

Master Thesis Health Sciences

University of Twente

Analysis of the Surgical Outpatient Clinics at Medisch Spectrum Twente June, 2012

Joy van Amersfort

s0205176

Health Sciences - Health Services and Management

ANALYSIS OF THE SURGICAL OUTPATIENT CLINICS AT MEDISCH SPECTRUM TWENTE.

Research in conclusion of the master Health Sciences at the University of Twente.

EXAMCOMMITEE:

UNIVERSITEIT TWENTE

Dr. ir. I.M.H. Vliegen

Dr. J. van Til

MEDISCH SPECTRUM TWENTE

R. Posthuma

Joy van Amersfort s0205176

Student Health Sciences Specialization Health Services and Management

Faculty Management and Governance

University of Twente, Enschede



UNIVERSITEIT TWENTE.

Foreword

You have started to read my report for my master thesis, the result of the final part of my studies Health Sciences at the University of Twente. In this report, I have analyzed the surgical outpatient clinics at Medisch Spectrum Twente. During this time I have learned a great deal about challenges, opportunities, setbacks and obstacles. There is no course that teaches or prepares you for the daily practice, and I am glad I have had the opportunity to have an assignment which brought me there. I would like to thank my instructors Ingrid Vliegen and Janine van Til for their guidance, their patience and support. I also would like to thank Remco Posthuma for his openness, willingness to help, hospitality and also his support throughout the last year. Thanks to the staff, especially the secretaries, for their effort and contribution to the data collection. Thanks to Deloitte for offering the opportunity to contribute to their project, participate in a workshop and insight into their project.

Joy van Amersfort Hengelo, June 2013

Summary

The surgical outpatient clinics at MST service a wide variety of patients. There are three different specialties, namely traumatology; vascular surgery and oncology and gastroenterology surgery. All specialists also see patients from the category 'general surgery'. The specialists hold their consultation hours at three different outpatient clinics. At the outpatient clinics supply and demand are matched, supply being the capacity of the outpatient clinic and demand being the number of appointments needed. A shortcoming in outpatient clinic capacity may cause high access time, overloaded sessions and thus delays in the clinic and overtime. The general experience of the staff is that the access times vary greatly per specialism. The staff finds the frequency of overbooked appointments too high and it causes overloaded consultation hours. They label the waiting time in the clinic as long and sometimes extreme. These problems are affecting patients as well and could lead to dissatisfaction.

The dimensions of quality are safety, timeliness, efficiency, effectiveness, patient-centeredness, and equity. These are also aims for improvement as the experienced problems can be categorized into these dimensions. However, there is a lack of objective information concerning the dimensions of quality in daily practice regarding the consultation hours and there is no insight in terms of quantitative data. The main goal of this study is therefore to investigate how the consultation hours can be improved, with recommendations towards improving the efficiency, effectiveness, timeliness and patient-centeredness of the surgical outpatient clinics at MST.

Data is collected by the means of, 1) survey research, to gather information on the patient perspective and waiting – and service times, 2) a data set of the patient population during the period of data collection to create insight in overbooked appointments and no shows. In addition, supply and demand are compared, access times are gathered, and utilization is calculated.

The results of this study indicate that access times are not consistent in their length which indicates an imbalance between fluctuations in demand and supply. Measuring access times more frequent may provide further insight in the fluctuation and help determine the extent of the shortcoming of supply. Investigation and determination of variations/fluctuations in supply and demand should offer the greatest potential for success according to literature. Fluctuation in supply was seen in the utilization analysis: consultation hours are often not held as scheduled and start an hour later or end earlier than planned. This indicates that specialists carry out other responsibilities in the time that was initially reserved for consults, and secretaries leave a buffer at the end of afternoon sessions where they do not plan any appointments. The efficiency of the consultations hours can therefore be improved. Reducing these fluctuations should also allow to reduce overloaded sessions. There was no balance between overbooked appointments and no shows, and the amount of overbooked appointments was relatively large. It is advised to formulate a policy for overbooking appointments to avoid overloaded sessions which cause delays and overtime.

A general lack of capacity was seen and mostly attributed to oncology. Oncology also had the largest proportion of overbooked appointments and delays which support a capacity problem. Apart from generating capacity, demand can also be reduced. For example by revising the policies for follow-up patients.

Variability in arrival times of patients did not seem to affect the performance of the appointment system as very little patients were tardy. Variability in service time could not be attributed consistently to gender, age, location or activities that were performed during the consult, which can indicate a natural variability inherent to the process. Investigation of this variability may provide insight into possible patient categorization into different codes and service times. Looking at specific patient processes might also lead to the selection of tasks that can be delegated from specialists to nursing staff, nurse practitioners, residents, or possibly other departments.

Waiting times were confirmed, but may be longer and more extreme in practice: 70,15% of the respondents had to wait for their appointment, however only 33,99% of the respondents had to wait as long or longer than their maximum acceptable waiting time. Waiting time can be caused by variability in service time and overbooked appointments. Further research into these causes will allow waiting time to be reduced.

The majority of the respondents were satisfied with the service at the outpatient clinics. The respondents found it most important to have sufficient time with the specialist, the comfort of the waiting area was found least important. Respondents find it more important not to wait longer than their maximum acceptable waiting time than being notified on their waiting time exceeding their appointment time. However, the respondents were divided in their level of agreement on the notification of the waiting time. This can be improved by making use of different tools available for this: a scale in minutes at the front desk where the indicator can be moved to current waiting times or applying for a monitor where news and information can be displayed in the waiting area. Respondents were satisfied with the waiting area, but did indicate suggestions for improvements: most mentioned were recent newspapers and literature and a coffee/tea machine.

Samenvatting

Er komt een breed gevarieerde patiëntenpopulatie in de poliklinieken Heelkunde in het MST. Er zijn drie verschillende specialismen werkzaam op deze poliklinieken, namelijk traumatologie, vaatchirurgie en oncologie en gastro-enterologie. Alle specialisten zien ook algemene chirurgie patiënten. De specialisten houden hun spreekuren op drie verschillende locaties. Op de poliklinieken komen vraag en aanbod samen, waar de vraag bestaat uit het aantal consulten dat nodig is en het aanbod bestaat uit de capaciteit van de poliklinieken. Een tekort aan poliklinische capaciteit kan hoge toegangstijden, overbelaste sessies en daarmee vertragingen in de kliniek en overwerk. De ervaring van het personeel is dat de toegangstijden variëren per specialisme, het aantal afspraken dat overboekt wordt te groot is en een overbelasting veroorzaakt. Verder benomen zij de wachttijd als lang en soms extreem. Deze problemen beïnvloeden ook de patiënt en dit kan leiden tot patiëntontevredenheid.

De dimensies van kwaliteit zijn veiligheid, tijdigheid, effectiviteit, patiëntgerichtheid, en gelijkheid. Tegelijkertijd zijn dit doelen tot verbetering, omdat de ervaren problemen kunnen worden gerelateerd aan deze dimensies. Er is echter een gebrek aan objectieve informatie met betrekking op de dimensies van kwaliteit in de praktijk van de spreekuren en er is geen inzicht op het gebied van kwantitatieve data. Het hoofddoel van deze studie is daarom om te onderzoeken hoe de spreekuren kunnen worden verbeterd door aanbevelingen te doen om efficiëntie, effectiviteit, tijdigheid en patiëntgerichtheid te verbeteren.

Data wordt verzameld door 1) een vragenlijstonderzoek, om informatie te verzamelen over het patiëntenperspectief en wacht- en service tijden, 2) een dataset te creëren, gedurende de dataverzamelingsperiode, van de patiëntenpopulatie om overboekingen en no shows inzichtelijk te maken. Daarnaast wordt vraag en aanbod vergeleken, toegangstijden verzameld en bezetting berekend.

De resultaten van dit onderzoek laten zien dat de toegangstijd niet consistent is qua lengte. Dit is een indicatie voor een onbalans in de variatie in vraag en aanbod. Regelmatige metingen met betrekking tot de toegangstijden kunnen verder inzicht geven in deze variaties en de tekortkoming van het aanbod vast stellen. Deze benadering heeft in de literatuur de meeste potentie op succes. Variatie in het aanbod is geconstateerd in de bezettingsanalyse: spreekuren worden vaak niet gehouden zoals gepland. Dit geeft aan dat specialisten op die momenten andere verantwoordelijkheden uitvoeren gedurende de tijd dat eigenlijk voor consulten had moeten worden gebruikt. Hiernaast laten secretaressen een buffer aan het einde van de middag waar geen afspraken in worden gepland. De efficiëntie van de spreekuren kan worden verbeterd. Door het reduceren van variaties in het aanbod komt er meer tijd vrij voor consulten en kan het aantal overboekingen omlaag gebracht worden. Er was geen balans gevonden tussen de no shows en het aantal overboekingen, welk relatief hoof was. De aanbeveling is dan ook om een beleid te formuleren voor het overboeken van afspraken om overvolle sessies te voorkomen en daarmee wachttijd en overwerk.

Over het algemeen is er een gebrek aan capaciteit, met name voor oncologie. Dit specialisme heeft tevens het hoogste aantal overboekingen en de hoogste wachttijden, welk het gebrek aan capaciteit

onderschrijft. Naast het genereren van capaciteit, kan de vraag ook worden gereduceerd. Bijvoorbeeld door het beleid te herzien voor herhaalconsulten.

Variabiliteit in aankomsttijden van patiënten bleken geen rol te spelen op de prestaties van het afspraken systeem, omdat weinig patiënten te laat waren voor hun afspraak. Variabiliteit in service tijd kon niet worden verklaard door geslecht, leeftijd, locatie of verrichtingen. Dit kan een indicatie zijn van een natuurlijke variabiliteit die bij het proces hoort. Onderzoek hiernaar kan inzicht bieden in mogelijkheden tot het categoriseren van patiënten in verschillende afspraakcodes en service tijden. Analyse van specifieke patiëntprocessen kan ook leiden tot de identificatie en selectie van taken die kunnen worden gedelegeerd van de specialisten naar de verpleegkundigen, nurse practitioners, artsen (niet) in opleiding, of mogelijk naar andere afdelingen.

Wachttijd werd bevestigd als probleem, maar langere en meer extreme wachttijden kunnen in de praktijk voorkomen: 70,15% van de respondent moest wachten, echter 33,99% van de respondent heeft langer moeten wachten dan voor hen maximaal acceptabel was. Wachttijd kan worden veroorzaakt in variabiliteit in service tijd en overboekingen. Verder onderzoek naar deze oorzaken kan ertoe leiden dat wachttijd wordt gereduceerd.

De meerderheid van de respondenten was tevreden met de service van de poliklinieken. De respondenten vonden het meest belangrijk dat de specialist voldoende tijd voor hun had, het comfort van de wachtruimte vonden zij het minst belangrijk. Respondent vonden het belangrijker om niet langer te wachten dan hun maximaal acceptabele wachttijd dan op de hoogte te worden gehouden van de wachttijd. De respondenten waren echter verdeeld in de mate waarin zij het eens waren over de stelling dat zij op de hoogte worden gehouden van de wachttijd. Dit kan verbetert worden door een liniaal met minuten waarvan de indicator aangeeft hoe lang de huidige wachttijd is of een monitor in de wachtkamer waar nieuws en informatie mee gecommuniceerd kan worden. Patiënten waren over het algemeen tevreden met de wachtruimte, maar hadden wel suggesties voor verbeteringen: veel genoemd waren de literatuur (meer en recentere bladen/kranten) en een koffie – en thee apparaat.

Content

Foreword
Summary
Samenvatting6
Chapter 1 Introduction
1.1 Context analysis
1.1.1 Planning process
1.1.2 Patient process
Figure 2 Patient process14
1.1.3 Current situation at surgical outpatient clinics
1.2 Identifying the problem15
Chapter 2 Methods
2.1 Questionnaire
2.2 Total population
2.3 Tactical level
Chapter 3 Results
3.1 Representativeness of survey sample
3.2 Analysis of the questionnaire and total population
3.2 Results on total population
3.3 Results on tactical level
Chapter 4 Discussion
4.1 Limitations 42
Appendix A Phases of the Managerial Problem Solving Method and the Research Cycle
Appendix B Questionnaire
Appendix C Reference framework
Appendix D Scatter plots of forced waiting time versus appointment time
References

Chapter 1 Introduction

Santeon is a national hospital group consisting of six top clinical hospitals spread over the Netherlands. Medisch Spectrum Twente (MST) is one of these hospitals and one of the largest non-academic hospitals in the Netherlands. MST has two hospital locations, namely Enschede and Oldenzaal, and 'outside' clinics (in Dutch: buitenpoliklinieken) in Haaksbergen and Losser. Combined these locations provide care and services to an area with approximately 264.000 inhabitants (MST, n.d.).

There are currently three surgical outpatient clinics: outpatient clinic 19 and 28 in Enschede and outpatient clinic 11 in Oldenzaal. Outpatient clinic 19 is the *treatment outpatient clinic* (in Dutch 'behandelpoli') and is used by several specialties for follow-up-treatment and small surgical procedures that require no general anaesthesia. Outpatient clinic 28 is the *surgical outpatient clinic*, where the specialists hold their consultation hours. In Oldenzaal the same services are offered as in the outpatient clinics in Enschede.

A wide variety of patients are seen by three different specialties: traumatology, vascular surgery, and oncology and gastroenterology. All specialists also see *general surgery* patients. The specialist determines the division between time spend on consultations, surgeries, rounds, and other activities. Oncologists and trauma specialists spend 28% of their time on consultation hours, while vascular surgeons spend 23% of their time on consultation hours (Deloitte, 2012). In 2011 the specialities saw nearly 16.000 patients in total for their first outpatient clinic visit, which is a growth of 1,7% from 2010, and little over 39.000 patients for their follow-up consultation, which is a growth of 10,6% from 2010. The distribution of patients seen for their first outpatient clinic visit and follow-up consultation by the three specialties are displayed in Figure 1.



Figure 1 Distribution of patients seen in 2011 per specialty

On a national level, the Dutch government states that healthcare needs to be effective, safe and timely (Rijksoverheid, n.d.). On the organizational level, Santeon strives for high quality of care, safety and hospitality (Santeon, n.d.). Quality of care is determined by several concepts that are often a part of goals, regulations, and performance measures used in health care. Busch and Bovendeur (2013) state that quality of care is a measure to indicate the extent in which experience/performance is in line with expectation.

According to Berwick (2002) and Joshi and Berwick (2008) there are six concepts that are viewed as aims for improvement as well as dimensions of quality, which are:

- Safety: Patients ought to be as safe in health care facilities as they are in their own homes.
- Effectiveness: The science and evidence behind healthcare should be applied and serve as the standard in the delivery of care.
- Patient-centeredness: The system of care should revolve around the patient, respect patient preferences, and put the patient in control.
- Timeliness: There should be no waiting times or delays experienced by patients and those who give care.
- Efficiency: The reduction of waste and, thereby, the reduction of the total cost of care should be never-ending.
- Equity: The system should seek to close racial and ethnic gaps in health status.

Gasquet, Villeminot, Estaquio, Durieux, Raveud and Falissard (2004) discuss that healthcare not only aims to improve health status but also aims to respond to patient needs and wishes to ensure their satisfaction with care. In a outpatient clinic setting, it has been proven that satisfied patients are more likely to cooperate with treatment, to maintain a continuing relationship with a practitioner and thus enjoy a better medical prognosis (Deyo & Inui, 1980; Williams, 1994). Shaller (2007) states that there is a growing recognition for the importance of patient centeredness and evidence for its value in contributing to other goals such as efficiency and effectiveness (Coulte & Ellins, 2006). In this study four dimensions of quality are of particular interest: effectiveness, patient centeredness, timeliness and efficiency. Literature on these dimensions is discussed in the paragraphs below, followed by the context analysis at the surgical outpatient clinics (Paragraph 1.1) and the identification of the experienced problems within the context (Paragraph 1.2).

Patient satisfaction is an aspect of quality of care under the domain of patient centeredness. Edgman-Levitan (2008) states that a healthcare organisation's ability to deliver high quality and thus patient-centred care depends on their ability to translate and apply customer service principles to a clinical setting. Customer service is of importance as better service leads to higher satisfaction. This is subsequently of value in the relation between the hospital organisation and third party payers. A satisfied customer in healthcare creates value that may be in terms of repeat visits, positive word of mouth or trusting relationships. Existing customers are an invaluable source of information that can be used to explore possible improvements and perhaps determine unnecessary or unvalued services (Heskett, Jones, Loveman, Sasser & Schlesinger, 1994). Grönroos (2010) defined seven criteria of good perceived service quality which can be applied in healthcare as well, however certain criteria might have a greater meaning to various customers: 1) Professionalism and skills, 2) The attitudes and behaviour of the employees, 3) Accessibility and flexibility of the service, 4) Reliability and trustworthiness of the service providers, 5) Service recovery: the service providers are able to recover whenever something goes wrong or something unpredictable happens, 6) Servicescape: the physical surrounding and other aspects of the environment enable a positive experience, and 7) Reputation and credibility.

Zaghloul and Abou El Enein (2010) discuss that customer satisfaction is an important factor when looking at the performance of an appointment system. They found that patient satisfaction was related to their perception of waiting time in the clinic and time spend with the specialist. Anderson, Camacho and Balkrishnan (2007) note that the time spent with the specialist is a stronger predictor

of patient satisfaction than the time spent in the waiting room. Meza (1998) defines a good appointment system as 'one that allows the patient to be seen on the day that he/she wishes and keeps the waiting time for both patient and doctor to a minimum, while allowing adequate time for every consultation'. In this study the patient perspective and satisfaction plays an important role in measuring the performance of the appointment system as they can provide valuable information from their experiences. Literature shows that limiting or reducing waiting times while allowing for sufficient time with the specialist become important goals when aiming to improve quality of care through providing patient-centered care and maximizing patient satisfaction.

Limiting waiting time is not easy to accomplish as it arises partly due to variability in service time as described by Noon, Hankins, and Cote (2003). Zhu, Heng and Teow (2010) investigated causes of long patient waiting time and clinic overtime. They identified five causes of patient waiting time: Overloaded sessions, late start of sessions, unused session time, unevenly distributed slots, and irregular calling sequence. The first three causes have also been identified as causes for clinic overtime. The authors state that overloaded sessions can be caused by double-booking/overbooking appointment slots or naturally flow from variability in service times. These possible causes of waiting time are investigated in this study.

Clinic overtime and overloaded sessions have an impact on the employee satisfaction and their experience of the workload. Workload can be viewed as a balance between the amount of work that needs to be done within a set amount of time, versus the capability of the employee to carry the workload. Healthcare staff experience a high workload as one of the most important causes of stress (Rycken, van, 1997). When the employee experiences a high degree of control and the task demands are high, the workload is seen as a challenge (Karasek, 1979). When the task demands are high and there is a low degree of control, there is a situation in which work stress can be developed. Work stress can also develop itself when there are low task demands. De Rooij (2004) underlines that work stress can be caused by work overload and a lack of tasks. Excessive stress can ultimately lead to a burn-out through a lengthy process and cause staff absence (Rooij, de, 2004).

LaGanga and Lawrence (2007) state that overbooking appointments mitigates the lost productivity caused by no-shows, but it may lead to an increase of patient wait time and provider overtime. In their simulation study they research and evaluate the performance of scheduling rules that are designed to account for an excess of overbooked appointments. They found that the performance of the best system for a given show rate depends not only on the scheduling rule and the show rate itself but also on the relative performance of alternative rules. It is also stated that variability in service times do influence waiting time for patients and overtime for staff, however it had little impact on the performance of the set of scheduling rules that performed the best. They conclude that the overbooking policy of *round to nearest interval* (RNI) performed best at high show rates. This method entails compressing inter-appointment times in proportion to show rates and rounding each calculated time to the nearest practical clock time generally works at least as well as other scheduling policies, but without their increased waiting time for patients.

Another type of waiting time is access time or waiting lists. In 2000 norms were formulated on maximally accepted access times for hospital care (in Dutch: Treeknormen). Waiting lists can not only threaten the timeliness and equity of access to healthcare, but can also implicate medical, financial, legal and social consequences, such as the decline of quality of life of the patient while waiting

(Oudhoff, Timmermans, Rietberg, Knol & van der Wal, 2007). Wigersma, Kuipers and Bijnen (2003) state that few patients in general surgery experience consequences of long waiting times. They note that patients with more severe complaints are generally not prioritized in waiting lists whilst doing so may positively influence the issues related to waiting lists. According to Kreindler (2010) 'the question is not how to eliminate wait times, but how to keep them at a safe and acceptable level, while balancing this aim with other policy goals such as promoting quality, equity and wise use of resources'. He states that waiting lists arise when the demand for care exceeds the supply. 'Work on bottlenecks in services in outpatient clinics has shown that discrepancy between demand and capacity, along with mismatch between the variations in demand and capacity, is a major reason for queues and waiting lists' (NHS Modernisation Agency, 2005). The shortcoming of the supply can be rooted in a lack of capacity or inefficient use of existing capacity. Kreindler's literature study offers an overview in measures to reduce waiting lists categorized in supply- and demand-side strategies and global strategies.

Capacity management is a systematic way to review the needs and usage of capacities. According to Vissers (1993) there are three central questions relevant to capacity management in healthcare. First, how much capacity is needed to cover the expected demand for care? Second, how can available resources best be allocated to departments/specialties? Third, how can allocated resources be used sufficiently for the purpose of the healthcare processes? The latter two questions are not included in this study as such. The capacity in outpatient clinics consist mostly of physical capacity (consulting rooms, examination rooms), staff capacity (secretaries, nurses, residents), and specialist capacity (the hours spend by the specialist on consultations).

Summarizing, it is necessary to investigate how much capacity is available at the outpatient clinics and whether it is sufficient to cover the expected demand. Literature indicates that a lack in capacity is related to high access times and may lead to overfull sessions with many overbooked appointments. Overbooking appointments and variability in service time may cause waiting— and over time or mitigate production loss by no shows. These related concepts can be viewed from the perspective of the department, but also from the patients perspective. Apart from striving care to be effective, efficient, timely, safe, and equitable: Delivering patient centered care and having satisfied patients also yields higher quality of care. Patients are not only consumers of health care, but also a valuable source of information.

1.1 Context analysis

This paragraph offers the context in which the consultations are held. The planning process is explained in Paragraph 1.1.1. In Paragraph 1.1.2 the patient process is discussed after the patient has arrived at the outpatient clinic for their appointment. Information was acquired by observations, face to face semi-structured interviews, conversations, and e-mail contact. Sources of information were several secretaries, a nurse, a specialist, and the head of the surgical outpatient clinics.

1.1.1 Planning process

The consultation hours at outpatient clinic 28 are held from 8:15 to 12:00 and from 13:00 to 15:30. At outpatient clinic 11 and 19 the consultation hours are held from 8:00 to 12:00 and from 13:00 to 15:30. At outpatient clinic 11 and 28, the specialist has a coffee break between 10:00 and 10:30. The planning of the consultations is done by the secretariat.

There are two type of patients: new patients and follow-up patients. New patients are referred by their general practitioner and follow-up patients are patients who visit the outpatient clinic for a check-up, for example after an operation, or patients who are referred by another department within the hospital. Patients can call between 8:30 and 16:30 for the scheduling of their appointment. The secretariat is able to plan appointments three months ahead. The secretary makes an appointment on the first free available suitable slot, unless the complaints or situation of the patient is urgent, then the appointment is overbooked. Patients who need an appointment outside of this three month period are placed on a waiting list and receive a letter with their appointment information after a new time period is opened for scheduling. Patients also have the possibility to enter a form on the website of the outpatient clinics to make an appointment. In practice, very little patients make use of this online feature. Patients who do fill in a form, receive a call back from a secretary and an appointment is made by phone.

When the specialist is absent there are so-called 'blockades' in the agenda: within these timeframes it is not possible for a secretary to plan any patients. Specialists hold their consultation hours weekly on the same day of the week. However, these consultation hours may be cancelled based on their operating schedule or additional consultation hours become available due to reduction periods (whenever time in the operation room is cancelled). The schedule of the specialist becomes definitive six weeks ahead. Whenever a specialist will be absent within this period, arranging a replacement is the responsibility of the specialist. Since patient scheduling is done three months ahead, appointments have to be rescheduled whenever a specialist is going to be absent and there is no replacement.

1.1.2 Patient process

Figure 2 shows the patient process graphically: After a patient arrives for their appointment, they go to the front desk and they are received by the secretary. The secretary indicates in X/Care (the hospitals information system) that the patient has arrived. At outpatient clinic 28 in Enschede and outpatient clinic 11 in Oldenzaal patients can be seen first by a nurse or a specialist. There are several rooms, of which one room is used by a nurse to see patients. Specialists have their own room when they are holding their consultation hours. When a patient is seen by a nurse first, they start the consult in the room assigned to the nurse where for example stitches are removed. The specialist leaves his room and goes into the room with the nurse and the patient, to check on the patient, after which he returns to his room and continues his consultation hour. The same principle is applied at outpatient clinic 19 in Enschede: patients are set up in different rooms by a nurse and the specialist goes from room to room to see the patients.



Figure 2 Patient process

1.1.3 Current situation at surgical outpatient clinics

Within the context of the surgical outpatient clinics the staff and patients experience a performance gap on the dimensions of efficiency, effectiveness, timeliness and patient centeredness regarding the consultation hours. Improvement on these dimensions will lead to a greater perceived quality of care by the stakeholders involved. The problems experienced were determined and defined as problems on the operational level, but may be related to capacity and utilization on a higher hierarchical level (Hans, Houdenhoven, van & Hulshof, 2012).

On the dimensions of efficiency and effectiveness: the nurses experience an *uneven workload distribution* during the day where, sometimes there is idle time which refers to moments during the day where nurses have no patients and sometimes one nurse has to support multiple specialists in their consultation hours meaning peak moments where they have to attend to multiple patients at the same time. In addition, staff beliefs that the frequency of overbooking appointments is too high and hinders daily practise. It is likely that delays and overtime are caused by frequent overbooked appointments. Appointments are considered *overbooked* when their start or end time is equal to or overlaps with another appointment, or when they are placed in a time frame which has been blocked in the agenda – for example in the coffee break or before the start/end of the consultation hours. Secretaries overbook appointments within the mind set of patient centeredness; a patient with pain complaints or certain test results might be overbooked so he or she can be seen sooner. The patient does not always have a medical necessity to receive an overbooked appointment. At outpatient clinic 19 overbooked appointments are hardly made and patients are often able to visit the clinic on the same day before 12:00 when they call early in the morning.

On the dimensions of patient centeredness and timeliness (and partly effectiveness): the problems of waiting time in the clinic and access times are identified. Waiting time can be defined as voluntary (indirect) and forced waiting time (direct). Voluntary waiting time is the time the patients wait until their appointment and forced waiting time is the time the patients wait after their appointment time has passed. Forced waiting time is experienced as a problem. It does not only mean that the patient has to wait, but the staff may have to work overtime or skip breaks when the delays are large. Forced waiting time has a negative impact on perceived quality of care for the patient. 'Frequent involuntary changes in appointments and long direct waits can cause dissatisfaction among patients who book in advance' (Gupta & Denton, 2008).

Access time is the time between 'the present day' and the third available slot. This indication for the *access time* is used by many hospitals and by the CBO (Central Accompagnement Organization, in Dutch 'Centraal BegeleidingsOrgaan') in their project Working Without Waitlists (CBO, 2007). The access time is registered each month by the secretaries by determining the amount of days between 'the present day' and the first and third available slot in the schedule of each specialist for new and follow up patients, as well as the average amongst specialists.

1.2 Identifying the problem

A shortcoming in outpatient clinic capacity may cause high access time, overloaded sessions and thus delays in the clinic and overtime. The general experience is that the access times vary greatly per specialism. The oncologists have an access time which is much higher than the other specialists. The staff finds the frequency of overbooked appointments too high and label the waiting time in the

clinic as long and sometimes extreme. Figure 3 shows how previously mentioned key concepts are interrelating with each other and dimensions of quality.



Figure 3 Interrelation between key concepts and dimensions of quality

According to Heerkens (2010) it is important to identify the problem as the actual problem. However, there is a lack of objective information concerning the dimensions of quality in daily practice and there is no insight in terms of quantitative data on the operational and tactical level. The capacity needs to be investigated to determine whether there is enough capacity to meet the demand of consultations. Steensma (2006) states that exploring problems and enhancing insight are two important functions of case studies.

The main goal of this study is therefore to investigate how the consultation hours can be improved, with recommendations towards improving the efficiency, effectiveness, timeliness and patient-centeredness of the surgical outpatient clinics at MST.

The Managerial Problem Solving Method (MPSM) and the research cycle were used as a framework. See appendix A for the classification of the problems, the phases of the MPSM and the research cycle, and how these are applied within this study.

To reach this objective six different research questions and goals have been formulated.

- 1. What are the problems experienced by the staff?
- 2. What are current access times, waiting times, and service times for patients of the outpatient clinics?
- 3. What are the perceptions of current patients with regard to their acceptability of waiting time in relation to the current waiting times, and their perceptions on the notification of waiting time, comfort of the waiting area, ease of making an appointment, and sufficient time of the specialist?
- 4. What is the current frequency of overbooked appointments and no shows in the schedules of the outpatient clinics?
- 5. How does the supply (capacity) at the outpatient clinics relate to the demand (patients)?
- 6. What are the possibilities for improvement of patient scheduling, and what are the expected effects.

In Chapter 2 the methods that were used to analyze the current situation at the outpatient clinics will be outlined. In Chapter 3 the results of the analyses are discussed. Chapter 4 contains the discussion which outlines the limitations, the conclusions and recommendations.

Chapter 2 Methods

A survey was performed to gather information on the problem of the waiting time of patients, as well as their perception of- and experience with - the outpatient clinic. The questionnaire is described in Paragraph 2.1 and can be found in Appendix B. As access times are registered by the secretariat, this is excluded from this chapter. Data was collected on the total population of patients that visited the outpatient clinic during week 43 and 44 of 2012. Insight was provided in the frequency of overbooked appointments and no shows, and was used to derive the utilizations of the consultation hours. The methods for this data collection are discussed in Paragraph 2.2. The sample and total population were compared based on gender distribution, age and consult types to check for representativeness. The capacity of resources was investigated and the demand for consultations was determined. The methods used for this are presented in Paragraph 2.3. In a reference framework in Appendix C background information is outlined on the choices made for several elements as found in this study.

2.1 Questionnaire

A questionnaire was designed and composes of four parts: Demographic information of the respondent, characteristics of the consult, time registration, and patient perspective on the waiting area; the ease of making appointments; the notification on waiting time; having sufficient time with the specialist; and their maximum acceptable waiting time. The questions were divided into a part that the respondents fill in during their waiting time and a part that they fill in after their appointment ended. Respondents were informed on forehand that they are also asked to fill in some questions after their appointment ended. The questionnaire contained a time registration to be able to gather information on service times and waiting times. It also contained different statements and a ranking of these statements to research the perceptions of respondents.

Demographic information

The respondent was asked to fill in their *date of birth* and *gender*. Age was calculated by subtracting *the date of birth* from *the date of the appointment*. *Date of birth* and *gender* were used to track and determine other variables as the *consult type, the specialist* and the *nature of the appointment slot* (regular or overbooked).

Characteristics of the consult

Questionnaires were distributed over the three outpatient clinics where the respondent filled in the *date, location, reason of visit, who they saw first* (nurse/specialist), and *activities that took place* during their appointment. *The reason of visit* consisted of several options, as there are patients who are visiting the outpatient clinic for the first time, patients who have a follow-up appointment, and patients who are scheduled for a small surgical procedure.

After the consult has ended the respondent was asked to fill in additional characteristics related to the patient process. The respondent was asked who they saw first: if they were called forward by the specialist, they were asked to skip to the last question of the questionnaire. The last question comprised of different activities that can occur during the consult, from physical examination and measurement of vital signs to wound care and removal of stitches. There was a *not applicable* item available when no activities took place, e.g. only a conversation, and there was an*-other* item in case

an activity took place that was not listed. Figure 4 shows different paths a respondent could follow when answering the questions.



Figure 4 Possible paths through the last part of the questionnaire

Time registration

Figure 5 displays the four times that were part of the time registration and the three variables that were derived from it. Mean, frequency, standard deviation, minimum, and maximum were calculated for *voluntary waiting time, forced waiting time,* and *service time*. Based on collected data the distribution of punctual and tardy patients was determined. The waiting times of patients were made insightful and the proportion of patients whose consult started before their appointment time were identified. The total waiting time that was experienced is built up from *voluntary and forced waiting time*. When either of the waiting times is negative the total waiting time is shortened. The correlation between *voluntary and forced waiting time* was calculated by Pearson's correlation test. One-way ANOVA tests were used to study the influence of *specialty* and *location* on *forced waiting time*. The correlation test. *Appointment time* was analyzed for the morning and the afternoon consultation hours separately, since these sessions are held independent of each other. The correlation between *forced waiting time* and *appointment time* was investigated by conducting a bivariate (Pearson) correlation analysis. The null hypothesis assumes there is no actual correlation between these variables.



The planned *service time* is the time that is used for each appointment slot of the different consult types. This was compared with the *service time*, as observed in the questionnaire, by using a paired samples t-test to determine whether the planned times reflect consult durations in practice. The observed *service times* were also compared with the outside observation on *service times* by conducting F- and T-Tests. This assessment can lead to four scenarios: First, the times of self-observation were exactly the same as the times filled in by the respondents. Second, the times of

self-observation were significantly similar to the times of outside observation. Third, the respondents have overestimated their times. Four, the respondents have underestimated their times.

The service times were viewed per consult type and split up in *service times* for specialists and nurses. Consult types with a *n* < 10 were excluded as these subgroups were assumed to be too small to be able to draw conclusions from. When respondents were seen by a nurse and they have also seen the specialist, the estimation of this time resembled the *service time* of the specialist. This was the case in for example the CB consult type which is mainly held in outpatient clinic 19. Factors of influence on *service time* such as age, gender, location, and activities that took place were investigated by Kruskal-Wallis tests and complementary Mann-Whitney tests. A Mann-Whitney test compares 2 independent groups and provides results on whether or not these groups differ significantly, however it is assumed that conducting such analysis is not relevant when subgroups are small due to limited generalization based on such small subgroups.

It is important to determine how representative in terms of accuracy the observed *service times* were. The determination of the sample size given a certain accuracy was done by the use of the formulas below (Ozcan, 2009). A small number of observations were done to determine the sample size. The results of the observations were the input for either formula. The desired confidence level gives the value for *z*. In this study the decision was made for a confidence level of 95% (z = 1,96), and the amount of maximum acceptable error between 1 and 1,5 minute.

a)
$$n = \left(\frac{zs}{\alpha \bar{x}}\right)^2$$
 b) $n = \left(\frac{zs}{e}\right)^2$

where:

- z = number of standard deviations to achieve desired confidence level
- *s* = sample standard deviation
- α = desired accuracy
- \bar{x} = sample mean
- *n* = sample size
- e = amount of maximum acceptable error

Table 1 contains a collection of data and results of the determination of the sample size based on two mornings of observations (outside observation) on the *service time* of four consultation hours. *Service time* was chosen as subject of the observations as it is a strong characteristic of the consult. Three different types of consults were observed: oncology follow up (ONC), general surgery follow up (HEC) and traumatology follow up (TRC). Overall the standard deviations were relatively high when looking at the mean of the service time. A larger sample will be needed to become representative when the desired accuracy becomes lower. These preliminary results were used as a guideline of the sample size. The formulas were also used to determine the accuracy of the sample sizes of *service time*.

	Frequency	\bar{x} (min)	<i>s</i> (min)	Ζ	<i>e</i> (min)	Sample size	<i>e</i> (min)	Sample size
ONC (1)	14	11,8	6,6	1,96	1,5	69	1	155
ONC (2)	6	7,5	4,6	1,96	1,5	32	1	73
Total	20	10,78	6,27	1,96	1,5	65	1	146
HEC (1)	3	8,33	4,03	1,96	1,5	28	1	62
HEC (2)	3	5	2	1,96	1,5	7	1	15
HEC (3)	4	6	4,42	1,96	1,5	29	1	66
Total	10	6,4	3,37	1,96	1,5	18	1	40
TRC (1)	8	6,13	3,65	1,96	1,5	20	1	44
TRC (2)	9	5,88	3,82	1,96	1,5	21	1	47
Total	17	6	3,62	1,96	1,5	19	1	44

Table 1Data and results of observations to determine the sample size

Note that the first column indicates the consult type and the number indicates the observation round. HEC has three rounds as general surgery patients can be seen by every specialist.

Patient perspective

The patient perspective was represented by three aspects in the questionnaire. The respondent was asked to indicate the extent in which he or she agrees/disagrees with a set of four statements, fill in their maximum acceptable waiting time, and rank the four statements and the maximum acceptable waiting time in importance relative to each other.

The first statement specified the perceived ease of making appointments on a preferred time/day/location. The second statement reflected the comfort of the waiting area. The third statement concerned the notification when the waiting time was exceeding their appointment time. The fourth statement was linked to the patient perspective on the time that the treating specialist has for them during their consult. The extent to which they agree/disagree was indicated by a four-point Likert scale to avoid neutral answers to the statements. Information on these statements provided insight in the patient perspective by measuring their experience with four different topics. The possible influence of other characteristics, such as age, gender, location, reason of visit, and specialty, on their level of agreement was studied by an ordinal regression model. This was only conducted when the level of agreement varied in a statement to gain insight into factors that influence and possibly predict the outcome. Identifying relevant factors may provide points for improvement.

At the second part of the patient perspective respondents were asked to indicate their maximum acceptable waiting time. This allowed for a comparison of the stated maximum acceptable waiting times with the observed *forced waiting time*. The influence of characteristics such as age, gender, location, and specialty, was investigated by conducting one-way ANOVA tests and a Pearson's correlation test.

In the third and last part of the patient perspective the respondent was asked to rank the four statements, which they indicated their agreement on, and their maximum acceptable waiting time. Ranking these statements from 1 to 5, with 1 being valued as most important and 5 as least important, provided insight into their level of agree- and disagreement and their valuation of the importance of the statements relative to each other.

2.2 Total population

In addition to the data collection by the means of a questionnaire, data is also collected on the total population of patients during week 43 and 44 of 2012. The goal of this data collection was to gain insight in the frequency of overbooked appointments and no shows, and the utilization of the consultation hours.

The list of appointments for each consultation hour held within these two week was digitalized into a dataset in MS Excel. The following variables were registered of each consultation hour:

- Morning or afternoon consultation hour: indicated by AM or PM.
- The planned starting time of the first appointment.
- The planned end time of the last appointment.
- The date of the consultation hours.
- Specialist.
- Location.
- Total appointments: summed up by the number of consult type.
- Total overbooked appointments: summed up by the number of overbooked appointment per consult type.
- Total no-shows: summed up by the number of no-shows per consult type.

Three variables were needed to be able to calculate whether or not a consultation hour started or ended sooner or later than the planned opening or closing time of that respective location. First, a variable was included to indicate a morning or afternoon consultation hour. Second, the planned time of the first appointment was registered. And third, the planned end time of the last appointment was registered. Combined this information was used to describe utilization of the consultation hours, which related to the dimension of efficiency. The variable total appointments gave an overview of the distribution of the different consult types which was used to examine the representativeness of the sample. Same principle was applied to overbooked appointments and no shows per consult type per speciality and location.

2.3 Tactical level

To gain insight in the supply and demand on tactical level, the capacity of resources and the resources required were investigated. The hospital board collaborated with external advisors on, amongst others, the subject of capacity. The supply in six months is calculated based on the schedules of the specialists and were pooled per specialty. This amount was corrected for vacation days, congress days, and emergencies/illness and assumes an effective time of 83%. The demand was calculated based on production data on consults from a management summary (Deloitte, 2013).

Data on the access times is monthly collected by the secretariat by determining the difference between the date of measurement and the first and third available appointment slot. This data was requested from the secretariat for week 44, week 48 in 2012 and week 4 in 2013. It has to be noted that the access times to residents are not measured by the secretariat.

Chapter 3 Results

In this chapter the results of this study are presented. In Paragraph 3.1 the characteristics of the sample are discussed, after which the results of the analyses are presented. In Paragraph 3.2 the results of the objective waiting- and service times and the subjective experience of the patient are presented. Paragraph 3.3 shows the results of the capacity analysis.

3.1 Representativeness of survey sample

The sample size of the survey research was 471 respondents and the total population consisted of 1790 appointments. Table 2 illustrates the comparison of the mean age and gender distributions for the three locations. Outpatient clinic 19 showed a lower mean age (44,24 years) than the other outpatient clinics (Enschede 28: 56,12 years and Oldenzaal: 54,42 years), but had a higher standard deviation (21,79 years opposed to 17,25 years for Enschede 28 and 16,57 years for Oldenzaal).

		Gender	Mean Age	Ν	Std. Deviation	Minimum	Maximum
			(years)		(years)	(years)	(years)
6	Sample	Male	43,89	63 (65,63%)	20,65	3	80
lic 1		Female	44,90	33 (34,37%)	24,13	8	100
t clir		Total	44,24	96 (100%)	21,79	3	100
cient	Population	Male	43,44	194 (64,24%)	21,64	2	91
tpat		Female	45,19	108 (35,76%)	23,53	2	99
no		Total	44,07	302 (100%)	22,32	2	99
8	Sample	Male	57,80	131 (49,62%)	16,34	12	87
iic 2		Female	54,46	133 (50,38%)	18,00	12	95
clir		Total	56,12	264 (100%)	17,25	12	95
ient	Population	Male	56,37	403 (48,38%)	18,10	0,25	93
tpat		Female	55,08	430 (51,62%)	19,78	0,75	95
no		Total	55,70	833 (100%)	18,99	0,25	95
1	Sample	Male	54,28	41 (36,94%)	17,48	17	84
nic 1		Female	54,51	70 (63,06%)	16,15	11	81
: clin		Total	54,42	111 (100%)	16,57	11	84
ien	Population	Male	52,34	232 (35,42%)	20,79	2	85
tpat		Female	56,47	423 (64,58%)	17,10	6	94
no		Total	54,56	655 (100%)	18,70	2	94

Table 2Comparison of gender and mean age of sample and population for outpatient clinic 19

The majority of respondents that visited outpatient clinic 19 was male, in Oldenzaal the majority was female, and in outpatient clinic 28 the distribution was equal. The gender of the population of the sample over the location were significantly different (p < 0,05 and p = 0,06 for Enschede outpatient clinic 28 compared to Oldenzaal outpatient clinic 11). The mamma care outpatient clinic is situated at outpatient clinic 11 in Oldenzaal, which explains the majority of females in this location. Outpatient clinic 19 had significantly more men than women and there was also a significant difference in age compared to the other two locations. Analysis of the total population of outpatient clinic 19 showed

that the distribution in gender in the sample was similar to that of the total population, as well as the mean age and standard deviation for males and females were similar in the sample and the total population.

The same comparison was made between the sample and the total population of outpatient clinic 28 in Enschede and outpatient clinic 11 in Oldenzaal. Analysis of the total population of both clinics showed a similar distribution in gender in the sample to that of the total populations, as well as the mean age and standard deviation for males and females were significantly similar. Based on these results the assumption was made that the sample is representative for the total population of both clinics.

The sample was also compared to the total population with regard to the consult types. Figure 6 provides a graph with consult types, their amount and percentages they are represented within the sample and the total population.



Figure 6 Distribution of consult type over total population in week 43 and 44 in 2012

The largest patient groups in the total population (consult types ONC, CB, HEC, TRC, VAC, HEN) consisted of 1335 patients, which resembled 77,8% of the total population (excluding telephonic consults). 82,4% of the sample (388 respondents) consisted of the above mentioned consult types. By comparing the proportions of these consult types within the sample to the total population, we can see to which extent consult types were represented. For example, follow up oncology patients (ONC) have similar proportions, while patients that came for a small surgical procedure (POK30) and patients of the mama care clinic (MCP) were underrepresented in the sample, and vascular surgery patients (VAN and VAC) had larger proportions within the sample than they had in the total population.

The assumption was made that the sample is representative for the total population in terms of gender, age and consult type. We therefore ran analyses based on the questionnaire sample and were able to draw conclusions that were representative for the total population.

3.2 Analysis of the questionnaire and total population

In this section the results of the research question two and three are presented. The research questions are displayed followed by their results. The element of *time registration* is discussed first, followed by *service times* and *patient perspective*.

What are current waiting times for patients of the outpatient clinics?

Voluntary waiting time is the time between patient arrival and their appointment. The first quartile of *voluntary waiting time* was at 5 minutes, the median at 10 minutes, and the third quartile at 15 minutes. These waiting times show the arrival pattern of patients – the majority of the patients arrived within 15 minutes prior to their appointment – which can be used in a simulation study to evaluate an appointment system. It is questionable whether the proportion of tardy patients in the sample (5,38%, n = 25) is representative for the entire population, since the overall response was 26,31% (n = 471). Tardy respondents arrived between 1 and 40 minutes later than their appointment time. The distribution of positive *voluntary waiting times* showed that most respondents had the tendency to fill in their arrival time in multiples of five minutes, see the bar chart in Figure 7.



Figure 7 Bar chart of voluntary waiting time

Figure 8 shows the distribution of *forced waiting time*, which is the waiting time between the appointment time and the start of the consult. The descriptive statistics of *forced waiting time* showed that the mean and median waiting time were both ten minutes (n = 392). This implied a symmetric distribution of *forced waiting time* (*skewness* = 0,168, *std. error* = 0,123). 68,3% of the sample waited between 0 minutes and 29 minutes. However, there was evidence that the distribution contains more values in the tails of the distribution rather than around the mean (*kurtosis* = 4,21, *std. error* = 0,246). This was enforced by the perception of the staff of secretaries: they believe the patients waiting time is more extreme and frequent in practice (Workshop Deloitte, 2012).



Figure 8 Bar chart of forced waiting time Note that the negative forced waiting times are grouped under no forced waiting time.

71 of the respondents had a negative *forced wait time*, which means that their consult started before their planned appointment time, and their *voluntary wait time* is shortened. Figure 9 shows a grouped scatter plot for *who the patient saw first* and their *voluntary waiting time* versus negative *forced waiting time*. A Pearson's correlation test confirms a negative correlation which means that whenever the *forced waiting time* becomes more negative the *voluntary waiting time* is shortened:

- Overall: r = -0,923, n =71, p < 0,0005
- Specialist: *r* = -0,894, *n* = 34, *p* < 0,0005
- Nurse: *r* = -0,926, *n* = 36, *p* < 0,0005

For respondents with positive *forced waiting time*, there is no statistically significant correlation between positive *forced waiting time* and *voluntary waiting time* (r = 0,059, n = 275, p = 0,331).



Figure 9 Grouped scatter plot of voluntary wait time and negative forced waiting time

Figure 10 shows the distribution of *forced waiting time* per specialty grouped by specialist and nurse. The respondents of vascular surgery reported a larger spread in negative *forced waiting times* than the other specialties. This could be explained by the differences in patient processes of vascular surgery patients and the other specialties. Oncology respondents reported the largest spread in *forced waiting time*. And traumatology respondents had the smallest range in *forced waiting time* of all specialties.



Figure 10 Distribution of forced waiting time per specialty grouped by specialist/nurse

All negative *forced waiting times* were set to 0 for the remainder of the analyses, because patients did not have to wait before the planned start of their appointment. There was no statistically significant difference in *forced waiting time* between locations as determined by one-way ANOVA (F(2,389) = 2,707, p = 0,068), however, the difference in *forced waiting time* for traumatology and oncology between outpatient clinic 11 and 28 was large. Analysis of homogeneity in variances (Levene's test) showed a significant difference for *forced waiting time* in the specialties (p < 0,001). A Welch ANOVA was therefore conducted: there was no difference in the mean *forced waiting times* for the four specialties (F(3,177) = 474, p = 0,063).

Forced waiting time and appointment time were plotted against each other in Figure 11. A Pearson correlation test confirmed a weak (close to moderate) positive correlation between *forced waiting time* and *appointment time* in the morning consults (r = 0,261, n = 323, p < 0,0005). It may be that delays in the schedule were made up by using the coffee break. Therefore, the morning consultation hours were split between 8:00 and 10:00 and from 10:00 to 12:00. A Pearson correlation test confirmed a weak (close to moderate) positive correlation between *forced waiting time* and appointments between 8:00 and 10:00 (r = 0,292, n = 193, p = 0,01). For the appointments from 10:00 to 12:00 there was no significant relation found between appointment time and *forced waiting time* (r = 0,0086, n = 131, p = 0,332). A Pearson correlation test showed a moderate positive relation between *forced waiting time* and appointment time and appointment time in the afternoon consults (r = 0,388, n = 65, p = 0,0005). Corresponding scatter plots are presented in Appendix D.





What are current service times for patients of the outpatient clinics?

The observed mean *service times* are presented in Table 3 with their standard deviation, minimum, and maximum. This table also shows the results of the comparison between the observed *service times* and the planned *service time* of 10 minutes for each consult type by a paired samples t-test. There was no significant difference between planned *service time* and observed mean *service times*. The accuracy of the observed *service time* was presented in terms of time and percentage that it is within the actual mean. For example, for oncology follow up patients the accuracy lays within 1,3 minutes of the actual mean and achieved an estimate within 14,17% of the actual mean. The standard deviations were relatively high compared to the means and the desired accuracy consisted of high percentages.

	n	Mean service time (mm:ss)	Standard Deviation (mm:ss)	Minimum (mm:ss)	Maximum (mm:ss)	Acc (m	uracy m:ss)	Sig. (2 tailed)
ONC*	68	09:13	0:05:07	02:00	25:00	01:18	14,17%	0,214
TRC	42	10:12	0:04:37	04:00	20:00	01:24	13,70%	0,766
VAC	26	12:23	0:07:20	03:00	30:00	01:47	14,34%	0,110
HEC**	31	09:48	0:05:15	03:00	25:00	01:51	18,86%	0,893
HEN	30	11:04	0:05:23	03:00	20:00	01:56	17,39%	0,288

Table 3 Descriptive statistics of observed service times for specialists

*Note that this subgroup contains several outliers. Five of them are clustered together and one is a far outlier. The far outlier is excluded (service time of 35 minutes). Inclusion of this far outlier would imply a mean service time of 09:36 with a std. dev. of 05:58.

**Note that this subgroup contains 2 outliers which have been excluded. Inclusion of these outliers would imply a mean service time of 11:33 with a std. dev. of 08:08.

Outside observations on *service time* were made for the ONC, HEC and TRC consults during two morning consultation hours, as mentioned previously. The mean *service times* and their standard deviation as observed from the questionnaire in this study do not differ significantly to the observations made by outside observation as determined by t- and f-tests, with the exception of the mean *service time* for TRC. This supports the belief that the registered *service times* by respondents do not significantly differ from the outside observation and the high variation found in this study is representative for daily practice. This can possibly be generalized for other consult types as well.

The observed *service time* for the CB consult type was 17,58 minutes with a standard deviation of 12,57 minutes. These patients were seen by a nurse first and also saw the specialist (n = 73): it shows that 28,76% (n = 21) estimated to have seen the specialist for 1-2 minutes, 35,62% (n = 26) estimated to have seen the specialist for 3-4 minutes and 35,62% (n = 26) estimated to have seen the specialist for 5 or more minutes. It is important to note that the planned *service time* for CB is 5 minutes based on the time of the specialist.

Respondents were asked to list the activities that took place during their consult. There was no relation between service time and reported activities found for follow up patients of traumatology, vascular surgery, general surgery and new general surgery patients (TRC, VAC, HEC, and HEN) by conducting Kruskal-Wallis tests. Within the samples of TRC, VAC and HEN there were several subgroups with approximately a similar distribution: the two largest subgroups were not applicable and physical examination with similar sizes. In all three samples these two subgroups consisted of majority of the sample, for TRC this was 78,05% (n = 32), for VAC 72% (n = 18), and for HEN 83,33% (n = 32) = 25, note that the *physical examination* subgroup has a size of 20). The remaining subgroups consisted generally of less than 3 respondents. For the sample of HEC the subgroups of not applicable and physical examination consisted of 41,94% (n = 13), the largest subgroup in this sample was other. The respondents specified the other activities done as preparation of hospitalization, monitoring of the splint, and evaluation of a photo. For ONC a relation between service time and activities that took place during consults was confirmed, χ^2 (5, n = 65) = 11,45, p = 0,043, however the subgroups between which a significant difference was observed were too small to base conclusions on. There was also a relation confirmed by a Kruskal-Wallis test between service time and activities that took place during CB-consults, χ^2 (10, n = 65) = 19,27, p = 0,037. There is a significant difference between wound care and physical examination (U = 39, p = 0,001), and between not applicable and wound care (U = 28,5, p =0,00). There was no significant difference found in gender: χ^2 (1, n = 69) = 0,021, p = 0,884, or age categories: χ^2 (7, n = 69) = 6,11, p = 0,527.

There were no significant differences found in service times in gender, between location or age categories for TRC, VAC, ONC, and HEN consults as determined by Kruskal-Wallis tests. For HEC there was no significant difference in *service time* between locations and age categories, however, there was a significant difference in gender (χ^2 (1, n = 53) = 4,47, p = 0,035).

Kruskal-Wallis tests have also been used to evaluate differences in mean *service time* for the patients who were seen by a nurse first in the above mentioned consult types. There were no significant outcomes which means there is no difference in mean *service times* between activities.

What are the perceptions of current patients with regard to their acceptability of waiting time in relation to the current waiting times, and their perceptions on the notification of waiting time, comfort of the waiting area, ease of making an appointment, and having sufficient time with the specialist?

The maximum acceptable waiting time of 50% of the respondents was between 15 and 30 minutes. Figure 12 shows the distribution of the *maximum acceptable waiting time* (in minutes). The *maximum acceptable waiting time* did not differ significantly for males and females or between locations as determined by a one-way ANOVA test.



Figure 12Distribution of maximum acceptable waiting time (in minutes)Note that all respondents filled in a waiting time with a multiple of 5, except the respondent that filled in 0. And
the majority of the respondents filled in a maximum acceptable waiting time of 10, 15, 20 or 30 minutes.

Table 4 shows the overview of the mean *maximum acceptable waiting times* per specialty and age category. There was a statistically significant difference between specialties as determined by one-way ANOVA (F(3,386) = 3,16, p = 0,025). A Tukey post-hoc test revealed that *maximum acceptable waiting time* was statistically significant between oncology and resident (p = 0,043). The *maximum acceptable waiting time* was evaluated per *age categories* by a one-way ANOVA test: There was no statistically significant difference (F(7,395) = 1,81, p = 0,083). Levene's test for homogeneity of variances confirmed that the variances in *maximum acceptable waiting time* per *age category* are not considered equal (p = 0,004). In addition a Pearson's correlation test is conducted (linearity assumed, p = 0,011). There was a positive weak correlation between *age* and *maximum acceptable waiting time* (r = 0,125, n = 403, p = 0,012).

		Mean (min)	N	Std. Deviation (min)
	Traumatology	20,67	104	10,476
ties	Oncology	24,65	101	14,565
cial	Vascular surgery	23,77	65	11,694
Spe	Resident	20,21	120	12,659
	Total	22,08	390	12,606

 Table 4
 Comparison of mean maximum acceptable waiting time per specialty and age category

Table 5 shows the mean *forced waiting time* compared by *maximum acceptable waiting time*. For example, 123 respondents indicated that their *maximum acceptable waiting time* was 15 minutes and their mean *forced waiting time* was 12 minutes with a standard deviation of 13 minutes.

Maximum acceptable waiting time (hh:mm)	Mean (hh:mm)	N	Std. Deviation (hh:mm)
0:00	0:00	1	
0:05	0:07	8	0:07
0:10	0:11	53	0:13
0:15	0:12	123	0:13
0:20	0:11	46	0:12
0:25	0:10	1	
0:30	0:14	98	0:17
0:35	0:40	1	
0:40	0:15	1	
0:45	0:09	7	0:09
1:00	0:14	17	0:22
Total	0:12	356	0:14

Table 5Comparison of mean forced waiting time with maximum acceptable waiting time

33,99% (n = 121) of the respondents was forced to wait as long or longer than their maximum acceptable waiting time. Which means the appointment of the majority of the respondents started before the waiting time exceeded their maximum acceptable waiting time. 40 respondents (11,24%) waited as long as their *maximum acceptable waiting time* and 81 respondents (22,75%) waited longer. Table 6 shows the *maximum acceptable waiting time* and the *forced waiting time* of these respondents. It also includes the percentage of the total subgroups.

Table 6Comparison of mean forced waiting time for respondents whose wait time was equal orlonger than their maximum acceptable waiting time

Maximum acceptable	Mean (hh:mm)	Std. Deviation	N	N Total	Percentage of total
waiting time (nn.mm)		(nn:mm)	-		
0:00	0:00		1	1	100%
0:05	0:15	0:01	3	8	37,5%
0:10	0:20	0:12	29	53	63,04%
0:15	0:24	0:12	51	123	41,46%
0:20	0:25	0:08	16	46	34,78%
0:30	0:42	0:18	19	98	19,39%
0:35	0:40		1	1	100%
1:00	1:15	•	1	17	5,88%
Total	0:26	0:15	121		

79 of the 471 respondents skipped the ranking of statements entirely in the questionnaire. Of the remaining 392 respondents 23,72% (n = 93) did not fill in the ranking as intended, e.g. ranked

statements individually rather than relative to each other or skipped the ranking of at least one statement. Figure 13 shows the ranking of the statements.



Figure 13 Ranking of statements

As mentioned before, it is expected that the *forced waiting time* is more extreme in daily practice. Respondents were asked to rank their maximum acceptable waiting time in comparison to the other statements: 4,68% (n =14) found not waiting longer than their maximum acceptable waiting time as the most important, 26,42% (n = 79) considered this as very important, 31,77% (n = 95) ranked the statement as important, 21,07% (n = 63) found it of little importance, and 16,05% (n = 48) scored this as least important. The ranking of the statement on notification of the waiting time when it is exceeding the appointment time is also related to the forced waiting time: 2,34% (n =7) found this the most important statement, 14,38% (n = 43) considered this as very important, 27,09% (n = 81) ranked it as important, 38,80% (n = 116) found it of little importance, and 17,39% (n = 52) ranked this as least important.

Table 7 shows the distribution of the level of agreement on the four statements. For each statement, except *notification of the waiting time*, the majority of the respondents agree. Respondents find it more important not to wait longer than their maximum acceptable waiting time than being notified on their waiting time exceeding their appointment time.

The respondents were divided in their level of agreement on the notification of the waiting time. Therefore, by the means of ordinal regression the strongest prediction model is presented. This model includes the variables *reason of visit, specialist, age categories,* and *appointment time categories.* The negative log log function provides the best fit (p = 0,012).

	Ease of making an		Comfort of the		Notification of the		Sufficient time with	
	appointment		waiting area		waiting time		the specialist	
	n	%	n	%	n	%	n	%
Entirely disagree	18	3,8	21	4,5	108	22,9	7	1,5
Somewhat disagree	25	5,3	51	10,8	101	21,4	6	1,3
Somewhat agree	174	36,9	220	46,7	134	28,5	100	21,2
Entirely agree	249	52,9	176	37,4	66	14,0	330	70,1
Missing	5	1,1	3	,6	62	13,2	28	5,9
Total	471	100,0	471	100,0	471	100,0	471	100,0

Table 7Distribution of level of agreement on the four statements

Tables 8 is a classification table that shows the predicted categories with the actual categories and show how often the models can produce correctly predicted categories based on the values of the predictor variables. The model correctly predicted 22,22% of the respondents that selected *entirely agree*. For the category *somewhat agree*, 70,31% is correctly predicted. The category *somewhat disagree* has not been correctly predicted by this model. And the model predicts 34,29% of the *entirely disagree* respondents correctly. Overall, the model did not accomplish to identify strong predicting factors for agreeing or disagreeing on the notification of waiting time. It can be concluded that *gender* and *location* had no influence. Which means that the level of agreement for respondents is not related to their gender or location.

Table 8	Classification table of the best fitted model
---------	---

		Predicted Response Category					
	Entirely agree Somewhat agree Entirely disagree						
	Entirely agree	14	48	1	63		
Notification	Somewhat agree	11	90	27	128		
waiting time	Somewhat disagree	5	61	31	97		
	Entirely disagree	6	63	36	105		
Total		36	262	95	393		

When looking at the ease of making an appointment 90,77% (n = 423) agreed on it and 16,39% (n = 29) found this the most important and 42,14% (n = 126) ranked it as very important. 59,20% (n = 177) found the comfort of the waiting area the least important. While the respondents agreed on this statement (84,62%, n = 396), the majority of the comments filled at the end of the questionnaire were regarding the waiting area. Respondents had suggestions on improving the waiting area to their wishes: more and recent magazines and newspapers, a coffee and tea machine, radio in the waiting area, adjustment of the chairs – as they are too high for shorter people to reach the ground. 97,1% (n = 430) agreed that they had sufficient time with the specialist and 74,58% (n = 223) ranked this as most important.

3.2 Results on total population

This section will present the results of the research questions related to the data collection done on the total population of patients seen in week 43 and 44 of 2012.

What is the current frequency of overbooked appointments and no shows in the schedules of the outpatient clinics?

18,89% (n = 338) appointments were overbooked and 3,18% (n = 57) of the patients did not show for their appointment. Figure 14 shows the proportion of overbooked appointments and no shows for each consult type. Telephonic consults have the largest proportion of overbookings (82,67%), followed by the follow-up patients: UC 48,89% (n = 22), ONC 25,90% (n = 94), TRC 20,31% (n = 39), HEC 19,42% (n = 47), and VAC 14,97% (n = 22).



Figure 14 Proportions of overbooked appointments and no shows

Outpatient clinic 11 at Oldenzaal has higher proportions of overbooked appointments per specialty, except for oncology which has a similar proportion as outpatient clinic 28 at Enschede, see Table 11. When comparing the total appointments for the specialties in Oldenzaal with Enschede, it became clear that there are less consultation hours in Oldenzaal for the specialties vascular surgery and traumatology, however, residents had more consultation hours in Oldenzaal than in Enschede. Explanations for more frequent overbooking in Oldenzaal may be that patients prefer Oldenzaal over Enschede, or the patient is not available on a day that the specialist has their consultation hours in Enschede – assuming the specialist has consultation hours in Enschede as well as in Oldenzaal, or the specialist only holds consultation hours in Oldenzaal and the patient prefers this specialist. No shows per location and specialty are also presented in Table 9. The proportions of no shows per location and per specialty were higher for outpatient clinic 28 in Enschede than for outpatient clinic 11 in Oldenzaal.

LaGanga & Lawrence (2007) concluded that the overbooking policy of the RNI method is performed best at high show rates. In this study high show rates were found (Table 9), therefore this method can be applied to the outpatient clinics and used as a guideline.

Location/Specialty	Total appointments	Fotal appointments Overbookings No sho		No sho	ws
Enschede outpatient clinic 19	302	16	(5,30%)	12	(3,97%)
Resident	302	16	(5,30%)	12	(3,97%)
Enschede outpatient clinic 28	833	149	(17,89%)	29	(3,48%)
Vascular surgery	206	31	(15,05%)	7	(3,40%)
Oncology	259	80	(30,89%)	9	(3,47%)
Traumatology	324	38	(11,73%)	13	(4,01%)
Resident	44	0	(0%)	0	(0%)
Oldenzaal outpatient clinic 11	655	173	(27,41%)	16	(2,44%)
Vascular surgery	49	15	(30,61%)	3	(6,12%)
Oncology	333	94	(28,23%)	6	(4,88%)
Traumatology	67	19	(28,36%)	4	(5,97%)
Resident	206	45	(21,84%)	3	(1,45%)
Total	1790	338	(18,89%)	57	(3,18%)

Table 9 Overbooked appointments and no shows per location and specialty

In a morning consultation where appointments are booked from 8:10 and a coffee break of 30 minutes is planned, there are 20 appointment slots of 10 minutes (D, deterministic service time). N is the capacity of the clinic and is used to calculate K, the number of appointments to be scheduled. Interarrival time (T) is calculated by multiplying the service time (D) with the show rate (S). Table 10 shows the results of round to the nearest interval method applied to the outpatient clinics. Overbooking one appointment means that the *service time* per patient needs to be a bit faster than no overbooked appointments. Depending on the variability in the *service times*, patients could perhaps also be overbooked in high show rates.

Show	Number of	Rounded number	Interarrival	Extra	Expected
rate (S)	appointments	of appointments	time	appointments	number of
	to be scheduled	to be scheduled	(T; T=D*S)	(K-N)	patients
	(K; K= N/S)	(К)			(E(x)=S*K)
1	20	20	10	0	20
0,99	20,20	20	9,9	0	19,8
0,98	20,41	20	9,8	0	19,6
0,97	20,62	21	9,7	1	20,37
0,96	20,83	21	9,6	1	20,16
0,95	21,05	21	9,5	1	19,95

Table 10 Round to the nearest interval method

The utilization of the outpatient clinics was used to describe efficiency during week 43 and 44 of 2012. At outpatient clinic 19: nine morning consultation hours for CB-consults were held, which equals a total capacity of 36 hours. 14 hours and 45 minutes were lost due to consultation hours starting/ending sooner/later than scheduled opening times. This meant an utilization of 59,3%. When looking at the utilization of the consultation hours for small surgical procedures we can see that the utilization was overall acceptable. There is the perception that there is not enough capacity for this consult type in Enschede. With a capacity for 50 procedures, 56 were booked (of which 10 overbooked – 17,86%). The utilization could be better when normal opening times were used: there were five consultation hours in the morning and three in the afternoon, with a planned coffee break

from 10:10 to 10:30, and a planned *service time* of 30 minutes. All three afternoon consultation hours went 30 minutes into overtime, because of an overbooked procedure. One morning consultation started one hour later and ended two hours earlier.

Table 11 shows the frequency of consultation hours held at outpatient clinic 28 and 11, followed by the total time available and the time lost due to consultation hours starting later than the opening time and ending sooner than the closing time. For the morning consults at outpatient clinic 28, oncology had the highest utilization followed by traumatology. Vascular surgery had a lower utilization than the two other specialties because the vascular nurse practitioner had deviating opening times. A resident had the lowest utilization at the morning consultation hours. A likely explanation for low utilization is that the time is used for other responsibilities. The overtime in morning consultations for oncology and vascular surgery was relatively high, especially considering the time lost. For the afternoon consultation hours, the utilizations were more equal. However, the time lost is mostly explained by the fact that appointments are rarely booked later than 15:00-15:10.

			Overall	Oncology	Vascular Surgery	Traumatology	General surgery
		Frequency	35	10	10	13	2
		Total time (hrs)	113:45	32:30	32:30	42:15	6:30
28	ing	Time lost (hrs)	27:00	2:05	9:35	8:00	3:30
nic	orr	Utilization	76,27%	93,59%	70,51%	81,07%	46,15%
cli	Μ	Overtime (hrs)	7:35	3:25	3:45	0:25	n/a
ede		Frequency	23	2	8	11	2
sch	u	Total time (hrs)	57:30	5:00	20:00	27:30	5:00
En:	ternoc	Time lost (hrs)	11:55	0:45	1:55	3:40	1:00
		Utilization	79,28%	85%	90,42%	86,67%	80%
	Ai	Overtime (hrs)	0:25	n/a	0:25	0:25	n/a
	orning	Frequency	20	9	2	2	7
		Total time (hrs)	70:00	31:30	7:00	7:00	24:30
11		Time lost (hrs)	3:05	0:30	0:35	0:30	1:15
nic		Utilization	95,60%	98,41%	91,67%	92,86%	94,90%
l cli	Μ	Overtime (hrs)	3:05	1:30	0:35	0:05	0:50
lenzaa		Frequency	19	9	1	2	7
	uc	Total time (hrs)	47:30	22:30	2:30	5:00	17:30
Ö	oou.	Time lost (hrs)	14:05	7:35	0:10	1:05	4:30
	fter	Utilization	70,35%	66,30%	93,33%	78,33%	74,29%
	Αi	Overtime (hrs)	0:50	0:50	n/a	n/a	n/a

Table 11Utilization and overtime of outpatient clinic 28 and 11

At outpatient clinic 11 the utilizations of all specialties were above 90%, which was higher than in outpatient clinic 28. The time lost in Oldenzaal was about nine times less than in Enschede, most likely because specialists have no other responsibilities to do at that location. There was also less overtime. The utilization for oncology was quite low for the afternoon consultation hours with a high amount of time lost.

3.3 Results on tactical level

The access times, supply and demand are discussed in this paragraph. First, the access times are listed, followed by the supply and demand per specialty.

What are current access times for patients of the outpatient clinics?

The access times are shown in Table 12 for week 44, week 48 in 2012 and week 4 in 2013. These times are the access times to the third available appointment slot. The access time were fluctuating across the three presented months and per specialty as well. On ten measurements the access time exceeded the norm of four weeks.

	Outpatient clinic 28 Enschede			Outpatient clinic 11 Oldenzaal		
	Week 44	Week 48	Week 4	Week 44	Week 48	Week 4
New oncology	3,79	1,79	5,11	5,86	2,5	2,79
Oncology follow up	3,32	2,67	4,93	4	1,43	2,79
New vascular surgery	3,86	2,97	2,57	5,29	6,29	4,29
Vascular surgery follow up	2,33	2,29	2,57	4,29	6,29	2,29
New traumatology	1,89	1,39	5,93	3,14	3,14	3,14
Traumatology follow up	1,76	1,39	8,39	3,14	3,14	3,14

Table 12 Access times outpatient clinic 28 and 11 (in weeks)

Note that in Oldenzaal there is only one specialist holding their consultation hour for vascular surgery and traumatology. And when the measurement of week 48 was done, consultation hours of 2 oncologists were not yet available for planning.

How does the supply (capacity) at the outpatient clinics relate to the demand (patients)? Table 13 shows the overview of supply and demand per specialty. The demand exceeded the supply for the specialties of oncology, general surgery, and vascular surgery. The demand for health care is too high for oncology to meet with their supply. This results in overbooking of patients and higher access times than acceptable. The difference between supply and demand can be explained by the reduction of two nurse practitioners who have not been replaced. One staff member is included in supply regardless of her maternity leave and the contract of one staff member ends in November 2013. This implies that the available hours for consultations for oncology will further decrease/has decreased compared to the current results.

	Oncology	Vascular Surgery	Traumatology	General Surgery	Total
Demand (hrs)	1968	1067	817	1022	4874
Supply (hrs)	1390	1050	1028	886	4354
Difference (hrs)	-578	-17	211	-136	-520

Table 13 Overview supply versus demand (Deloitte, 2013)

High access times were an experienced problem identified in the context analysis. If supply and demand are balanced, the access times would be consistent regardless of their length. However, access times were not consistently high or higher than the norm of four weeks. This implies that either the supply, demand or both are fluctuating. A fluctuation in supply was seen in the utilization analysis: a total of 89 hours and 30 minutes were lost which is an indicator that there were quite a lot of sessions that fluctuated in supply. During this time lost, specialists carry out other responsibilities as for example surgeries.

Chapter 4 Discussion

In this chapter the main conclusions and recommendations are listed and results are placed in a broader context with literature. And finally limitations of methods and results are discussed.

The aim of this study was to investigate how the consultation hours can be improved. The results of this study indicate that access times are not consistent in their length which indicates an imbalance between fluctuations in demand and supply. Fluctuation in supply was seen in the time lost in the utilization analysis and the efficiency of consultations hours can slightly be improved. Reducing these fluctuations should also allow to reduce overloaded sessions. A general lack of capacity was seen and mostly attributed to oncology. Oncology also had the largest proportion of overbooked appointments and delays which support a capacity problem. Factors such as arrival and service time variability, patient and provider preferences, available information technology, and the experience level of the scheduling staff affect the performance of appointment systems (Gupta & Denton, 2008). Variability in arrival times of patients did not seem to affect the performance of the appointment system as very little patients were tardy. Variability in service time could not be attributed consistently to gender, age, location or activities that were performed during the consult, which can indicate a natural variability inherent to the process. Waiting times were confirmed, but may be longer and more extreme in practice. There was no balance between overbooked appointments and no shows, and the amount of overbooked appointments was relatively large.

The majority of the respondents were satisfied with the service at the outpatient clinics. The respondents found it most important to have sufficient time with the specialist, the comfort of the waiting area was found least important. Respondents find it more important not to wait longer than their maximum acceptable waiting time than being notified on their waiting time exceeding their appointment time. However, the respondents were divided in their level of agreement on the notification of the waiting time. Respondents were satisfied with the waiting area, but found this the least important.

Shortcoming of supply

Access times are measured once every month, which gives a less clear overview than weekly measurements. In this study it is assumed that the absence of steady access times indicate fluctuation in supply and demand. When access times are low, and the demand is high, this might be an indication for overbooked appointments. At the outpatient clinics, two possible causes are seen of a shortcoming in supply: lack of capacity and inefficient use of existing capacity (Kreindler, 2010). The observed lack of capacity reinforces the expectation of high access times as concluded in literature (Kreindler, 2010; NHS Modernisation Agency, 2005; Heij & Prins, 2005). Measuring access times more frequent may provide further insight in the fluctuation and help determine the extent of the shortcoming of supply.

Lack of capacity

The biggest capacity problem is found at oncology. Although the department has attracted a physician that will hold oncology consultation hours in Oldenzaal, an oncology nurse practitioner has gone on maternity leave. In the dataset of the total population it has been observed that a resident physician has also held oncology consults in Oldenzaal. This can also be considered as extra capacity,

when specialists of traumatology see as much general surgery patients as possible (since they have excess capacity). Capacity will also be increased by opening the outpatient clinics longer. Efficient use of extended and current opening times can make a difference in the shortcoming of supply. A pilot is planned to open the clinics to 16:00.

Splitting up and/or shifting tasks from specialists to nurses or residents should free up time as well. It has been observed in this study that patients who are seen by a nurse first spend less time with the specialist. It has to be noted that there is no shared schedule between nurses and specialists. Combination appointments will provide more control over workload distribution of nurses. A discussion with specialists and nurses could provide insight into the possibilities for this. Sibbald, Shen and McBride (2004) state that within a given service a skill mix change is brought about through enhancement, delegation, substitution, and innovation. It may also mean shifting tasks to another department. The purpose of these changes is to promote efficiency and/or effectiveness of healthcare. In their systematic review they investigated the outcome of these changes. Skill mix changes have proven to be potentially successful in literature and may also be successful at the outpatient clinics at MST.

Reduction of demand will create a balance in access times. Heij & Prins (2005) suggest that the demand can be reduced by revising the policy for making follow-up appointments. Is it possible for follow-up appointments to be held via telephone, e-mail, or e-health applications. In the current situation telephonic consults are planned in sessions, mainly overbooked. Alternatively, the patient can contact the outpatient clinics when complaints are experienced and a follow up appointment is needed, although this approach requires appointment slots to be available on short term. The period of time in between check –ups can also be evaluated. Whether service times can be reduced should be included to previously mentioned discussion of variability of service. These options can be further investigated to reduce demand.

Inefficient use of existing capacity

Heij & Prins (2005) state that the fluctuation in supply is often larger than that of demand. Each week the specialists have the same amount of time scheduled for holding consultations at the clinics. Their roster does not become definitive until six weeks ahead, while patients are scheduled three months ahead. Whenever a specialist deviates from their initial roster and clinic time is reduced, it is likely that appointments have to be rescheduled. From a patient perspective, cancelation or (frequent) rescheduling of appointments can lead to dissatisfaction of patients (Gupta & Denton, 2008). Thus minimizing rescheduled appointments enhances patient-centeredness. From an efficiency point of view, it was observed that 89,5 hours of clinic time were lost due to clinics opening later and closing earlier than planned.

Silvester, Lendon, Bevan, Steyn and Walley (2004) argue that a lack of capacity is rarely the major problem. Studies have shown that there is no relation between waiting lists (access time) and organizational capacity and level of demand (Goldratt and Cox, 2000; Schonberger, 1986; Womack and Jones, 1996). Silverster *et al* (2004) therefore studied causes of access time. First, waiting lists will arise rapidly when demand exceeds supply (capacity). However, they state that this rarely happens (Audit Commission, 2002; Audit Commission, 2003; Martin et al, 2003; Murray,2000). Second, a fundamental mismatch between variation in the demand and the variation in supply is the

most common cause of high access time in their experience. When comparing these causes with the results of this study we see that demand seems to exceed the supply, capacity is used inefficiently, and a mismatch between the variation in demand and supply. Literature suggests that investigation and determination of variations/fluctuations in supply and demand offer the greatest potential for success. Silvester *et al* (2004) list key steps to achieve this:

- Understand the system:
 - Understand the demand and capacity of the system at a macro level and the impact that different patient flows have on each other.
 - $\circ~$ Map the patients' journey through clinical processes.
- Simplify the processes:
 - Reduce the number of steps involved.
 - $\circ~$ Reduce the number of queues at bottlenecks in the process.
- Control the variation:
 - Identify patients with similar flow characteristics and separate flows where appropriate.
- Reduce the variation:
 - Measure the demand and capacity continuously over time.
 - $\circ~$ Understand the causes of variation that affect the demand and capacity.
- Make the system safe for patients and staff:
 - $\circ\;$ Set the capacity appropriately to account for the variations and minimize the delay for all patients.
 - Monitor the variation.

Silvester and Lee (2004) conducted a case study where the above mentioned principles were applied. Variation in demand (amount of patients) and capacity (number of appointment slots) per week were visually presented in a graph. They observed that the variation in the capacity was much greater than that of demand, and by reducing that variation the access time to the outpatient clinic was reduced to five days from two weeks.

At Ziekenhuis Groep Twente (ZGT) tactical planning has resulted in success (Dijen, van, 2009). Every two weeks specialists and planners participate into a meeting on tactical planning where they look eight to twelve weeks in retrospect and forward. By looking back to recent numbers they can predict demand for the upcoming period as specialists often generate their own demand. They created so-called capacity care pathways. Which indicate how much time is needed in the outpatient clinic, surgery, and admittance. Based on recent numbers and how much capacity is need, the time needed is predicted for the upcoming weeks. Frequent meetings could assist in making the decision to open extra sessions. It has been observed that extra sessions were opened within the same week, which leads to the secretaries having a difficult time filling the appointment slots on short notice. When access times are increasing, the decision can be made during those meetings to open up extra sessions. It would offer a certain flexibility in capacity and control over the demand, without overbooking appointments which are not needed. A similar approach could work for MST. Rijntjes (2011) researched the design of a tactical resource capacity planning concept for the outpatient clinics and operating rooms of MST.

Waiting times

Waiting time for patients is one of the experienced problems at the outpatient clinics in all stakeholders. Overloaded sessions, late start of sessions, unused session time, unevenly distributed slots, and irregular calling sequence are causes of waiting times (Zhu, Heng & Teow, 2010). At the

outpatient clinics it is unknown whether delays can partly be explained by the late start of sessions due to late arrival of the specialist, unused session time, and irregular calling sequence. These causes should be further investigated to possibly reduce waiting-, idle-, and/or over time. Lack of timeliness is confirmed in this study: 70,15% of the patients were forced to wait for their appointment. Evidence shows that waiting times are more extreme in practice and this is underlined by perceptions of the staff (Workshop Deloitte, 2012). Harper and Gamlin (2003) reported similar waiting times in their analysis of an ENT (Ear, Nose, and Throat) outpatient clinic. Through simulation they succeeded to reduce the waiting time. Simulation would seem like a logical step for further research.

Patient perspective

34% of the respondents was forced to wait as long or longer than their maximum acceptable waiting time. This percentage is likely to be higher as waiting times are assumed to be longer in practice. As respondents found it important not to wait longer than their acceptable waiting time, it is important to address the issue waiting times. Respondents found the notification on waiting time less important than not waiting longer than their acceptable waiting time, however, the only statements on which respondents disagreed was on the notification of the waiting time. This disagreement shows an opportunity for improvement: In daily practice patients are rarely informed on their waiting time, which is contradicting with the respondents that filled in that they agreed on the statement. Analysis showed no significant influence of location on the level of agreement on the statement. So the notification on waiting time can be improved for all clinics. There are different tools available for the notification of waiting time: a scale in minutes at the front desk where the indicator can be moved to current waiting time or installing a screen where news and information can be displayed in the waiting area. It was not expected that respondents would agree on the comfort of the waiting area, as there is room for improvement. Servicescape is one of the criteria determined by Grönroos (2010) for perceived quality and the indicated suggestions from respondents were mostly related to the waiting area. Suggestions involved adding recent newspapers and literature and a coffee/tea machine.

The median of the maximum acceptable waiting time is at 15 minutes, however, there was a relatively large proportion of respondents that was willing to wait longer than this. Explanations for large acceptability of waiting time are that patients visit the clinic on yearly basis or took a day off and therefore accept a long waiting time. Huang (1994) researched that surgical outpatients were reasonably satisfied when waiting no longer than 30 minutes when arriving on time, and willing to accept an hour of waiting time when arriving late. Patients who arrive up to 15 minutes early take the responsibility for the extra waiting time caused, but patients arriving even earlier intend to be seen earlier. This study did not investigate the acceptability of waiting time as extensively as Huang's study, but it has been observed that the majority of the patients is willing to wait up to 30 minutes.

Overloaded sessions

Overloaded sessions can be caused by double-booking/overbooking appointment slots or naturally flow from variability in service times, and therefore cause waiting time (Zhu, Heng & Teow, 2010; Noon, Hankins & Cote, 2003). In this study no relation was found between forced waiting time and location or specialty.

Overbooked appointments

In this study there is no balance between overbooked appointments and no shows, therefore it is recommended to avoid overbooking unless medically necessary (LaGanga & Lawrence, 2007). 51,48% of the overbooked appointments are attributed to oncology. For oncology overloaded sessions with overbooked appointments are likely to attribute to high waiting times. A clear policy for overbooking appointments should be considered: limitation of overbooking appointments only for oncology patients; limitation of overbooking appointments to patients with a medical necessity (Oudhoff *et al*, 2007; Wigersma *et al*, 2003). In which situations it is medically necessary to see a patient on the short term, and thus overbook the appointment, should be determined to avoid overbooking out of the desire to be patient friendly.

A high show rate was observed and thus overbooking according to the RNI-method could prove to be viable at the outpatient clinics. Monitoring of no show rates will assist in decision making for appointment rules on overbooking.

Variability (service times)

97,1% agreed that they had sufficient time with the specialist and 74,58% (n = 223) ranked this as most important. These results are in line with the findings of Zaghloul & Abou El Enein (2010) and Anderson, Camacho & Balkrishnan (2007).

On average the mean service times do not differ significantly from the planned service time for each consult type. However, the standard deviations and accuracy of the samples lead to a large range in service times. Therefore the conclusion can be made that, even though the samples do not have the desired accuracy, the data underlines the large variability in service time. The planned service times should be evaluated. This can be done by comparing them to the times determined by the association of surgery (which are based on expert opinions). Specialists would need to invest time in defining their patient population and groups that have the most variability. Identification of these groups can allow categorization of patients. There are several methods for the clustering of patients: Dilts, Khamalah and Plotkin (1995) review cluster analysis as applied in healthcare settings. The authors state that while there are no formal rules for making clustering decisions, they provide an overview and illustration with the major decision points and possible applicable rules. In all likelihood the outpatient clinics will benefit from using categorization based on post-classification (after the patient has consumed healthcare), historical data, diagnosis-related groups (DRG's) and expert knowledge. When making patient categories it is important to also look at the resources that they use and the resources that are available, for example the assistance of nurses. This is capacity planning and management. According to Vissers (1993) there are three central questions, as mentioned on page 12, in capacity management which will help in patient categorization.

The actual service times should be evaluated as well: It needs to be determined which factors of variability are known on forehand. If these factors cannot be known on forehand, then applying variable inter-appointment times could be an option. For example from 9:00 to 10:00 appointment slots can be increased to 12 minutes instead of 10, meaning you service one less patient during your consultation hour, but variability in service times are accounted for. Since the coffee break is often to get back on schedule, servicing one less patient before the break could allow a full break. Further

research on changes in the appointment system would need to be investigated. Literature suggests that appointment systems with fixed intervals remain superior over systems with variable intervals. *Unevenly distributed appointments (efficiency)*

Unevenly distributed appointments are also causes for delays (Zhu, Heng & Teow, 2010). Appointments can be unevenly distributed throughout the session due to different service times, however at the outpatient clinics most consult types have a scheduled service time of 10 minutes. Another form of unevenly distributed appointments is seen when secretaries purposefully keep the end of sessions free to prevent overtime. However, when at the same time appointments are overbooked earlier on in the session, there are still delays in the schedule which is ineffective and inefficient.

Overtime

Delays in appointment schedules cause the skipping of breaks and overtime for staff. It has been observed that a large part of the coffee break is used to catch up on delays in the appointment schedule. This is supported by the conclusion that forced waiting time increases until 10:00 in the morning, and after the coffee break there is no significant relation between the waiting time and appointment time. Overloaded sessions, late start of sessions, unused session time are inefficiencies that also have been determined as causes of clinic overtime (Zhu, Heng & Teow, 2010). The amount of overtime is calculated based on the appointment schedules in week 43 and 44: 11 hours and 55 minutes. 89,51% of the overtime was from the morning consultation hours and almost half of the total overtime comes from oncology. It has to be noted that overtime was based on the scheduled ending of the last appointment of the schedule. Due to variability in service time it is possible that the overtime deviates: it may be shorter or longer. In any case overtime and skipping or shortening breaks as a result overbooked sessions on the long term may lead to excessive workload.

Investigation of workload at the outpatient clinics did not fall into the scope of this study, however, it may be worth looking into the experience of the staff with the current workload to inventory possible causes of stress.

4.1 Limitations

The limitations of this study will be discussed regarding the design and conduct of the questionnaire, the data on population level, and tactical level.

Patients were asked to use the clock available in the waiting area, however this was an analogue clock, chances are that patients would have been more likely to record accurately with a digital clock. It has to be noted that this might not have made a difference for service times, as the sample sizes are smaller than desired. Larger sample sizes would have provided a better estimation of mean service times and its variation. In this study no significant difference was found between the service times observed by outside- and self-observation. When sample sizes of the different consult types would have been larger, the accuracy of the estimation of the mean observed service times would have been closer to the actual mean. Having a larger sample and better accuracy on service times might have allowed for the analyses regarding the service times to show significant results. The influence of factors such as age and activities done were expected to have an influence on service time, but in general no relation was found. When for example analysis would have showed that older follow up traumatology patients need significantly more time than younger patients, this could be

anticipated on when planning the appointment and thus minimizing delays in the clinic. A larger sample might also have shown a smaller variation in service times, which would mean that variability in service time are not as 'severe' as found in the current sample.

It was observed that respondents had the tendency to report the times in multiples of 5 minutes, this is in line with the expectation that patients are less likely to record accurately according to Polgar and Thomas (2008). Respondents proved that they were less likely to carry out observations as agreed (Polgar and Thomas, 2008), as the start and end time of the consult were the times of the time registration that were missing the most. This was expected, and measures were taken to limit the chance that respondents would skip this question.

Regarding the statements on which the respondents were asked to indicate their level of agreement. In general acquiescence bias has been observed: 'Respondents tend to be more likely to agree than disagree with statements in surveys' (Soroka, 2007). Social desirability or reluctance to express negative opinions may be reason for this (Lebow, 1974; French, 1981; Hulka, Zyzanski, Cassel & Thompson, 1971). When looking at the results of the CQI: 92% (n = 35) of the respondents indicated that they were not being notified on their waiting time. This result is not similar to the results from this study. In addition, 63% (n = 78) confirmed that they were seen within 15 minutes after their appointment time. And 80% (n = 40) indicated that they waited between 15 and 60 minutes. This data would support the findings in this study.

The response rate differed greatly per day, depending on the secretary that was handing out questionnaires. Also, some secretaries indicated that they did not have time to ask patients to fill in questionnaires. Some patients at outpatient clinic 19 were unwilling to fill in a questionnaire because of their short appointment. There are many oncology patients in Oldenzaal, the circumstances or severity of individual patients may have contributed to a lower response rate and earlier in 2012 another student conducted a survey as well: patients who then filled in a questionnaire were unwilling to complete another.

It is assumed that week 43 and 44 of 2012 are representative for any other week. However, week 43 was part of a holiday: One specialist was absent during this week due to vacation. The utilization during these weeks seemed acceptable, but opening times varied between consultations. When an outpatient clinic opens at 8:00, the secretary has little time to move to the clinic and start up the consultation hours. Therefore, many consultation hours do not start until 8:10. This difference in time explains part of the time lost in the utilization calculations. When not taking this time loss into account, utilization percentages will be higher.

The capacity calculations have a few limitations. First, residents and nurse practitioners are not taken into account in the capacity calculations. Second, days are considered in the calculations which are also used for rounds, which yield lower effective time. Third, the same percentage of effective time is used for each speciality while there are different number of specialists for oncology versus traumatology and vascular surgery. The supply on a half year basis has been corrected for 83% effective time to account for vacation days, congress days, and sick leave. It is unclear whether the needed time is corrected for each specialist individually or collectively. In the supply, hours have also been considered for staff members who went on maternity leave, or whose contract will end which means that lack of capacity would be even greater. However, the demand in the calculation was based on nine months, which is from a different time span than the calculation of supply.

In conclusion, the context of the consultations is formed by the path that the patient follows through departments, from the consultation to the surgery in the operation room (OR), admittance to a ward, and a follow-up at the outpatient clinic. "Only optimizing the outpatient clinic capacity may lead to waiting time and congestion downstream at the operating rooms" (Hulshof, Boucherie, Hans & Hurink, 2011). This is also called sub-optimization. Therefore this interrelation between departments is important to recognize, as the attempt to reduce problems in the outpatient clinics may have consequences further along the pathway of the patient.

Appendix A Phases of the Managerial Problem Solving Method and the Research Cycle

In the context of the outpatient clinics the experienced problem is an action problem: This is 'a perceived (by the problem owner) discrepancy between norm and reality' (Heerkens, 2010). In each of the phases of the MPSM (except the phase where a solution is chosen) a knowledge problem can arise. A knowledge problem represents a need for information, clarification or insight (Heerkens, 2010). When a knowledge problem is encountered, the MPSM is departed and the research cycle is entered. When the phases of the cycle have been completed, the gathered knowledge is used to continue solving the action problem (Heerkens, 2010).

The first four phases of the MPSM and the research cycle are followed and found in the different chapters within this study. In Chapter 1, the first phase was followed through and the experienced problems were explored. Based on the identification of the problems, the problem-solving process was started (Chapter 2) and allowed for the analysis of the problems (Chapter 3) and the generation of alternative solutions (Chapter 4). The research cycle was used complementary to the analysis of the problems, as there was no insight or data available.

Managerial Problem Solving Method – Action problem

- (1) Identifying the problem.
- (2) Planning the problem-solving process.
- (3) Analyzing the problem.
- (4) Generating alternative solutions.
- (5) Choosing a solution.
- (6) Implementing the solution.
- (7) Evaluating the solution.

Research Cycle – *Knowledge problem*

- (1) The research goal
- (2) The problem statement
- (3) The research questions
- (4) The research design
- (5) The operationalization
- (6) The measurement (gathering of data)
- (7) The processing of data
- (8) The drawing of conclusions (answering of the problem statement).

(Heerkens, 2010)

Appendix B Questionnaire

Vragen voorafgaand aan uw afspraak

Wij vragen u bij het opschrijven van de tijden gebruik te maken van de klok die in de wachtkamer hangt.

1.	Datum van van	daag (<i>dd-mm-jjjj</i>)				
2.	Uw aankomsttijd in de wachtkamer (uur:minuten)					
3.	Geboortedatum <i>(dd-mm-jjjj)</i>					
4.	Geslacht O Man		0	Vrouw	,	
5.	Locatie O Ensche O Oldenz	de poli 19 aal	0	Ensche	ede poli 28	
6.	Uw afspraaktijo	d (uur:minuten)	·····			
7.	Wat is de reden van uw bezoek? O Onderzoek om diagnose vast te stellen O Controleafspraak/vervolgafspraak O Behandeling/kleine ingreep O Anders namelijk					
8.	Er worden verschillende stellingen weergegeven. Geef per stelling aan in welke mate u het met de stelling eens bent					
а.	Ik kan gemakke Iocatie dat mij Volledig oneens O	elijk afspraken make <u>uitkomt.</u> Enigszins oneens O	en voor onde Enigszins me C	rzoek/ l	behandelingen op e Volledig mee eens O	en tijdstip en/of
b.	De ruimte waarin ik kan wachten heeft een prettige sfeer met voldoende mogelijkheden om mij te ontspannen. Volledig oneens Enigszins oneens Enigszins oneens Enigszins mee eens					
C.	Indien ik langer wachttiid.	r moet wachten dan	de afspraak	tijd wo	ord ik op de hoogte g	gehouden van de
	Volledig oneens	Enigszins oneens O	Enigszins me	e eens	Volledig mee eens	

d. De behandelend specialist neemt voldoende tijd om met mij te praten wanneer ik een afspraak heb.

Volledig oneens	Enigszins oneens	Enigszins mee eens	Volledig mee eens
0	0	0	0

9a. Bedenk bij de volgende stelling hoelang u bereid bent te wachten na uw afspraaktijd (wat is uw maximum acceptabele wachttijd?).

Een afspraak op de polikliniek begint niet later dan minuten wachttijd na de afspraak tijd.

9b. Rangschik de stellingen in mate van belangrijkheid, waarbij 5 het minst belangrijk en 1 het meest belangrijk. Deze stellingen zijn eerder genoemd bij vraag 8 en 9a.

Rangorde	Stellingen			
	Ik kan gemakkelijk afspraken maken voor onderzoek/ behandelingen op een tiidstin en/of locatie dat mij uitkomt			
	De ruimte waarin ik kan wachten heeft een prettige sfeer met voldoende			
	mogelijkheden om mij te ontspannen.			
	Indien ik langer moet wachten dan de afspraak tijd word ik op de hoogte			
	genouden van de wachtijd.			
	De behandelend specialist neemt voldoende tijd om met mij te praten			
	wanneer ik een afspraak heb.			
	Een afspraak op de polikliniek begint niet later dan mijn maximum			
	acceptabele wachttijd na de afspraak tijd.			
	(de wachttijd zoals ingevuld bij 9a)			

Hoe laat wordt u naar binnen geroepen? (*uur:minuten*)Wij vragen u de tijd op te schrijven voordat u de spreekkamer binnen gaat.

		•	
•••	•••	••••	•••

Vragen na afloop van uw afspraak

Deze vragen kunt u na afloop van uw afspraak invullen, voordat u het formulier inlevert bij de balie.

11. Hoe laat was uw afspraak afgelopen? (uur:minuten)

.....**:**.....

12. Door wie bent u naar binnen geroepen?

0	Dokter	0	Verpleegkundige
	ga door naar vraag 15		ga door naar vraag 13

- 13. U bent door de verpleegkundige naar binnen geroepen, heeft u de dokter ook gezien?
 - OJaONeega door naar vraag 14ga door naar vraag 15
- 14. U bent door de verpleegkundige naar binnen geroepen en u heeft de dokter ook gezien. Hoelang schat u dat de dokter in de spreekkamer is geweest?
 - O 1 tot 2 minuten
 - O 3 tot 4 minuten
 - O 5 minuten of langer
- 15. Welke verrichtingen hebben plaatsgevonden tijdens uw afspraak? Meerdere antwoorden mogelijk
 - O Niet van toepassing
 - Lichamelijk onderzoek waarbij u zich gedeeltelijk of geheel heeft moeten ontkleden
 Controle van ademhaling/meten van bloeddruk/opnemen temperatuur
 - O Hechtingen verwijderen
 - O Wondcontrole/verzorging
 - O Kleine operatieve ingreep
 - O Anders, namelijk
 -

Hartelijk dank voor het invullen van dit formulier en uw bijdrage aan dit onderzoek!

Wij vragen u vriendelijk om dit ingevulde formulier in te leveren bij de balie. Mocht u vragen of opmerkingen hebben, dan kunt u een e-mail sturen naar <u>j.vanamersfort@mst.nl</u>

Opmerkingen:

Appendix C Reference framework

This framework outlines a reference framework providing background information on different elements as found in this study.

Survey research is a suitable method for gathering original data on attitudes and orientations to describe a population which is too large to observe directly (Babbie, 2007). A questionnaire is often used in survey research and Babbie (2007) defines it as 'a document containing questions and other types of items designed to solicit information appropriate for analysis'.

There are two ways of observation possible when conducting a data collection method: selfobservation and outside observation. Self-observation means that the subject of observation collects the data opposed to outside observation where the researcher or another party collects data on the subject of observation. 'When research involves the observation of human subjects, self-observation becomes feasible and, at times, desirable' (Polgar & Thomas, 2008). There are several advantages and disadvantages to both methods, see Table 1.

		by Folgal & momas (2008.115).			
	Self-observation	Outside observation			
Advantages	Greater access to subjective	Greater objectivity			
	experience	Less bias			
	Less intrusive	More likely to record accurately			
	Less expensive	More likely to carry out			
		observations as agreed			

Table 1Self-observation versus outside observation by Polgar & Thomas (2008:115).

Self-observation as primary method of observation allows for a larger data collection in the set time span, as several specialists hold their consultations simultaneously as well as in different locations. In addition to self-observation, outside observation provides insight in the accuracy of the respondents on the element of time registration in the questionnaire. A questionnaire is designed for self-observation and outside observation is done regarding time registration for comparison.

Peer reviews of the questionnaire were used to improve it before distribution. There are limited items to attract higher response rates and to ensure the respondent is able to fill in the questionnaire within 10 minutes of their waiting time (Leung, 2001; Sierles 2003). The questionnaire can be found in Appendix C. Leung (2001) states that there is no optimal length for a questionnaire and that the response rate probably depends on the type of respondents. According to Sierles (2003) most persons perceive themselves as busy and are more likely to fill in the questionnaire if they can fill it in, immediately, easily, within 5 to 10 minutes and without having to look up information. Questionnaires are accompanied by a clipboard and a pen to improve the ease of use.

At MST the staff is able to voice their opinion and views on the daily practice. However, the patient is an important stakeholder as well. As part of the Santeon hospital group, MST uses the Customer Quality Index (CQI) to measure patient satisfaction (MST, n.d.). There is a specific questionnaire of the CQI that measures the satisfaction of outpatient clinic patients (CKZ, n.d.). MST sends these questionnaires to random patients several months after their visit. The CQI for outpatient clinics is not used in this survey study, because it is quite an extensive list of items and not every item is relevant for the scope of this study. A selection of relevant items is used and when needed rephrased in the questionnaire. In this survey study it is desirable that the respondent is able to complete the first part of the questionnaire in their waiting time. The information gathered is at the moment of their visit, rather than using results of the CQI measurement where the patient has to answer questions in retrospect.

Characteristics of the consult

The activities that took place during a consultation may influence the duration of the consult (service time). There may also be a relation between the activities and consult type, and activities and whether or not the respondent also saw the nurse.

Time registration

The choice for time registration as an element of the questionnaire is related to the planned times per consult type and waiting times. A stopwatch time study is a method of work measurement, in which the time is determined for a qualified worker to carry out a specific job at a defined level of performance (Ozcan, 2009). The assumption is made that every staff member is a qualified worker: A qualified worker is 'a person who is accepted as having the necessary physical attributes, intelligence, skill, education, and knowledge to perform the task' (Ozcan, 2009; Slack, Chambers & Johnston, 2007).Time registration is used to gain insight whether or not these planned times resemble the time used in practice for different consult types and to what extent those times vary. In addition, there is a lack of information regarding forced waiting time while it is experienced as a problem. Also gathering data on voluntary waiting time shows arrival patterns of patients and could potentially be used in further research by using queuing theory and/or a simulation model.

It is desirable that the patients register all four times in the questionnaire. *Arrival time* is listed as one of the first questions, in this way the patient notes down his arrival time as soon as he starts waiting. *Appointment time* is already known, yet it is still possible for patients to make an error. Appointment times can be corrected when looking up consult type, specialist and the nature of the appointment according to *date of birth* and *gender*. Respondents are specifically asked to register the *start time of the consult* before they enter the consult room. And the *end of the consult* is filled in after their appointment ended.

A likely explanation for forced waiting time is a delay in prior consult(s) or late arrival of the specialist at the start of the consultation hours. As mentioned earlier, there is a lack of information regarding the waiting times at the outpatient clinics. For both *voluntary* and *forced waiting time* the descriptive statistics give an overview on these times. In general: waiting times can be positive and negative. Patients who are late have a negative *voluntary waiting time* and when a consult starts before the appointment time the *forced waiting time* is negative. Therefore the distribution of negative and positive waiting times is described. It has been observed that patients who see a nurse first are seen before their planned appointment time with the specialist. Those patients will have a negative *forced waiting time*, which means their *voluntary waiting time* is shortened. It could occur that a consult with the specialist starts before the planned appointment time, in this case there will also be a negative *forced waiting time*. The *forced waiting time* may be different per specialty and location: the distribution and relation should give more insight into this. Delays in previous consult(s) may be an explanation for greater *forced waiting time*: the relation between *forced waiting time* and time of the day should be investigated.

Patient perspective

The four statements that are chosen represent four areas and they are based on statements used in the CQI outpatient clinic and a study on patient wishes by Nivel (CKZ, n.d.; Brouwer, Leemrijse, Sixma & Friele, 2002).

The first statement is related to the ease of making appointments on a preferred time/day/location: The planning of an appointment is usually the first contact the patient has with the outpatient clinic. The context analysis in Chapter 1 indicates that, the appointment schedules are filled with sometimes high percentages of overbooked appointments; there may be a lack of capacity, and high access times. It is unclear how the patient experiences the ease of making appointments. The second statement reflects the comfort of the waiting area: When the patient arrives at the outpatient clinic for their appointment, he/she will experience waiting time (either voluntary and/or forced). Hence, the comfort of the waiting area becomes a point of interest. In what way do patients experience the waiting are and is there a difference between locations for example. The third statement concerns the notification when the waiting time is exceeding their appointment time: In some cases the patient will be forced to wait: are patients informed by a notification of the waiting time when it exceeds their planned appointment time? The fourth statement is linked to the patient perspective on the time that the treating specialist has for them during their consult. The extent to which they agree/disagree is indicated by a four-point Likert scale to avoid neutral answers to the statements.

The second part of the patient perspective is an indication of the maximum acceptable waiting time of the respondent. The CQI for outpatient clinics and Brouwer et al. (2002) included an item related to waiting time: where the respondent is asked whether their consult started within 15 minutes after their appointment time. No information could be found on the origin of the norm of 15 minutes used in these questionnaires. Therefore, the choice is made to replace this norm and ask the respondent to determine their own maximum acceptable waiting time (forced waiting time).

By adding a ranking item to the patient perspective the respondent is asked to assign a certain weight to a topic, rather than only indicating their level of agreement. When a certain topic is valued as important and the general opinion is of disagreement, then this topic should be of high priority for improvement.

Data collection on population level

Using data on overbooked appointments from the sample of the questionnaire does not provide information on the entire population of patients. Therefore an additional data collection is done to provide insight in the experienced problem of *overbooked appointments*, as well as distributions of consult types and efficiency of the consultation hours.

Appendix D Scatter plots of forced waiting time versus appointment time



Figure 1 Scatterplot of forced waiting time versus appointment times in the morning



Figure 2 Scatterplot of forced waiting time versus appointment times in the afternoon

References

Anderson, R.T., Camacho, F.T. & Balkrishnan, R. (2007). Willing to wait?: The influence of patient wait time on satisfaction with primary care. *BMC Health Services Research*, 7(31)

Audit Commission, (2002). *Ear, Nose and Throat and Audiology Services: access to care.* Audit Commission: London.

Audit Commission, (2003). *Acute Hospital Portfolio, Review of National Findings: Outpatients*. Audit Commission: London.

Babbie, E. (2007). The practice of social research. Belmont, USA: Thomson Wadsworth.

Berwick, D. M. (2002). A User's Manual for the IOM's 'Quality Chasm' Report'. *Health Affairs* May/June: 80–90.

Boddy, D. (2008). Management. An introduction. Essex, England: Prentice Hall.

Brouwer, W., Leemrijse, C., Sixma, H.J. & Friele, R.D. (2002). *Klantenwensen in de zorg.* Utrecht: Nivel.

Busch, M.C.M. & Bovendeur, I. (2013). *Wat is kwaliteit?* In: Volksgezondheid Toekomst Verkenning, Nationaal Kompas Volksgezondheid. Bilthoven: RIVM.

CBO. (2007). *Sneller beter, draaiboek Doorbraak Werken Zonder Wachttijd*. Retrieved on June 27, 2012 on www.cbo.nl/Downloads/168/Draaiboek_WZW.pdf

Centrum Klantervaring Zorg (CKZ). (n.d.). *CQI Poliklinische Zorg*. Retrieved on September 12, 2012 on http://www.centrumklantervaringzorg.nl/vragenlijsten/poliklinische-zorg.html

Coulte, A. & Ellins, J. (2006). Patient-focused interventions: A review of the evidence. London: Picker Institute Europe.

Deloitte. (2012). Optimization of surgical outpatient clinics. Enschede: Medisch Spectrum Twente.

Deyo, R.A. & Inui, T.S. (1980). Dropouts and broken appointments. A literature review and agenda for future research. *Med Care*, 18, 1146-1157.

Dijen, van, M. (2009). Opmerkelijke resultaten met tactisch plannen. Health Digest, Ernst & Young.

Edgman-Levitan, S. (2008). *Measuring and improving patient experiences of care*. In E.R. Ransom, M.S. Joshi, D.B. Nash, S.B. Ransom (eds), The Healthcare Quality Book: Vision, Strategy and Tools. Chicago: Health Administration Press.

French, K. (1981). Methodological considerations in hospital patient opinion surveys. *Intj Nurs Stud*, 18, 7-32.

Gasquet, I., Villeminot, S., Estaquio, C., Durieux, P., Raveud, P. & Falissard, B. (2004). Construction of a questionnaire measuring outpatients' opinion of quality of hospital consultation departments. *Health and Quality of Life Outcomes*, 2, 43.

Goldratt, E. & Cox, J. (2000). *The Goal* (2e). Gower: Aldershot.

Grönroos, C. (2010). *Service management and marketing*. Chichester, England: John Wiley & Sons Itd. Gupta, D. & Denton, B. (2008). Appointment scheduling in health care: challenges and opportunities. *IIE Transactions*, *40*(9), 800-819.

Hans, E.W., Houdenhoven, van, M. & Hulshof, P.J.H. (2012). A Framework for Healthcare Planning and Control. In: Handbook of Healthcare System Scheduling. International Series in Operations Research & Management Science. Berlin, Germany: Springer.

Harper, P.R. & Ganlim, H.M. (2003). Reduced waiting times with improved appointment scheduling: a simulation modeling approach. *OR Spectrum*, 25, 207-222.

Heij, L. d., & Prins, N. (2005). Signalement werken zonder wachtlijst. Diemen: College voor zorgverzekeringen.

Heskett, J.L., Jones, T.O., Loveman, G., Sasser, J. Jr & Schlesinger, J.A. (1994). Putting the service-profit chain to work. *Harvard Business Review*, 167 (Mar/Apr).

Huang, X.M. (1994). Patient attitude towards waiting in an outpatient clinic and its applications. *Health Serv Management Res*, 7(1), 2-8.

Hulka , B.S., Zyzanski, S.J., Cassel, J.C., Thompson, S.J. (1971). Satisfaction with medical care in a low income population. *J Chronic Dis*, 24, 661-73.

Hulshof, P.J.H., Boucherie, R.J., Hans, E.W. & Hurink, J.L. (2011). *Tactical resource allocation and elective patient admission planning in care pathways* [Internal report]. University of Twente: faculty Electrical Engineering, Mathematics and Computer Science.

IBM. (n.d.). *Pseudo R-squared measures.* Retrieved on March 21, 2013 on http://publib.boulder.ibm.com/infocenter/spssstat/v20r0m0/index.jsp?topic=%2Fcom.ibm.spss.stati stics.cs%2Fcurvefit_table.htm

Joshi, M.S. & Berwick, D. (2008). *Healthcare quality and the patient*. In Ransom, E.R., Joshi, M.S., Nash, D. & Ransom, S.B., The Health Care Quality Book; Vison, Strategy and Tools. Chicago: Administration Press.

Karasek, R. (1979). Job Demands, Job Decision Latitude and Mental Strain: Implications for Job Redesign. *Administratative Quarterly*, 24, 285-306.

Kreinder, S.A. (2010). Policy strategies to reduce waits for elective care: a synthesis of international evidence. *British Medical Bulletin*, 95, 7-32.

LaGanga, L.R. & Lawrence, S.R. (2007). Appointment scheduling with overbooking to mitigate productivity loss from no-shows. *University of Colorado*: Leeds school of business.

Lebow, J.L. (1974). Consumer assessments of the quality of medical care. Med Care, 12: 328-37.

Leung, W. C., (2001). How to design a questionnaire? Student BMJ: 9, 171–216.

Martin, R.M., Sterne, J.A.C., Gunnell, D. et al. (2003). NHS waiting lists and evidence of national and local failure. *British Medical Journal*, 326: 188.

Meza, J.P. (1998). Patient waiting times in a physician's office. Am J Manag Care, 4, 703-712.

MST. (n.d.). Ziekenhuis Medisch Spectrum Twente. Retrieved on December 11, 2012 on http://www.mst.nl/onzeorganisatie/

MST. (n.d.). Meten van patiënttevredenheid. Retrieved on February 26, 2013 on http://www.mst.nl/onzeorganisatie/patienttevredenheid/

MST. (2011). *Jaarverantwoording* 2011. Enschede: Medisch Spectrum Twente. Murray, M. (2000). Patient care: access. *British Medical Journal*, 320: 1594–6.

NHS Modernisation Agency. (2005). *Improving Flow-Improvement Leaders' Guides: Process and Systems Thinking*. London, England: Department of Health.

Noon, C. E., Hankins, C. T. & Cote, M. J. (2003). Understanding the impact of variation in the delivery of healthcare services. *J Healthc Manag*, 48, 82-98.

Ozcan, Y.A. (2009). *Quantitative Methods In Health Care Management*. United States of America, San Francisco: Jossy-Bas, a Wiley Imprint.

Polgar, S. & Thomas, S.A. (2008). *Introduction to research in the health sciences*. Philadelphia, USA: Elsevier.

Rijntes, R.M. (2011). Tactical planning for Medisch Spectrum Twente: designing a tactical resource capacity planning concept for the outpatient clinics and operating rooms at MST. Enschede: University of Twente.

Rooij, de, L. (2004). Preventie ziekteverzuim, stress en burn-out. Soest: Uitgeverij Nelissen.

Rycken, van, J. (1997). Werkdruk & Welzijn: maatschappelijke, organisatorische en persoonlijke oorzaken van werkdruk in de sector zorg en welzijn. Utrecht: SWP.

Santeon. (n.d.). Missie en Visie. Retrieved on January 21, 2013 on http://www.santeon.nl/nl/wat-is-santeon/missie-en-visie

Schonberger, R.J. (1986). *World Class Manufacturing: the lessons of simplicity applied.* The Free Press: New York.

Shaller, D. (2007). Patient-centered care: What does it take? Stillwater, Minnesota, USA: Picker Institute.

Sibbald, B., Shen, J. & McBride, A. (2004). Changing the skill-mix of the healthcare workforce. *Journal of Health Services Research & Policy*, 9(1), 28–38.

Sierles, F.S. (2003). How to do research with self-administered surveys. *Academic Psychiatry*: 27, 104–113

Silvester, K., Lendon, R., Bevan, H., Steyn, R. & Walley, P. (2004). Reducing waiting times in the NHS: is lack of capacity the problem? *Clinician in Management*, 12.

Slack, N., Chambers, S. & Johnston, R. (2007). *Operations Management*. England, Harlow: Pearson Education, Prentice Hall.

Soroka, S.N. (2007). Canadian perceptions of the healthcare system. Toronto, Canada: Health Council of Canada.

Standaart, C.A. (2010). Resultaatverantwoordelijke eenheden: de oplossing? *Zorg en financiering, 6*(7), 11-19.

Steensma, H. (2006). Actieonderzoekers: adviseurs of wetenschappers? Develop, 2, 8-21.

Vissers, J.M.H. (1993). *Capaciteitsmanagement in ziekenhuizen*. In G. de Vries (eds), patiëntenlogistiek in ontwikkeling, inzichten en toepassingen (pp 77-104). Utrecht: De Tijdstroom.

Vissers, J.M.H., Bertrand, J.W.M. & Vries, de, G. (2001). A framework for production control in health care organizations. *Production Planning & Control: Operations Management, 12(6),* 591-604.

Williams, B. (1994). Patient satisfaction: a valid concept? Soc Sci Med, 38, 509-516.

Workshop Deloitte. (2012). Optimalisatie poli heelkunde. Enschede: Medisch Spectrum Twente.

Womack, J. & Jones, D. (1996). *Lean Thinking: banish waste and create wealth in your organisation*. Simon and Schuster: New York.

Zaghloul, A.A.Z. & Abou El Enein, N.Y. (2010). Hourly block and standard patient scheduling systems at two private hospitals in Alexandria. *Journal of Multidisciplinary Healthcare*, 3, 225-232.