse on the day of admittance at the inpatient department. Each following day the nurse at the inpatient department checks the discharge trajectory and informs *Transferpunt* in case of changes. At the general overview at the inpatient department, where all patients who are staying at the inpatient department are listed, the head of the department or the nurse practitioner will indicate if follow-up care for the patient is arranged. So an extra check is added. A variance rapport is also added to the clinical pathway where activities are listed that according to the content and point in time do not meet the clinical pathway. The head of the inpatient department will be evaluating this variance rapport.

Phase nr	1	2	3	4	5	6a	6b
Phase	Admittance emergency department	Admittance inpatient department	Surgery	Post operative day 1	Post operative day 2+3	Post operative day 4	Discharge
Task	-	Registration follow-up care	-	Check registration + temporary discharge date on whiteboard	Check discharge trajectory	-	-
Responsible	-	Nurse	-	Nurse	Nurse	-	-

Table 23: Agreements registration follow-up care

5.3 MEASUREMENT, REGISTRATION, AND INFORMATION SERVICES

Chapter 4 explained the use and storage of data. MST uses several databases and stores valuable data, but the relevant data cannot easily be obtained from the databases. And the linkage of databases is lacking. As a result, data is not available and processes cannot be monitored and evaluated.

Another precondition in the (TPGrapport, 2004) for a successful pull system is setting high standards for measurement, registration, and information services. The availability and correctness of information is highly important in effective logistic processes. Standardization of processes is impossible without the availability of relevant information. As a result of the lack of relevant information specific planning cannot be accomplished. A realizable service level must be established based on operational statistic data and patient preferences. The service level determines several performance indicators concerning the quality of the process, for example throughput time per process step, as well as the quality of the final result, for example the number of patients discharged from the nursing home back to their home situation. Those performance indicators need to be measured, registered and monitored. Based on those data processes can be evaluated and adjusted. Information transfer must also focus on the different links of the chain (TPG, 2004). MST can improve the information service by linking the different database systems. And with use of the available and correct information, MST can provide better monitoring and evaluation of their care processes. We give recommendations about the following subjects: Usefulness of Transferpunt database, Linkage of database systems within MST, and monitoring and evaluating the clinical pathway for hip fracture patients.

5.3.1 USEFULNESS OF TRANSFERPUNT DATABASE:

The first problem faced regarding the information service is the use of manual applications. A solution for this problem is that Transferpunt nurses can use an extra predefined set of choices in the main page database. Appendix 3 displays an overview of the main page of the Access database. We therefore recommend the use of a drop-down list which makes it possible to choose the specific type of follow-up care or follow-up care organization specified by DRG code. The Transferpunt database already uses drop-down lists for example civil class (‘burgelijke staat’) and care insurer (‘zorgverzekeraar’) displayed in the yellow boxes in appendix 3.

5.3.2 LINKAGE DATABASE SYSTEMS:

The first problem faced regarding the linking of the database systems is the lack of a treatment specification in the database of *Transferpunt*. To classify a patient at a certain treatment specification, for example, hip fracture, the patient description of each patient must be read and on the basis of the patient description the patients has to be classified manually. An additional problem is that the Transferpunt nurses use different names for a hip fracture like: “Collum #, collum fractuur, medial collum #, petrochantere femur #”. As a result, this database cannot easily be linked with the X-care database. A solution for this problem is that Transferpunt nurses can use also for this problem an extra predefined set of choices in the main page of the database.

Appendix 3 displays an overview of the main page of the Access database. We therefore also recommend the use of a drop-down list which makes it possible to classify patients per treatment type.

A second problem is that Transferpunt uses a new patient number for each patient applied for follow-up care. This number is displayed in Appendix 3 in the first yellow textbox. This patient number is not the same patient number used in the other databases within MST. Therefore we recommend that the general patient number ("Burger Service Nummer", BSN) is also stored into the database of Transferpunt. This number is already listed in the yellow textbox, but is not filled in at Transferpunt.

5.3.3 MONITORING AND EVALUATION CLINICAL PATH WAY:

This research focuses on the performance of January 2008 until August 2009. We recommend using this research as a zero measurement, and the new clinical pathway as an indicator for post measurement. The use of performance indicators make it possible to evaluate how successful the care process is in terms of making progress towards the predefined service level.

The following performance indicators can be used:

- Duration of registration based on time between admittance and applying at Transferpunt.
- Duration of medical treatment based on time between admittance and end date medical treatment.
- Access time for follow-up care based on time end date medical treatment and discharge.
- Length of stay MST based on time between admittance and discharge.
- Length of stay follow-up care organization AZP Eschpoort based on time between discharged MST (or admittance nursing home) and discharge nursing home.

Appendix 4 displays a measurement proposal for evaluating the clinical pathway and the collaboration with AZP Eschpoort.

5.4 BED CAPACITY DETERMINATION FOR FOLLOW-UP CARE IN NURSING HOME BY COMPUTER SIMULATION

In chapter 4, the problem of the number of beds in *AZP Eschpoort* that will be reserved for the hip fracture patients discharged from MST is explained. In this chapter, we analyze the optimal number of beds by using a simulation model of the historical discharge data of January 2008 until August 2009.

5.4.1 DESCRIPTION SIMULATION MODEL

We developed an Excel model where we analyze the actual bed capacity in nursing home AZP Eschpoort. Appendix 5 explains the purpose and functioning of the model. We analyze all admitted hip fracture patients at MST in the period January 2008 until August 2009. If a patient is discharged from MST in a certain week, we fill

out this patient in the Excel model, as 'patients applied' for short term rehabilitation in nursing home AZP Eschpoort.

Two different strategies are implemented: "with blocking" and "no blocking". In both strategies the following principles and restrictions are used:

- All hip fracture patients applied for short term rehabilitation at MST are in first instance discharged to AZP Eschpoort
- If beds are available at AZP Eschpoort, patients stay 90 days.
- The number of beds is exclusively used for hip fracture patients discharged from MST.
- Random numbers are based on the probability of the number of patients applied for short term rehabilitation at MST per week, on the actual period of January 2008 to August 2009.
- Simulation is based on probability distribution for a period of 230 year.

5.4.2 FORMULAS

$$\text{Occupation rate} = \frac{\text{the number of patients staying in nursing home AZP Eschpoort}}{\text{bed capacity AZP Eschpoort}}$$

$$\text{Refusal rate} = \frac{\text{the number of patients refused at nursing home AZP Eschpoort}}{\text{The number of patients discharged from MST}}$$

$$\text{Access rate} = \frac{\text{The number of patients waiting}}{\text{The number of patients discharged from MST}}$$

5.4.3 STRATEGIES

Strategy 1: with blocking

All patients applied for short term rehabilitation at MST are discharged to *AZP Eschpoort* on the condition that beds are available. In case no bed is available, the patient will be directly applied to other care organization. The access time for patients admitted at *AZP Eschpoort* is always zero. The access time for the patients refused at *AZP Eschpoort* is dependent on the access times for other care organizations.

Strategy 2: no blocking

In this strategy, all patients applied for short term rehabilitation at MST are always discharged to AZP Eschpoort. Depending on the total number beds, patients deal with access times. No patients are refused or discharged to other care organizations. The patients have no choice for a care organization.

5.4.4 OPTIMAL SOLUTION PER STRATEGY

MST strives for minimizing the access time to follow-up care, and AZP Eschpoort strives for maximizing the bed occupation, in practice they must achieve an occupation rate of 98%. We equalize the bed occupation and the refusal or access rate, 50% and 50%. Table 24 displays the results of the model for strategy 1 and the optimal number of beds, 33 beds. Table 25 displays the results of the model for strategy 2 and the optimal number of beds, 36 beds.

Number of beds	14	15	16	17	18	19	20	21	22
Occupation rate	96,49%	96,38%	95,91%	95,61%	95,17%	94,93%	94,32%	93,69%	93,05%
Refusal rate	50,99%	48,37%	45,14%	41,34%	38,70%	35,34%	32,83%	29,73%	26,44%
Access rate	0%	0%	0%	0%	0%	0,00%	0,00%	0,00%	0,00%
Score	72,75%	74,01%	75,39%	77,14%	78,24%	79,80%	80,74%	81,98%	83,31%

Number of beds	23	24	25	26	27	28	29	30	31
Occupation rate	92,11%	91,89%	91,31%	90,01%	89,17%	87,79%	86,80%	85,11%	83,95%
Refusal rate	23,69%	21,10%	18,79%	16,56%	14,33%	11,41%	9,48%	7,68%	6,57%
Access rate	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Score	84,21%	85,39%	86,26%	86,73%	87,42%	88,19%	88,66%	88,72%	88,69%

Number of beds	32	33	34	35	36	37	38	39	40
Occupation rate	82,43%	81,47%	80,33%	78,26%	76,37%	75,11%	73,10%	71,56%	69,54%
Refusal rate	5,40%	3,82%	2,79%	2,30%	1,40%	1,05%	0,65%	0,45%	0,23%
Access rate	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Score	88,51%	88,82%	88,77%	87,98%	87,48%	87,03%	86,22%	85,55%	84,65%

Table 24: Calculated optimal number of beds for strategy 1

Number of beds	25	26	27	28	29	30	31	32	33
Occupation rate	100,00%	99,95%	99,83%	99,77%	95,49%	92,79%	89,73%	86,64%	85,45%
Refusal rate	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Access rate	99,94%	99,58%	98,82%	98,69%	62,57%	47,75%	30,97%	22,54%	19,00%
Score	50,03%	50,18%	50,51%	50,54%	66,46%	72,52%	79,38%	82,05%	83,23%

Number of beds	34	35	36	37	38	39	40	41	42
Occupation rate	82,66%	80,54%	78,08%	74,99%	73,18%	71,09%	69,75%	68,04%	66,64%
Refusal rate	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Access rate	11,48%	9,81%	4,40%	2,32%	1,99%	1,04%	0,74%	0,26%	0,15%
Score	85,59%	85,37%	86,84%	86,34%	85,59%	85,02%	84,51%	83,89%	83,25%

Number of beds	43	44	45	46
Occupation rate	65,50%	63,18%	61,96%	60,51%
Refusal rate	0,00%	0,00%	0,00%	0,00%
Access rate	0,09%	0,30%	0,02%	0,00%
Score	82,71%	81,44%	80,97%	80,25%

Table 25: Calculated optimal number of beds for strategy 2

5.5 MANAGEMENT ACTIONS

Managing of the described recommendations in paragraph 5.1 up to 5.4 is mainly on tactical management level. Reducing patient variability by classifying patients into homogeneous sub groups can be obtained by evaluating monthly the new developed clinical pathway. Standardization of work processes can be realized by developing the clinical pathway. The use and linking of the database systems within MST can be obtained by adapting drop down lists. The total bed capacity reserved for hip fracture patients from MST to AZP Eschpoort can be obtained by agreements with the project group "Snel Herstel". The decisions on tactical level must be performed at operational level. For example the procedures within the clinical pathway concerning the day of registration must be performed by nurses at the inpatient department. And the Transferpunt nurses must fill in the new adapted drop down lists within the database system. Tactical management charges operational employees with tasks, but tactical management must control those tasks.

The corresponding managerial areas are medical planning, demand planning, and information and communication coordination.

Improvements regard to the patient variability concern and improvements regard to the day of registration concern medical planning at the hospital. Agreements about the bed capacity reserved for hip fracture patients concerns the demand planning. And improvements regard to the use and storage of data concern the information and communication coordination. Also patient information concerns information and communication coordination. Network coordination planning is an important management area in the future, when agreements are definitely made with nursing home AZP Eschpoort and the collaboration is implemented. Aspects like performance indicators which measures the results of the collaboration.

We subdivide the previously described process related factors on managerial area and hierarchical decomposition. Figure 42 and 43 display the position of the bottlenecks in the framework for hospital planning and control and the frame work of integrated care. This position indicates the management actions regarding the defined problems specified on managerial area and hierarchical decomposition.

Managerial area / Hierarchical decomposition	Medical planning	Resource capacity planning	Material planning	Financial planning
Strategic		Bed capacity (nursing home)		
Tactical	Patient variability			
Operational offline	Day of registration			
Operational online				

Figure 42: Framework hospital planning and control

(Source: Houdenhoven, 2007)

Managerial area / Hierarchical decomposition	Demand planning	Information and communication coordination	Network coordination planning
Strategic			Decision for collaboration for integrated care
Tactical	Bed capacity	Use and storage of data	Agreements for collaboration integrated care
Operational offline		Patient information	
Operational online			

Figure 43: Framework integrated care planning and control

(Source: Houdenhoven, 2007

5.6 CONCLUSION

- Inter and intra clinical variability patients can be reduced by classifying hip fracture patients into homogeneous sub groups within MST as well as within the nursing homes.
- The time between admittance and applying for follow-up care at Transferpunt can be shortened by standardization of work processes based on procedures and agreements. Therefore, MST is developing a clinical pathway.
- Usefulness of Transferpunt database can be improved by using a predefined set of choices in the main page of the database, like the use of a drop-down-list.
- Linking of the database systems within MST can be improved by classifying patients per patient type in the Transferpunt database by using a drop-down-list.
- Linking of the database system Transferpunt within MST can be improved by using the same patient numbers within the database systems.
- Performance indicators can be used for monitoring and evaluating the new clinical pathway and the defined service level

- The optimal number of beds for strategy 1: with blocking are 33 beds.
- The optimal number of beds for strategy 2: no blocking are 36 beds.
- Management action is mainly on tactical level and concerns medical, demand, and information and communication coordination.

6 CONCLUSION

In this chapter we discuss the conclusions on the three aspects of the main goal of this research:

We provide a detailed description of the integrated care processes of hip fracture patients of MST, identify factors that influence the access time to follow-up care, and formulate possible recommendations.

The description of the integrated care process of hip fracture patients of MST is twofold:

How is the process organized and what is the performance of this process?

Hip fracture patients arrive at the hospital with haste, and a surgical or orthopaedic doctor decides if a patient is admitted into the hospital. A national rule requires surgery within 24 hours. After surgery the patient recovers at the inpatient department and a nurse decides if and what type of follow-up care is required. In this research, we focus on one type of follow-up care: short term rehabilitation. In the nursing home the patient recovers by rehabilitation. The goal is to discharge a patient after a while from the nursing home to the patient's former home situation. Regarding the performance of the integrated care process the main aspects are the registration for follow-up care and the duration of medical treatment. Registration takes too long and slows down the process; as a result the access time to follow-up care increases. Duration of medical treatment is highly dependent on the physical condition of the patient. The treatment of a hip fracture is a standard surgery, but as a result of the high age of the patients, many side complications occur. This also influences the length of stay in the nursing home. In general, the data used for the performance analysis is hard to obtain.

Identifying factors that influence the access time to follow-up care are also twofold:

What patient characteristics predict a longer medical treatment at MST or a longer length of stay in the nursing home and what are the process at MST and the nursing home that influence the access time to follow-up care?

Regarding the patients characteristics, almost every screened hip fracture patient above 65 years of age is regarded as vulnerable. Because of the vulnerability, 26 percent of the patients are diagnosed with symptoms of a delirium and 21 percent of the screened patients show signs of malnutrition. The patients with symptoms of a delirium and patients where a dietician is consulted show shorter medical treatment than the patients with low scores. More attention is given to the patients with high scores. Younger patients (≤75year) show shorter medical treatment at MST than older patients (>75). In AZP Eschpoort the younger patients need longer average rehabilitation time than the older patients. In ZGS Oldenhove all patients above 65 years of age have almost the same average rehabilitation time. Patients at AZP Eschpoort in general need shorter rehabilitation

time than patients at ZGS Oldenhove. However patients from ZGS Oldenhove are mostly discharged to their own home and patients from AZP Eschpoort are sooner transferred to other types of care.

The process factors are fivefold. First, registration for follow-up care takes too long. This is because no procedures exist with respect to the moment a patient is applied for follow-up care, estimating the type of follow-up care at an early stage is difficult, and registration is delayed because Transferpunt is closed during the weekend. Second, the current use and storage of data within MST creates problems for evaluating and monitoring. X-care database contains much information, but the practical use of the database is difficult. The hip fracture patients' overview also contains patient with hip complaints, because for those patients there is no specific DRG code. The number of patients specified per treatment does not correspond with the total number of patients as a result of formulas in the system. At least, administrative differences exist between the surgical and orthopaedic department. The database of Transferpunt is not capable of creating an overview of the patients in a certain patient group specified by DRG code, for example hip fracture patients. And by using manual input of data, lots of different names are created for one type of follow-up care or care organization. Transferpunt uses a new patient number for each new patient applied for follow-up care. As a result, the number does not correspond with the patient number in X-care, therefore the linking a patient in the two database system is hard to obtain. Third, to shorten the access time for patients discharged from MST to a nursing home, AZP Eschpoort is willing to reserve a number of beds only for hip fracture patients from MST. But the number of required beds required is unknown. Fourth, the duration of medical treatment takes too long because many patients have multiple care problems and complications occur. Fifth, patients are not always informed well because information brochures are forgotten or information is not given accurately.

The recommendations for improvement of the integrated care process are also twofold:

Which interventions shorten the access time to follow-up care and on which management level and area action is required?

The recommendations focus on the main problems: patient variability, registration for follow-up care, use and storage of data, and bed capacity at AZP Eschpoort. Patient variability can be reduced by classifying hip fracture patients into homogeneous sub groups within MST as well as within the nursing home. The time between admittance and applying for follow-up care at Transferpunt can be shortened by standardization of work processes based on procedures and agreements. MST is currently developing a clinical pathway to do this. Usefulness and linking of Transferpunt database can be improved by using a predefined set of choices in the main page of the database, like the use of a drop-down-list for grouping patients and reducing manual input. Performance indicators can be used for monitoring and evaluating the new clinical pathway as well as for evaluating the predefined service level. Simulation shows that in the optimal situation a bed capacity of 33 beds is required if AZP Eschpoort admits all hip fracture patients from MST and when no beds are available the patient is discharged to another care organization. A bed capacity of 36 beds is required if all patients are admitted at AZP Eschpoort and MST always waits for a free bed. Overall, management action is mainly required

on tactical level and concerns medical planning, demand planning, and information and communication coordination.

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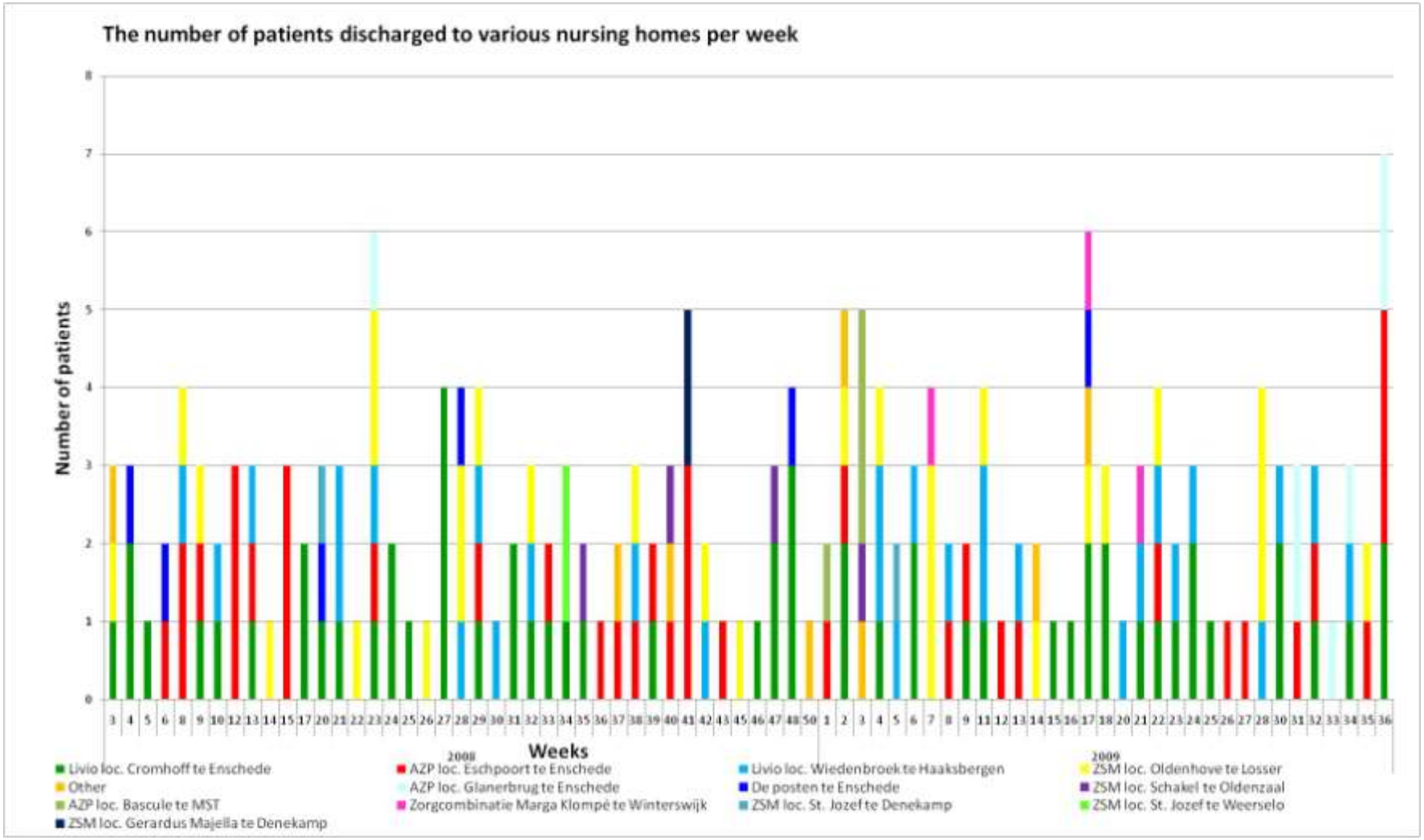
APPENDIX 1


The number of patients discharged to various nursing homes per week
Number of patients
0
1
2
3
4
5
6
7
8
3 4 5 6 8 9 10 12 13 14 15 17 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 45 46 47 48 50 1 2 3 4 5 6 7 8 9 11 12 13 14 15 16 17 18 20 21 22 23 24 25 26 27 28 30 31 32 33 34 35 36
2008
Weeks
2009
Livio loc. Cromhoff te Enschede
AZP loc. Eschpoort te Enschede
Livio loc. Wiedenbroek te Haaksbergen
ZSM loc. Oldenhove te Losser
Other
AZP loc. Glanerbrug te Enschede
De posten te Enschede
ZSM loc. Schakel te Oldenzaal
AZP loc. Bascule te MST
Zorgcombinatie Marga Klompé te Winterswijk
ZSM loc. St. Jozef te Denekamp
ZSM loc. St. Jozef te Weerselo
ZSM loc. Gerardus Majella te Denekamp

APPENDIX 2

Heupfracturen

Beginjaar DBC: 2008 t/m december

Chirurgie

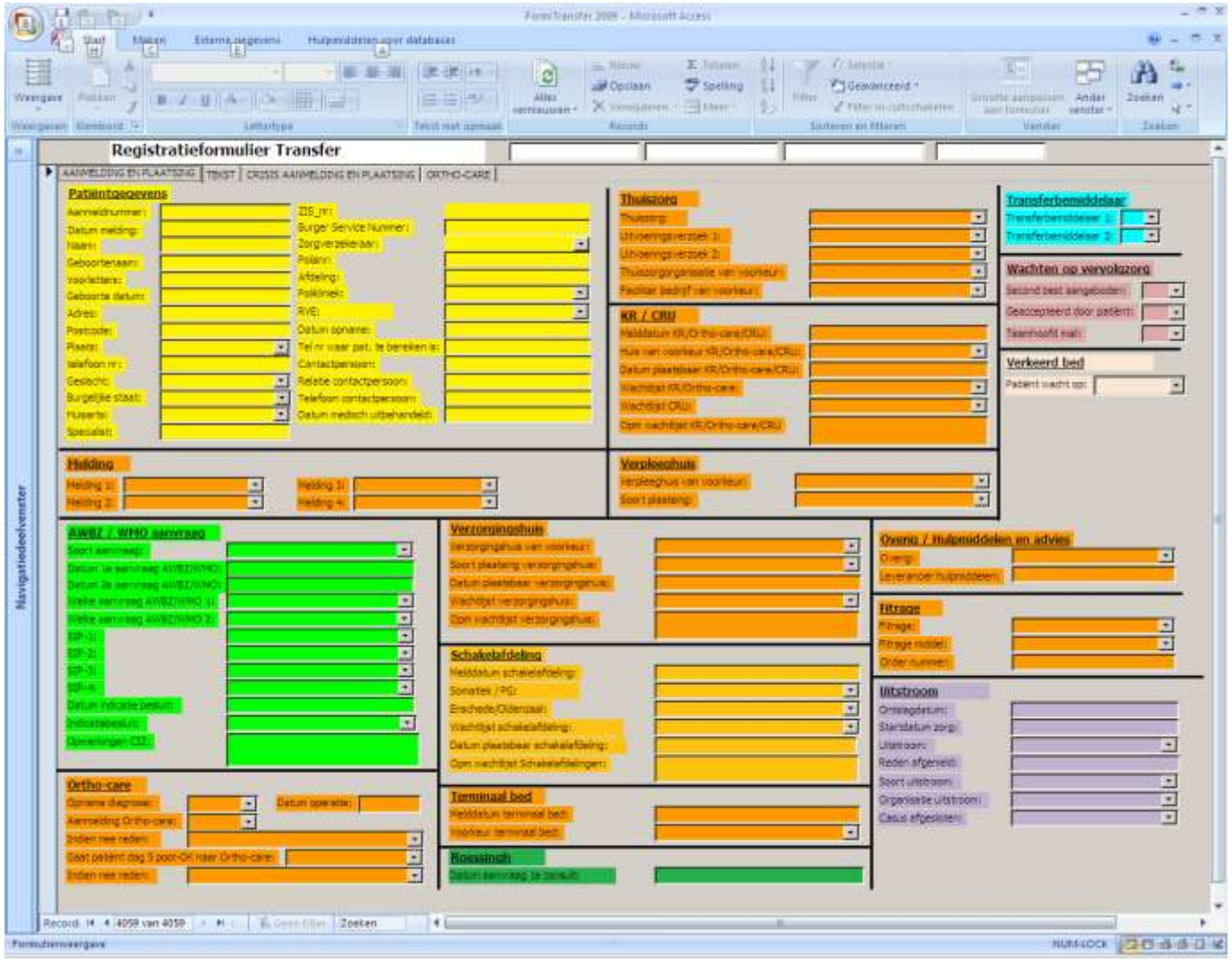
DBC Dataset	DBC Diagnose Code	DBC Diagnose Oms	DBC Behandeling Code	DBC Behandeling Oms	Aantal DBC Trajecten	Aantal patienten
03.11..218.101	218	femur, proximaal (+ collum)	101	Conservatief poliklinisch	12	12
03.11..218.103	218	femur, proximaal (+ collum)	103	Conservatief kl episode(n)	20	20
03.11..218.104	218	femur, proximaal (+ collum)	104	Enkelv polikl conserv	32	32
03.11..218.203	218	femur, proximaal (+ collum)	203	Operatief kl episode(n)	156	152
03.11..218.206	218	femur, proximaal (+ collum)	206	KZD operatief kl episode(n)	1	1
03.21..218.101	218	femur, proximaal (+ collum)	101	Conservatief poliklinisch	33	32
03.21..218.103	218	femur, proximaal (+ collum)	103	Conservatief kl episode(n)	2	2
03.21..218.104	218	femur, proximaal (+ collum)	104	Enkelv polikl conserv	38	38
03.21..218.202	218	femur, proximaal (+ collum)	202	Operatief dagopname(n)	1	1
03.21..218.203	218	femur, proximaal (+ collum)	203	Operatief kl episode(n)	2	2
					297	**242**

Orthopedie

DBC Dataset	DBC Diagnose Code	DBC Diagnose Oms	DBC Behandeling Code	DBC Behandeling Oms	Aantal DBC Trajecten	Aantal patienten
05.11..3018.111	3018	Acetabulum	111	Conservatief poliklinisch	1	1
05.11..3019.111	3019	Femur proximaal (+collum)	111	Conservatief poliklinisch	4	4
05.11..3019.113	3019	Femur proximaal (+collum)	113	Conservatief kl epi	14	14
05.11..3019.114	3019	Femur proximaal (+collum)	114	Enkelv polikl conserv	2	2
05.11..3019.213	3019	Femur proximaal (+collum)	213	Operatief kl epi	16	16
05.11..3019.216	3019	Femur proximaal (+collum)	216	KZD operatief met klin epi(n)	1	1
05.11..3019.223	3019	Femur proximaal (+collum)	223	Oper klin gewrichtsproth	85	84
05.11..3019.226	3019	Femur proximaal (+collum)	226	KZD Oper klin gewrichtsproth	2	2
					125	**122**

(Source: X-care MST, Jan-Dec 2008)

APPENDIX 3


Registratieformulier Transfer
AANMELDING EN PLAATSING
TRIGT
CRISIS AANMELDING EN PLAATSING
ORTHO-CARE
Patiëntgegevens
Thuiszorg
KR / CRU
Transferbemiddelaar
Wachten op vervolgzorg
Verkeerd bed
Melding
Verpleeghuis
AWBZ / WMO aanvraag
Verzorgingshuis
Overig / Hulpmiddelen en advies
Fitrage
Schakelafdeling
Uitstroom
Ortho-care
Terminaal bed
Roessingh
Navigatiedeelvenster

APPENDIX 4

Nummer	Te meten gegevens MST (algemene/prestatie indicatoren)	Wie registreert?	**Ontvangst gegevens**	Data voorziening	Omschrijving	Wie analyseert?
A.I.1	Totaal aantal heupfractuur patiënten opgenomen in MST	MST breed Barteld Lenting	Wekelijks Maandag? E-mail?	X-care – Heupfracturen	**Chirugie:** - Conservatief kl Episode(n): 03.11.218.103 - Operatief kl. Episode(n): 03.11.218.203 - KZD Oper kl Episode(n):03.11.218….. **Orthopedie:** - Conservatief kl. Episode(n): 05.11.3019.113 - Operatief kl. episode(n): 05.11.3019.213 - Operatief kl gewrichtsproth: 05.11.3019.223 - KZD Oper kl gewrichtsproth: 05.11.3019.226	M. v. S.
A.I.2	Aantal heup fractuur patiënten opgenomen per afdeling (D3, A5 en overig)	Barteld Lenting	Wekelijks Maandag? E-mail?	X-care - Heupfracturen	-	M. v. S.
A.I.3	Aantal heup fractuur patiënten opgenomen in het klinisch pad (per afdeling?)	M.v.S	Wekelijks Maandag Op afdeling	Rode mappen afdeling - Klinisch pad	-	M. v. S.
A.I.4	Aantal heupfractuur patiënten aangemeld voor KR Project Snel Herstel	Transferpunt Secr/bemiddelaar	Wekelijks	Transferpunt database - Orthocare/Snel Herstel	- Opname diagnose: Heupfractuur - Aanmelding Snel Herstel: Ja	M. v. S.
A.I.5	Aantal heupfractuur patiënten aangemeld voor KR bij ander verpleeghuis	Transferpunt Secr/bemiddelaar	Wekelijks	Transferpunt database - Orthocare/Snel Herstel	- Opname diagnose: Heup - Aanmelding Snel Herstel: Nee - Naam ander verpleeghuis	M. v. S.
	Reden dat heupfractuur patiënt niet bij	Transferpunt	Wekelijks	Transferpunt database	- Indien nee reden: Voorkeur, anders	M. v. S.

	AZP wordt aangemeld.	Secr/bemiddelaar		- Orthocare/Snel Herstel		
A.I.6	Aantal heupfractuur patiënten opgenomen voor KR in AZP	Transferpunt Secr/bemiddelaar	Wekelijks	Transferpunt database Uitstroom	- Soort uitstroom - Organisatie uitstroom	M. v. S.
A.I.7	Aantal heupfractuur patiënten opgenomen voor KR in ander verpleeghuis.	Transferpunt Secr/bemiddelaar	Wekelijks	Transferpunt database - Uitstroom	- Soort uitstroom - Organisatie uitstroom	M. v. S.
	Reden dat heup fractuur patiënt niet bij AZP wordt opgenomen	Transferpunt Secr/bemiddelaar	Wekelijks	Transferpunt database - Orthocare/Snel Herstel	- Patiënt 5 dagen na OK naar Snel Herstel, indien nee reden: Voorkeur, geen plek AZP, anders	M. v. S.
A.I.8	Uitstroom van alle opgenomen heup fractuur patiënten vanuit de verpleegafdeling	M.v.S.	Wekelijks	Rode mappen afdeling - Klinisch pad	- Naar huis (evt. met thuiszorg) - Naar KR - Naar langdurig - Overleden	M. v. S.
	Variantie rapportage (afwijkingen klinisch pad)	M.v.S.	Wekelijks Maandag Op afdeling	Rode mappen - Klinisch pad - Variantie rapport?		M. v. S.
P.I.1	Moment van aanmelding bij Transferpunt	Transferpunt Secr/bemiddelaar	Wekelijks	Transferpunt database - Patiënt gegevens - KR/CRU	- Datum opname - Melddatum KR/Snel Herstel	M. v. S.
P.I.2	Duur indicatieaanvraag	Transferpunt Secr/bemiddelaar	Wekelijks	Transferpunt database - Patiënt gegevens - AWBZ/WMO aanvraag	- Datum opname - Datum indicatie aanvraag	M. v. S.
P.I.3	Duur indicatie besluit SIP	Transferpunt Secr/bemiddelaar	Wekelijks	Transferpunt database - Patiënt gegevens - AWBZ/WMO aanvraag	- Datum opname - Datum indicatie besluit - Welke aanvraag (SIP)	M. v. S.
P.I.4	Duur indicatie besluit Regulier	Transferpunt	Wekelijks	Transferpunt database	- Datum opname	M. v. S.

		Secr/bemiddelaar		- Patiënt gegevens -AWBZ/WMO aanvraag	- Datum indicatie besluit - Welke aanvraag (regulier)	
P.I.5	Duur medisch uitbehandeld	Transferpunt Secr/bemiddelaar	Wekelijks	Transferpunt database - Patiënt gegevens	- Datum opname - Datum medisch uitbehandeld	M. v. S.
P.I.6	Ligduur in MST	Transferpunt Secr/bemiddelaar	Wekelijks	Transferpunt database - Patiënt gegevens - Uitstroom	- Datum opname - Datum ontslag	M. v. S.
P.I.7	Wachttijd MST	Transferpunt Secr/bemiddelaar	Wekelijks	Transferpunt database - Patiënt gegevens - Uitstroom	- Datum medisch uitbehandeld - Datum ontslag	M. v. S.

Tabel 1: Te meten gegevens MST

Nummer	Te meten gegevens AZP Eschpoort (algemene/prestatie indicatoren)	Wie registreert?	Ontvangst gegevens	Data voorziening	Wie analyseert?
A.I.6	Totaal aantal heup fractuur patiënten opgenomen voor Snel Herstel (KR) in AZP Eschpoort	Persoonlijk Begeleider AZP (PB)	Maandelijks Laatste dag vd maand E-mail	Excel sheet M.v.S.	M. v. S.
A.I.9	Aantal heup fractuur patiënten die binnen 90 dagen na opname op KR bed met ontslag gaat vanuit AZP	PB	Maandelijks Laatste dag vdmaand E-mail	Excel sheet M.v.S.	M. v. S.
	Reden dat patiënt langer dan 90 dagen op KR-bed in AZP ligt.	PB	Maandelijks Laatste dag vd maand E-mail	Excel sheet M.v.S.	M. v. S.
A.I.10	Aantal heup fractuur patiënten die uitstroomt naar huis	PB	Maandelijks Laatste dag vd maand E-mail	Excel sheet M.v.S.	M. v. S.
A.I.11	Aantal heup fractuur patiënten die uitstroomt naar een ander type zorg	PB	Maandelijks Laatste dag vd maand E-mail	Excel sheet M.v.S.	M. v. S.
P.I.8	Ligduur (KR duur) van de opgenomen heup fractuur patiënten	PB	Maandelijks Laatste dag vd maand E-mail	Excel sheet M.v.S.	M. v. S.

Tabel 2: Te meten gegevens AZP Eschpoort

APPENDIX 5

Deze handleiding beschrijft kort de opzet en de werking van het simulatie model uit paragraaf 5.4.

Doelstelling

Het genereren van een overzicht met betrekking tot het aantal benodigde bedden in de situatie dat het AZP Eschpoort (alle) heup fractuur patienten vanuit het MST opneemt. Daarbij geeft het overzicht de consequenties weer bij een bepaald aantal bedden voor de bezettingsgraad van het AZP Eschpoort, de wachttijd vanuit het MST en het percentage weigering bij volle bed bezetting in het AZP Eschpoort.

Model

Om de doelstelling te behalen zijn er twee strategieen opgesteld: 'with blocking' en 'no blocking'.

Strategie 1: 'with blocking'

Strategie 1 houdt in dat alle heup fractuur patienten, medisch behandeld in het MST, die Kortdurende Reactivering (KR) zorg nodig hebben, worden overgeplaatst naar AZP Eschpoort, onder de voorwaarde dat er bedden vrij zijn. Indien er geen bedden vrij zijn, wordt de patient direct aangemeld voor een andere zorgaanbieder.

Strategie 2: 'no blocking'

Strategie 2 houdt in dat alle heup fractuur patienten, medisch behandeld in het MST, die Kortdurende Reactivering (KR) zorg nodig hebben, in alle gevallen worden overgeplaatst naar AZP Eschpoort. Indien er geen bedden vrij zijn, wacht een bed in het MST totdat er plek is.

Aannames/beperkingen

De volgende principes worden gehanteerd in het model:

- Alle heup fractuur patienten, aangemeld voor KR vanuit het MST, worden in eerste instantie overgeplaatst naar AZP Eschpoort.
- Indien overplaatsing, patienten verblijven voor KR 90 dagen.
- De beschikbare bedden bij het AZP Eschpoort worden uitsluitend gebruikt voor heup fractuur patienten vanuit het MST.
- Random toewijzing is gebaseerd op de waarschijnlijkheid van het aantal heup fractuur patienten aangemeld voor KR vanuit het MST per week, op basis van cijfers in de periode jan 2008 t/m aug 2009.
- Simulatie is gebaseerd op een waarschijnlijkheidsdistributie van 230 jaar.

Werking model

1. **Vanuit MST**: # patienten aangemeld.
   Dit zijn het aantal heup fractuut patienten die worden aangemeld voor KR in een bepaalde week. Dit aantal is gebaseerd op random toewijzing op basis van de kans dat een bepaald aantal patienten per week voorkomt.
2. **Wachtkamer begin van de week**: # nieuwe patienten naar de wachtkamer.
   Dit zijn het aantal heup fractuur patienten die moeten wachten totdat er een bed vrij komt. In strategie 1 is dit altijd nul, omdat als er geen bedden vrij zijn, patienten direct worden aangemeld voor een andere zorgaanbieder. In strategie 2 kan dit wel voorkomen.
3. **Binnenkomende patienten in het verpleeghuis**: # nieuwe patienten in het verpleeghuis. Dit zijn het aantal heup fractuur patienten die direcht kunnen worden overgeplaatst vanuit het MST naar het AZP Eschpoort.
4. **Binnenkomende patienten in het verpleeghuis**: # patienten naar verpleeghuis via wachtkamer. Dit zijn het aantal heup fractuur patienten dat via de wachtkamer (in praktijk: liggen te wachten in het MST), worden overgeplaatst naar het AZP Eschpoort.
5. **Uitgaande patienten**: # patienten ontslagen vanuit het verpleeghuis. Dit zijn het aantal patienten die in een bepaalde week worden ontslagen. Dit is voor elke patient na 90 dagen In het model geldt dit als 13 weken.
6. **In het verpleeghuis**: # patienten in het verpleeghuis. Dit zijn het aantal heup fractuur patienten die in een bepaalde week verblijven in het verpleeghuis AZP Eschpoort voor KR zorg.
7. **Tekort:** Dit geeft in bewoording aan of er een 'tekort' is aan bedden.
8. **Wachtkamer einde van de week:** Dit zijn het aantal heup fractuur patienten die in de wachtkamer verblijven (in praktijk: die wachten in het MST) totdat er een bed vrij komt.
9. **Random toewijzing:** Dit is de kans dat een bepaald aantal heup fractuur patienten wordt aangemeld in een bepaalde week.
10. **Overcapaciteit:** Dit zijn de vrije bedden in het AZP Eschpoort.

Voorbeeld

Het aantal bedden, afgebeeld in het gele vlak in onderstaande tabel, kan aangepast worden naar eigen aantal.

<u>Strategie 1</u>:

Aantal bedden	20
Bezettingsgraad	94,3%
Weigeringsratio	33%
Wachtratio	0,00%

In week 31 zijn er 3 aanmeldingen voor een KR plek. In week 30 verbleven al 19 patienten in het verpleeghuis. Er worden 0 patienten ontslagen aan het begin van week 31. Hierdoor is er nog maar plek voor 1 patient. Dit is

te zien in de groene kolom: # nieuwe patienten naar verpleeghuis. De 2 andere aanmeldingen worden geweigerd en worden door het MST aangemeld voor een andere zorgaanbieder. De wachtkamer is bij strategie 1 altijd leeg, omdat patienten direct worden aangemeld bij een andere zorgaanbieder, indien er geen plek is. Het nieuwe totaal patienten in het verpleeghuis aan het einde van week 31 is 20 patienten.

Strategie 2:

Aantal bedden	30
Bezettingsgraad	92,7%
Weigeringsratio	0%
Wachtratio	47,90%

In week 31 zijn er 2 aanmeldingen voor een KR plek. In week 30 verbleven al 27 patienten in het verpleeghuis. Er worden 3 patienten ontslagen aan het begin van week 31. Hierdoor is zijn er nog 8 plakken vrij voor patienten. Er zijn geen patienten die nog wachten op een plek, in de wachtkamer. De 2 aanmeldingen kunnen worden geplaatst. Het nieuwe totaal patienten in het verpleeghuis aan het einde van week 31 is 26 patienten.

Strategie 1: “with blocking”

	Vanuit MST	Wachtkamer	Binnenkomende patienten in VH		Uitgaande patienten	In het VH		Wachtkamer		Over capaciteit
Weeknr	# P aangemeld, begin week	# nieuwe patienten naar wachtkamer, begin week	#nieuwe patienten naar VH, begin week	# patienten naar VH via wachtkamer, begin week	# P uitgegaan VH begin week	# patienten VH, einde week	tekort, einde week	Wachtkamer, einde week	RANDOM	bedden die beschikbaar zijn na ontslag deze week, begin deze week
1	2	0	2			2	-	0	0,446317209	20
2	4	0	4	0		6	-	0	0,85802126	18
3	4	0	4	0		10	-	0	0,943441624	14
4	3	0	3	0		13	-	0	0,686907023	10
5	1	0	1	0		14	-	0	0,312787074	7
6	4	0	4	0		18	-	0	0,88187957	6
7	4	0	2	0		20	-	0	0,886705056	2
8	2	0	0	0		20	-	0	0,414315908	0
9	0	0	0	0		20	-	0	0,053824966	0
10	5	0	0	0		20	-	0	0,697430145	0
11	1	0	0	0		20	-	0	0,165682725	0
12	4	0	0	0		20	-	0	0,938134727	0
13	2	0	0	0		20	-	0	0,414248731	0
14	1	0	1	0	2	19	-	0	0,177761939	2
15	1	0	1	0	4	16	-	0	0,207494093	5
16	4	0	4	0	4	18	-	0	0,952581924	8
17	1	0	1	0	3	14	-	0	0,172307828	7
18	0	0	0	0	1	13	-	0	0,008433621	7
19	2	0	2	0	4	11	-	0	0,370222518	11
20	1	0	1	0	2	10	-	0	0,331515992	11
21	3	0	3	0	0	13	-	0	0,671086513	10
22	5	0	5	0	0	18	-	0	0,963708654	7
23	4	0	2	0	0	20	-	0	0,867013807	2
24	3	0	0	0	0	20	-	0	0,742680436	0
25	2	0	0	0	0	20	-	0	0,434786766	0
26	6	0	0	0	0	20	-	0	0,998904877	0
27	3	0	1	0	1	20	-	0	0,756145097	1
28	4	0	1	0	1	20	-	0	0,880485617	1
29	2	0	2	0	4	18	-	0	0,408964651	4
30	2	0	2	0	1	19	-	0	0,526630683	3
31	1	0	1	0	0	20	-	0	0,629185875	1
32	1	0	2	0	2	20	-	0	0,804056921	2
33	2	0	1	0	1	20	-	0	0,388102658	1
34	3	0	3	0	3	20	-	0	0,658776094	3
35	3	0	3	0	5	18	-	0	0,83804282	5
36	4	0	4	0	2	20	-	0	0,874513391	4
37	1	0	0	0	0	20	-	0	0,267343442	0
38	3	0	0	0	0	20	-	0	0,69730982	0
39	3	0	0	0	0	20	-	0	0,734760517	0
40	4	0	1	0	1	20	-	0	0,931894194	1
41	3	0	1	0	1	20	-	0	0,602023136	1
42	1	0	1	0	2	19	-	0	0,284021172	2
43	1	0	1	0	2	18	-	0	0,323381833	3
44	4	0	3	0	1	20	-	0	0,930879248	3
45	3	0	2	0	2	20	-	0	0,800820192	2
46	3	0	1	0	1	20	-	0	0,732468776	1
47	3	0	3	0	3	20	-	0	0,778000584	3
48	0	0	0	0	3	17	-	0	0,070547186	3
49	3	0	3	0	4	16	-	0	0,642831845	7
50	2	0	2	0	0	18	-	0	0,483903395	4

Figuur 1: Strategie 1 “with blocking”: Voorbeeld bij het aantal van 20 beschikbare bedden.

Strategie 2: “no blocking”

	Vanuit MST	Wachtkamer	Binnenkomende patienten in VIR		Uitgaande patienten	In het VIR		Wachtkamer		Over capaciteit
Weeknr	# P aangemeld, begin week	# nieuwe patienten naar wachtkamer, begin week	#nieuwe/aangemelde patienten naar VIR, begin week	# patienten naar VIR via wachtkamer, begin week	# P ontslagen VIR, begin week	# patienten VIR, einde week	tekort, einde week	Wachtkamer, einde week	RANDOM	bedden die beschikbaar zijn na ontslag begin deze week
1	3	0	3			3	-	0	0,631471558	30
2	2	0	2	0		5	-	0	0,484794262	27
3	3	0	3	0		8	-	0	0,711248859	25
4	1	0	1	0		9	-	0	0,198528683	22
5	3	0	3	0		12	-	0	0,834848243	21
6	2	0	2	0		14	-	0	0,503625884	18
7	4	0	4	0		18	-	0	0,933156932	16
8	4	0	4	0		22	-	0	0,89702361	12
9	2	0	2	0		24	-	0	0,430750328	8
10	2	0	2	0		26	-	0	0,391822622	6
11	3	0	3	0		29	-	0	0,762511831	4
12	3	2	1	0		30	tekort	2	0,6376763	1
13	0	0	0	0		30	tekort	2	0,096731164	0
14	3	2	1	2	3	30	tekort	2	0,705397019	3
15	3	3	0	2	2	30	tekort	3	0,580474505	2
16	1	1	0	3	3	30	tekort	1	0,309516957	3
17	4	4	0	1	1	30	tekort	4	0,884270609	1
18	4	4	0	3	3	30	tekort	5	0,898911348	3
19	1	1	0	2	2	30	tekort	4	0,209333132	2
20	0	0	0	4	4	30	-	0	0,028029651	4
21	2	0	2	0	4	28	-	0	0,461208231	4
22	2	0	2	0	2	28	-	0	0,377270749	4
23	3	1	4	0	2	30	tekort	1	0,971818064	4
24	1	0	1	1	3	29	-	0	0,360794051	3
25	0	0	0	0	1	28	-	0	0,029115641	2
26	1	0	1	0	0	29	-	0	0,242794888	2
27	1	0	1	0	3	27	-	0	0,258118793	4
28	2	0	2	0	2	27	-	0	0,420494258	5
29	2	0	2	0	3	26	-	0	0,553413867	6
30	2	0	2	0	1	27	-	0	0,382796133	3
31	2	0	2	0	3	26	-	0	0,402928554	6
32	0	0	0	0	2	24	-	0	0,055485076	6
33	3	0	3	0	4	22	-	0	0,562767298	10
34	3	0	3	0	2	23	-	0	0,652581648	10
35	3	0	3	0	2	24	-	0	0,713269093	9
36	3	0	5	0	4	25	-	0	0,961194557	10
37	1	0	1	0	2	24	-	0	0,313583676	7
38	3	0	3	0	0	27	-	0	0,772548484	6
39	0	0	0	0	1	26	-	0	0,039264891	4
40	3	0	3	0	1	28	-	0	0,799304077	5
41	4	0	4	0	2	30	-	0	0,908840849	4
42	2	0	2	0	2	30	-	0	0,468731452	2
43	2	0	2	0	2	30	-	0	0,504367095	2
44	1	0	1	0	2	29	-	0	0,221350466	2
45	1	0	1	0	0	30	-	0	0,322532727	1
46	1	0	1	0	2	29	-	0	0,240167027	2
47	4	0	4	0	3	30	-	0	0,888354921	4
48	1	0	1	0	3	28	-	0	0,177939649	3
49	1	0	1	0	5	24	-	0	0,345992054	7
50	4	0	4	0	1	27	-	0	0,91439831	7

Figuur 2: Strategie 2 “no blocking”: Voorbeeld bij het aantal van 30 beschikbare bedden.