WORK ACTIVITY EVALUATED

IMPROVING THE WAY CONSULTATION HOUR ASSISTANTS SUPPORT MEDICAL SPECIALISTS IN THE CURRENT AND FUTURE ORGANIZATION OF THE CONSULTATION DEPARTMENT AT THE NKI-AVL

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MANAGEMENT SUMMARY

The demand for medical services in the Netherlands is growing due to technological and demographic developments. The change in the prevalence of care, an increase in the consuming behaviour of people and regulated market forces are supporting this trend for the coming years. Next to this, an increase in productivity is stimulated by the current system of hospital output prices. This system is based on diagnosis and treatment combinations. As a result of these market developments, the Netherlands Cancer Institute – Antoni van Leeuwenhoek Hospital (NKI-AVL) started to explore the possibilities for expanded growth. Up to the year 2020 a sustained growth of 45% is planned, from which 15% should be established by a more efficient use of existing resources. This study aims to improve the way consultation hour assistants (CHAs) support medical specialists in the current and future organization of the Consultation Department at the NKI-AVL.

First, the content of the job of CHA is established. Second, a measurement tool is chosen and a procedure is defined to determine how CHAs spend their working time. This measurement procedure, which is work-sampling, is applied into practice and the resulting data are analysed. Results following the analysis are discussed and verified. Next, the most influential areas for improvement are identified. Suitable strategies to improve the way CHAs support medical specialists at the CD are then developed, and corresponding effects within the current and future organization are explored. Finally, theory about behavioural change, which can be linked with organizational change, is used to create some practical insights about how the chance of success can be increased with respect to change initiatives.

Results show that 80% of the activity of CHAs during an average working day is found in the following 5 categories:

- Non-productive working time (25,7%)
- Making appointments with patients (17,9%)
- Taking care of the availability of patient records (17,7%)
- Registering patients upon arrival (8,6%)
- Providing telephonic support (8,5%)

Improvement scenarios focussing on these areas will have the highest impact on the support delivered by CHAs at the CD.

First, we conclude that the amount of non-productive working time of CHAs is too high in the current situation. Maintaining a non-productivity (NP) level of 25,7% is not advised. We would rather advise to aim for a NP-level of 10%. When the CHA FTEs are reduced to achieve this level, savings are estimated at €131.464 for the year 2010. The management of the CD should be aware of the major impact this change will have on CHAs and that resistance can be expected.

Second, we conclude that digitalizing the medical records and nursing records, which are currently available on paper, will result in a substantive drop in work activity at the side of the CHAs. If the digital records are introduced and the CHA FTEs are reduced to match the new demand for their support, estimated savings approach €2.000.000 over the next 10 years. The introduction of the digital patient record is expected to receive a warm welcome from CHAs, since the current paper record is a source of frustration for them.

Third, existing technology makes it possible that the (purely administrative) check-in procedure of a patient is fully automated. If the check-in procedure is automated and the CHA FTEs are reduced to match the new demand for their support, estimated savings approach €1.000.000 over the next 10 years. Since automating the check-in procedure will result in less personal contact between CHAs and the patients, this change initiative can be seen as a threat by CHAs.

Fourth, we conclude that if the non-productivity is reduced to 10%, the digital patient record is introduced, the patient check-in is automated and other work activities remain unchanged, the expected demand for the year 2020 can be fulfilled by only 15 FTE of CHAs (considering a 45% growth of demand up to 2020). If nothing changes up to 2020, we estimate that 28.1 FTE will be needed at that time. In comparison, 19.4 FTE is on average at work in the current situation. Note that the mentioned FTE numbers represent net employment and do not account for sick leave and holiday leave.

The mentioned improvement strategies result in a reduction of CHA FTEs needed on a daily basis. Alternatively these FTEs could be redeployed to provide more medical technical support to medical specialists during the consultations when this is considered to be beneficial. In the current situation a minor amount of time is spent on this activity. To illustrate the idea, we show within this report that increased support delivered by CHAs to anaesthesiologists during the Pre-operative Screening (POS) can result in an increase of POS-capacity by 33%. The corresponding work activity for CHAs, based on the current number of screenings, is estimated at an average of 180 minutes on a daily basis.

While considering these and other change initiatives to improve the support delivered by CHAs to medical specialist during the consultation hours at the CD, insights gained from research within the field of behavioural science can be of valuable help to change leaders. The five stages of behavioural change defined by Prochaska and Di Clemente (1983) can be used as a practical tool to reduce resistance to change and to increase participation of employees. Change leaders should monitor the different stakeholders and their progress of behavioural change, and introduce individualized stage-matched interventions to prepare them well. The more people are prepared to take action, the higher the chance of success of a change initiative.

PREFACE

With this thesis I will complete my master's degree in Industrial Engineering and Management at the University of Twente. The research involved was undertaken at the Consultation Department of the Netherlands Cancer Institute-Antoni van Leeuwenhoek Hospital (NKI-AVL). Many people have contributed to a greater or lesser extent to this research and some of them I would like to thank here.

My research comprehended interaction with the consultation hour assistants and team leaders working inside the Consultation Department. I thank all of them for their valuable time and proactive role in this research. If you would not have cooperated in such a positive way, I would have left with nothing.

I also thank Julia Veldhuijzen, former Head of Ambulatory Care at the NKI-AVL, for her inputs and great engagement during the research. Your enthusiasm and insight from years of experience were very valuable.

I express my gratitude to my academic supervisors, Professor Wim van Harten and Peter Vanberkel, for their help and feedback during the research process, and for offering me the opportunity to graduate on this very interesting subject. Your inputs have greatly supported me, and they have, so I believe, greatly improved the research itself.

Last, but definitely not least, I thank my family and girlfriend. Your continuous support in all possible ways was irreplaceable and extremely stimulating these past years of study, especially during the writing of this thesis.

This leaves me with nothing but to wish you a pleasant reading. I hope this research will be informative and valuable to you.

Marten B. de Bruin
Amsterdam, October 2010

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1 INTRODUCTION

1.1 CONTEXT

The demand for medical services in the Netherlands is growing due to technological and demographic developments. The change in the prevalence of care, an increase in the consuming behaviour of people and regulated market forces are supporting this trend for the coming years. Next to this, an increase in productivity is stimulated by the current system of hospital output prices. This system is based on diagnosis and treatment combinations.

As a result of these market developments, the Netherlands Cancer Institute – Antoni van Leeuwenhoek Hospital (NKI-AVL) started to explore the possibilities for expanded growth. Up to the year 2020, a sustained growth of 45% is planned from which 15% should be established by a more efficient use of existing resources.

This study aims to improve the way consultation hour assistants (CHAs) support medical specialists in the current and future organization of the Consultation Department at the NKI-AVL.

1.1.1 NKI-AVL

The Netherlands Cancer Institute – Antoni van Leeuwenhoek Hospital (NKI-AVL) is a Dutch cancer treatment centre in the western part of Amsterdam, in which a specialized hospital is combined with a scientific research laboratory. Since 1913, the primary objective of the hospital is to make a substantial contribution to combating cancer through a unique interaction of scientific research and clinical application, supported by strong training. The NKI-AVL has 180 beds, including 30 beds dedicated to day treatment (NKI-AVL, 2009). In 2009, 1683 Full Time Equivalent (FTE) employees were in service, including 106,2 FTE medical specialists. Over the same period, the NKI-AVL registered 6189 clinical admissions and 27.429 new patient visits to the Consultation Department.

1.1.2 CONSULTATION DEPARTMENT

The Consultation Department (in literature also known as the *Outpatient Department*) fulfils a central role within the patient flow process at the NKI-AVL. At the Consultation Department (CD), patients schedule their appointments for the necessary diagnostic examinations and medical treatments. Some small examinations and treatments that do not require specific hospital facilities are done inside the department. It is also the place where test results are reported to patients and discussed with them. The department is visited by new patients, patients with follow up appointments, patients seeing a new specialist, and patients requesting a second opinion. The consultations are conducted by medical specialists, nurse practitioners, paramedical personnel (dieticians, physiotherapists, speech therapist) and wound/colostomy care nurses.

Within the CD, consultation hours are set up for a wide range of clinical treatments. The consultation hours are set up according to a multidisciplinary working approach of medical personnel. This means that during the opening hours of the CD different medical specialists involved in the treatment of a patient (physicians and paramedics) can be consulted. The objective of the NKI-AVL is to make the visits for patients to the CD as efficient as possible. The NKI-AVL observed a total of 102.043 patient visits to the CD in 2009 (NKI-AVL, 2009). From this number, 27.429 cases represent first visits to the department, and the remaining 74.614 represent recurring visits.

The CD comprises 53 rooms that are available during working hours from Monday until Friday. In the last couple of years, the CD is confronted with an increasing demand for their facilities and services; consultation hours are full and there is almost no space available to accommodate new medical specialists. At the beginning of 2010, the NKI-AVL opened a temporary CD to increase the available capacity by 12 rooms. A permanent expansion of the CD has to be completed within five years. The room capacity of the CD will then comprise of 63 rooms. Preparing for the new situation is required, and therefore possibilities to increase efficiency in using the available facilities and services have to be explored.

1.2 PROBLEM STATEMENT AND CENTRAL RESEARCH QUESTION

Previous internal research at the Consultation Department (CD) indicated that medical specialists are supported by consultation hour assistants (CHAs) in administrative tasks and advisory services to patients during their work shifts at the CD. CHAs do not perform medical tasks in the current situation but are educated to do so (Kerkdijk, 2009).

Observations by people from outside the organization indicate that there is relatively large amount of CHAs present inside the CD of the NKI-AVL in comparison to other hospitals. CD management is not able to confirm this, but wishes to explore the possibilities to improve the efficiency of CHAs.

The problem statement is defined as follows:

> *The Consultation Department of the NKI-AVL wishes to explore the possibilities to improve the efficiency of consultation hour assistants in supporting medical specialists through better assignment of tasks, and to create insight in the effects this will have on the current and future organization of the Consultation Department.*

This problem statement leads to the following research question:

> *How can we improve the way consultation hour assistants support medical specialists in the current and future organization of the Consultation Department, and what are the organizational effects of these improvements?*

1.3 METHODOLOGY

This section describes the methodology used within this study. By answering the following research questions, we are able to answer the central research question as defined in Section 1.2.

What is the content of the job of CHA?

Background information was gathered to write draft work activity and task statements. After conducting background research on the job, semi structured interviews with CHAs and observations of the work sites were performed. This was done in order to gain firsthand knowledge of what job activities and tasks are, how they are performed, and the work conditions under which the job is performed. Subsequently, the draft statements were revised and finalized. Eventually, statements were reviewed and approved by CD management.

- *Corresponding sections: 2.1 and 2.2*

How can we measure the efficiency of CHAs?

A preliminary step towards improving the efficiency of CHAs in supporting medical specialists, was determining how working time is currently spent. Existing work evaluation tools were discussed using literature. A work-sampling technique was chosen to determine how CHAs spend their working time at the CD, and a measurement procedure was defined.

- *Corresponding section: 2.3*

What is the current efficiency of CHAs?

The defined measurement procedure was pilot tested on Monday 15 March 2010. The actual study was performed during 10 working days between 16 March and 12 April 2010; every day of the week was included twice. The resulting dataset was cleaned and 5110 observations remained for analysis purposes. The data was analysed using Excel spreadsheet software and the results were verified.

- *Corresponding section: 2.4*

What improvement areas can be identified?

Based on the results of the work-sampling study, the most influential areas for improvement were identified by constructing a Pareto-diagram. It was concluded that 80% of the work activity during the opening hours of the CD is clustered in 5 categories of activities. Improvement scenarios should therefore focus on these areas.

- *Corresponding section: 3.1*

What are suitable strategies to improve the efficiency of CHAs, and what are the effects of these strategies within the current and future organization?

After identification of the most influential areas for improvement, 3 scenarios were developed to improve the efficiency of CHAs. The effects of these strategies within the current and future organization were calculated using different demand figures (current demand and 3 different growth scenarios).

- *Corresponding sections: 3.2-3.6*

How should change be managed to increase the chance of success?

The proposed improvement scenarios interfere with the current work activities performed by CHAs. Theory about behavioural change, which can be linked with organizational change, was derived from literature and applied to the CD by using knowledge gained from observations by the researcher. This resulted in some practical insights that can be used to increase the chance of success with respect to change initiatives.

- *Corresponding sections: 4.1-4.4*

1.4 A DEFINITION FOR EFFICIENCY

The use of the term “efficiency” within healthcare organizations makes many care providers feel anxious because they think that the term implicates that they have to cut back on the services provided to their patients. Others interpret the term “efficiency” as the potential for making more resources available for the provision of healthcare by reducing the waste in the system. A variety of definitions of efficiency are currently in use and it is important to be aware of different meanings for the same word.

The Institute of Medicine defines efficiency as: “avoiding waste, including waste of equipment, supplies, ideas, and energy” (Institute of Medicine [IOM], 2001). The institute included efficiency as one of the six aims for the 21st-century. As a key attribute of the healthcare system it should be measured, reported, and optimized.

According to Palmer and Torgerson (1999) healthcare is efficient when healthcare resources are being used to get the best value for money. Within this context efficiency is concerned with the relation between resource inputs and either intermediate outputs, like the number of patients treated, or final health outcomes.

The concept of efficiency, defined in terms of input(s) and output(s), is widely used in economics and mainly based on the work of Farrell (1957). He states that the efficiency of an entity consists of two components: technical efficiency and allocative efficiency. Technical efficiency refers to the maximization of output for a given level of input(s), i.e. producing on the “technical frontier”. Allocative efficiency refers to the optimal set of inputs, i.e. the set of inputs that would minimize cost if the firm were producing on the technical frontier.

All of these definitions have certain elements in common. But they are sufficiently different to contribute to the anxious feeling healthcare providers can have when the term “efficiency” remains undefined. Within this study, efficiency is defined as the minimization of input and associated costs, for a given level of output. This definition is by design general enough to include different methods for describing the level of support provided by CHAs to medical specialists at the CD of the NKI-AVL.

2 THE JOB OF CONSULTATION HOUR ASSISTANT

In this chapter insight is created into the job of consultation hour assistant (CHA) at the NKI-AVL. First, the job is introduced (2.1). Second, the content of the job is depicted (2.2) and a measurement procedure for the efficiency of CHAs is defined (2.3). Next, the gathered data are analysed and the outcomes are discussed (2.4). Finally, the presented results are verified (2.5).

2.1 INTRODUCTION

Within this section the job of CHA at the CD is introduced by discussing its main characteristics. We start with the description of the job goal (2.1.1) and the requirements for the job (2.1.2). Next, a description of the workplace (2.1.3), working method (2.1.4) and the working hours (2.1.5) is given. Finally, it is explained how the planning and control of CHAs is arranged (2.1.6).

2.1.1 JOB GOAL

The goal of the job of CHA is defined by the NKI-AVL as:

"Accompanying and providing administrative and medical technical support during the consultation hours at the consultation department."

2.1.2 JOB REQUIREMENTS

There are two types of CHAs working at the CD, which are:

- 'Spreekuurassistente' (FWG-class: 35)
- 'Doktersassistente Poli' (FWG-class: 40)

The basic requirement to apply for the job of CHA inside the NKI-AVL is to have a medical assistant diploma (community college level) or a comparable degree. Every new CHA will start as a 'spreekuurassistente' (FWG-class 35) and is obliged to follow an additional training program in order to become a 'doktersassistente poli'. A specialized oncological training for CHAs is the prerequisite to enter FWG-class 40. FWG (in Dutch: 'functiewaardering gezondheidszorg') is a job rating system applied in healthcare in order to justify the distribution of wages. Within this study it is chosen to ignore the formal distinction that exists between the 'Spreekuurassistente' and the 'Doktersassistente Poli'. We will refer to both types of assistants by use of the term "consultation hour assistant (CHAs)" because in practice no differences exist between the tasks performed by them.

2.1.3 WORKPLACE DESCRIPTION

The consultation department is divided in 5 units. Four of these units (Poli 1, Poli 2, Poli 3 and Poli 4) are clustered on the ground floor in one of the wings of the main building. The fifth unit (Poli 6) is situated in a temporary building outside the hospital. CHAs are assigned to work for one of the units, and they perform tasks that relate to the activities taking place in the rooms that are dedicated to that unit. An overview of the number of rooms per unit is provided in Table 2.1.

Unit	# Rooms
Poli 1	15
Poli 2	9
Poli 3	8
Poli 4	9
Poli 6	12

Table 2.1: Room capacity per unit at the CD

The consultation hours at the CD are set up according to a multidisciplinary working approach of medical personnel. The majority of the activities performed by CHA during these hours are considered to be the same for the different units. Therefore, CHAs can be assigned to any unit and when required, they can assist on another unit.

Every unit has its own working area for the CHAs. The working area consists of a front desk and 5 or 6 side desks. The front desk is used for registering patients upon arrival. The side desks are used for consecutive steps in which contact between CHAs and patients is needed, which in most cases involves appointment making.

Every workplace is provided with a PC and telephone. Via the PC, CHAs can access CS-EZIS (Chipsoft electronic Care Information System), an information system used for data registration. Within CS-EZIS, assistants are restricted to the use of the following modules:

- Agenda
- Archive
- Patient
- OK

These modules are composed from a structured collection of functionalities, in which the CHAs perform a part of their work activities.

2.1.4 WORKING METHOD

CHAs work according to a predefined distribution of tasks. At every unit, one person is responsible for the registration of patients at the front desk. The other assistants are responsible for the accompaniment of the different consultation hours at the side desks. In practice, it happens often that a CHA working at one of the side desks is assisting at the front desk. The opposite is also the case.

2.1.5 WORKING HOURS

The consultation department is opened 5 days a week, from Monday to Friday. Opening hours are:

Morning	-	08:30-12:30 hrs.
Afternoon	-	13:30-16:30 hrs.

During the opening hours of the CD, CHAs are working in two shifts. The working hours related to these shifts are:

Early shift	-	08:00-16:30 hrs.
Late shift	-	08:45-17:15 hrs.

PLENARY MEETING

Every working day at 08:10 a.m., there is a plenary meeting in order to update staff about the daily activities, staff presence and to make necessary announcements. At 08:30 a.m., the meeting is finished and everybody goes to their workplaces.

LUNCH AND COFFEE/TEA BREAKS

Conforming to Dutch labour laws, CHAs that work over 4,5 hours a day have the right to spend a minimum of 30 minutes on their lunch break, which can be split up in two breaks of 15 minutes when necessary. Furthermore, the collective labour agreement states that CHAs have the additional right to be provided with two coffee/tea breaks, one during the morning and one during the afternoon (“CAO Ziekenhuizen 2009-2011”, n.d.). These breaks are considered to be part of the total working time if they do not last more than 15 minutes each. At the CD, it is collectively agreed to schedule a 45-minute lunch break between 12.00-13.30 hrs. to compensate the coffee/tea breaks in the morning and afternoon. The agreement is made because it is often difficult to actually establish coffee/tea breaks during the opening hours of the CD. The units are self-responsible for the distribution of lunchtime between the available personnel.

2.1.6 PLANNING AND CONTROL

Hierarchical leadership to the CHAs lies with the Head of Ambulatory Care and patient logistics. The functional and operational leadership is delegated to the departmental team leaders.

The main activities of the team leaders with respect to the supervision of CHAs are the coordination and coaching of staff, and the promotion and control of quality of work activities. The CD has two team leaders, which divide the workload and responsibilities.

WORK SCHEDULE

As of May 2010, there are 37 CHAs employed at the CD who together account for 28,81 FTE. Scheduling of the CHAs is done on a weekly basis by one of the team leaders. Scheduling matches available labour hours of the upcoming week with the total number of appointments made for each unit.

The rule of thumb being applied is that every 15-20 planned consults per unit require one CHA. Next to this, an estimation of the skill level of employees is used to adjust the schedule.

2.2 WORK ACTIVITIES AND CORRESPONDING TASKS

The job of CHA can be broken down into different work activities. Work activities provide the highest level of job description. They provide the major parts of work that are performed on the job and each activity comprises a number of tasks. A task is therefore defined as a logical and necessary step taken by a CHA in the performance of a work activity. In this section, work activities and corresponding tasks are presented in order to describe the content of the job of CHA. The activities are divided over the following 4 categories:

1. Activities at the start of the day
2. Activities during the morning and afternoon consultations
3. Activities at the end of the morning and afternoon consultations
4. Activities at the end of the day

2.2.1 ACTIVITIES AT THE START OF THE DAY

Every morning, CHAs working on the early shift are responsible for the preparation of the unit desks, the consultation rooms and consultation hours planned. The activities involved have to be finished before the consultations inside the rooms start (in most cases at 08:30 am).The tasks involved in the preparation phase are:

- Switch on the lights on when necessary (most lights go on automatically)
- Switch on the computers at the unit desks and inside the consultation rooms
- Open the file cabinets with the patient records, which are located behind the unit desks
- Prepare the consultation room when needed; rooms assigned to dermatology, ENT and Gynaecology require more extensive preparation than the others
- Write new appointments on the print outs of the consultation hour schedules
- Check e-mail for requests for making appointments
- Provide medical specialists with print outs of the schedules for their consultation hours

The majority of the tasks are straightforward and require only a small amount of time to be accomplished. Therefore, we will not go into more detail on the activities taking place at the start of the day.

2.2.2 ACTIVITIES DURING THE MORNING AND AFTERNOON CONSULTATIONS

Most work activity is observed during the opening hours of the CD. CHAs are responsible for the following activities:

- Taking care of the availability of patients records
- Registering patients upon arrival
- Providing medical technical support during a consult
- Making appointments with patients
- Accompanying patients on a stretcher
- Supporting visiting patients
- Providing telephonic support
- Matching work activities with colleagues
- Managing the items in stock

In contrast to the activities taking place at the start of the day (Section 2.2.1), the activities performed by CHAs during the morning and afternoon consultations are in most cases recurring; they are correlated with the number and presence of patients at the CD during the consultation shifts. The activities involved make up the biggest part of the job of CHAs. For this reason, we will continue with a more detailed description of the tasks involved.

TAKING CARE OF THE AVAILABILITY OF PATIENT RECORDS

During a consultation with a patient, the patient record needs to be available to the medical specialist. The patient record consists of a medical record and a nursing record, which are both available on paper. When a patient record is in use by a medical specialist or is available at a certain department, the current location where it can be found needs to be recorded in CS-EZIS. In this case, patient records are easily traceable when needed by somebody else. When not in use, the patient records are stored in the medical archive of the hospital. They can be requested and collected from the archive when necessary.

At the CD, CHAs are responsible for organizing the availability of the patient records to medical specialists. During the consultation process they are assisted in the performance of the corresponding tasks by the transportation team, which consist of 2 persons each day The transportation team is responsible for the request of patient records at the medical archive and the transfer of the patient records from the medical archive (or other department) to the CD, and backwards. The transportation team can also be consulted by CHAs when patient records are missing and not traceable. The transportation team is sometimes able to find a new lead because of their experience.

The tasks performed by CHAs during the process of taking care of the availability of patient records are visually represented in Figure 2.1. Early afternoon each day, a person from the transportation team arrives with the first delivery of patient records for the next day. A consultation schedule per medical specialist is printed out from CS-EZIS at the designated desk by one of the CHAs. The records are then stored in dedicated file cabinets, which are located behind the desks of each unit. The printouts of the schedules are used for marking the available patient records.

From the patient records that are signalled to be missing, the current location is traced using CS-EZIS. Records that are available at the Day Care Centre are listed separately. Around mid afternoon a second delivery of patient records for the next day takes place. Again the patient records are stored in the dedicated file cabinets and their availability is marked on the printouts. When this is finished (normally between 15:30-16:00 hrs.), an email is send to the Day Care Centre to request the earlier listed patient records that should be available inside this department.

At the start of the morning of the consultations, the requested patient records from the Day Care Centre and last minute available records are delivered at the CD. They are stored inside the file cabinets and the printout of the consultation schedule is again renewed. If patient records are then still missing, a more intense search is performed using CS-EZIS and telephone. Records that need to be available before 09:00 a.m. take priority. If no progress can be made on finding the records, transportation can be asked for help. Records found are normally on request collected by ‘transportation’. If no transportation is available and the record is needed immediately, a CHA collects the record her-/himself. A temporary patient record will replace records that cannot be found at all. This can only be done in consultation with the medical specialist with whom the patient has an appointment, since this person will be confronted with a lack of information about the patient.

Sometimes it can happen that a medical specialist requires a patient record ad hoc, which was not foreseen beforehand. In these cases, CHAs first trace the patient record inside the hospital. Then they make a decision between asking the transportation team to request and collect the patient record, and doing it themselves.

CHAs estimated that the tasks related to taking care of the availability of patient records during the consultation process, as described within this section, consume 1 to 1,5 hour per CHA each day. The daily amount of time spent on the activity is based on the number of records that need to be present at each unit, the number of missing records on the day of the consultations and the intensity of the search for the missing records.

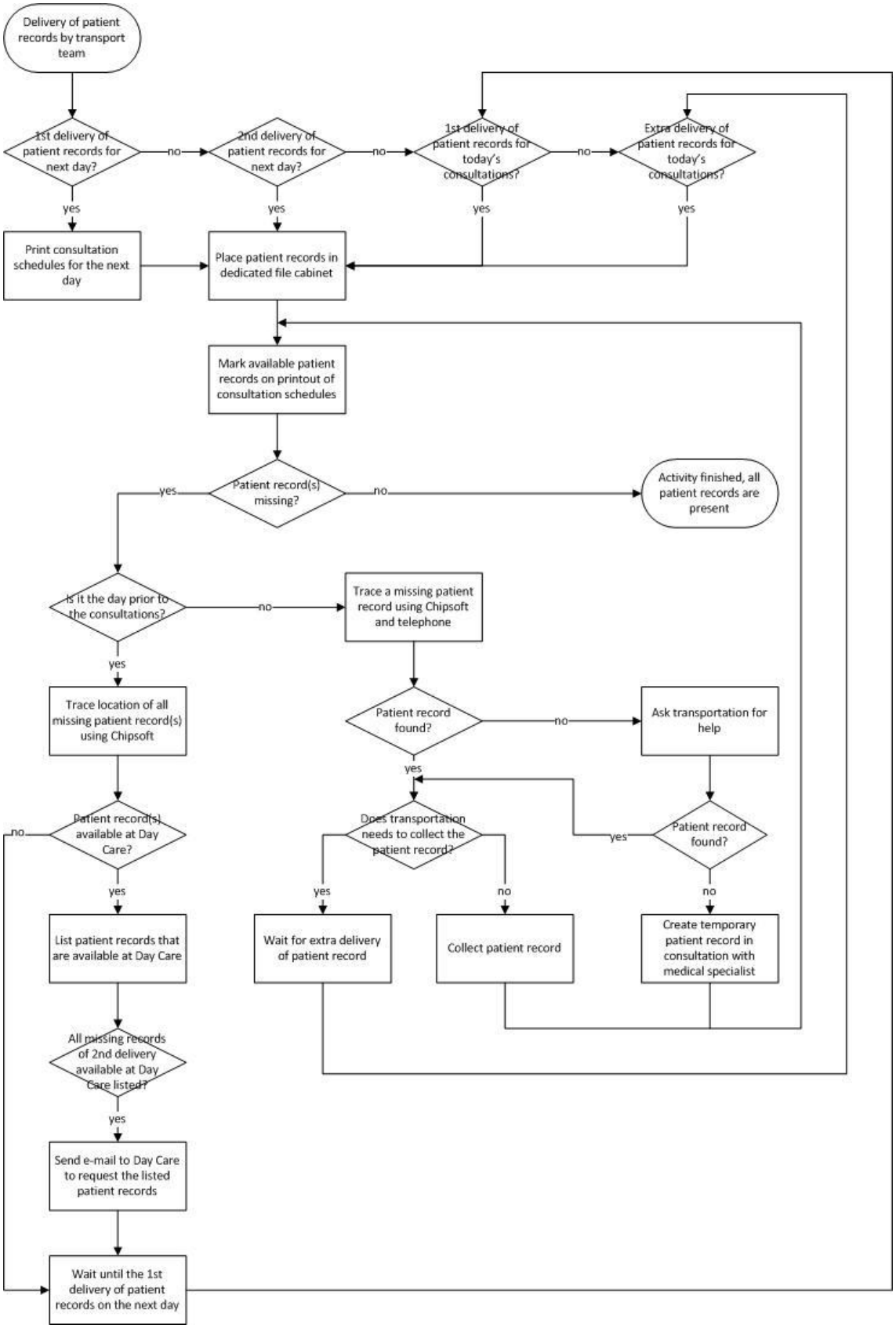

Figure 2.1: Flowchart representing the process for taking care of the availability of patient records

REGISTERING PATIENTS UPON ARRIVAL

During the opening hours of the CD, patients will make their presence known at the front desk of the unit where their appointment is planned. The presence of the arriving patient has to be registered. The registration consists of a number of consecutive steps/tasks performed by CHAs at the front desk of a unit.

The tasks performed by CHAs during the process of registering patients upon arrival, are visually represented in Figure 2.2. A CHA will ask the arriving patient with whom he or she has an appointment, in order to check if the patient is standing in front of the right unit or has to be redirected to another unit. Next, the patient is asked to provide his/her punch card. The punch card is a card containing personal information about the patient (like name, address, name of the general practitioner and insurance number). The central registration desk provided the punch card to the patient in an earlier stage. When the patient cannot provide a punch card, it is decided by the CHA if there is a need to create a new one at the registration desk or not.

A CHA will copy the content of the punch card to a blank form, which is called a route card (in Dutch: 'loopbriefje'). Next, the CHA will mark the presence of the patient in the CS-EZIS agenda. Then the route card is attached to the patient record that should be present inside one of the file cabinets. When a patient is seeing two or more medical specialist at different units during the consultation hour, it can happen that the patient is carrying his/her own record. In this case, the record is collected from the patient by the CHA, the route card is attached to the record and the record is stored in the designated file cabinet.

If it is a new patient who is standing in front of the unit desk, he/she is asked to provide the referral letter if this one is not yet present inside the patient record. In case a patient does not have any paperwork to deliver, the patient is asked by which hospital and by whom he/she is treated. Next, the secretary of the medical specialist that is seeing the patient inside the NKI is called and asked if he/she has received any paperwork. When the required information cannot be traced, the referring hospital is called. The secretary of the referring medical specialist inside that hospital is asked to fax the necessary information as soon as possible. When the necessary paperwork is available it is added to the patient's record.

The subsequent step is that the CHA makes an indication of the current waiting time. This is done by looking at the place of the arriving patient in the queue. The queue is visualised by the patient records inside the file cabinet. Since all patient records are stored inside the file cabinets in order of appointment and the records of patients that are already seen by a medical specialist are removed from the file cabinet, the CHAs only has to count the number of records that are still in front of the one of the arriving patient to make an estimation of the current waiting time. If there is none or minor waiting time, the patient is requested to take a seat in the waiting room until the medical specialist is ready to see the patient. The CHA will also quarter turn the patient's record inside the file cabinet to indicate the presence of the patient inside the waiting area. In case of substantial waiting time, the patient is provided with a buzzer and the number of the buzzer is written on the patient's route card. The patient is then free to move inside the hospital. When the medical is almost ready to see the patient, the patient will be buzzed by the CHA and has to make his/her presence known again at the front desk of the unit. The same steps will then be taken by a CHA as in the case of none or minor waiting time.

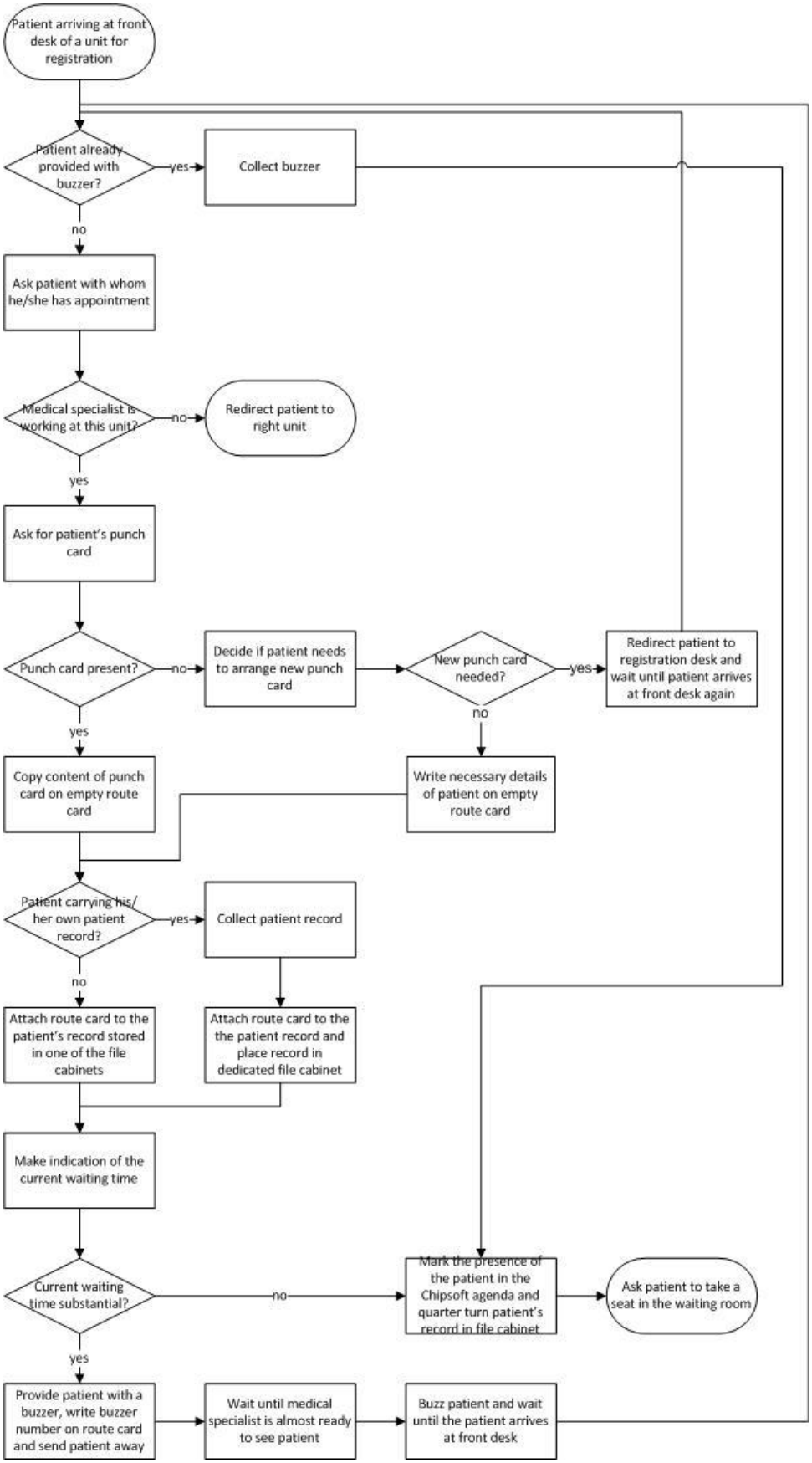

Figure 2.2: Flowchart representing the process for registering patients upon arrival

PROVIDING MEDICAL TECHNICAL SUPPORT DURING A CONSULT

During the actual consult between patient and medical specialist, a medical specialist can ask a CHA to perform a certain medical technical procedure, or assist the specialist while performing one. The tasks involved differ per medical specialty and thus per unit. Since the time spent on medical technical support during the consultations is estimated by the CHAs to be minimal, we will not go into much detail on the different tasks. The only clinic that receives substantial physical support from CHAs is the Dermatology Clinic (Unit 1). For other specialties no substantive arrangements are made. Below the different tasks involved in providing medical technical support during a consult are presented. Between parentheses the number(s) of the unit for which the task holds is given.

Independently performing a medical technical procedure by order of a medical specialist

Step 1: Prepare patient for the procedure

Step 2: Perform procedure

- Perform photodynamic therapy (1)
- Treat uncomplicated wounds (1/2/3)
- Remove stitches (1/2/3/4)
- Collect a wound culture (1/2/3)
- Collect a sample for a urine culture (all)
- Collect a MRSA culture (all)
- Measure blood pressure (1/2/3)
- Treat cannula (2)

Step 3: Report important details to medical specialist

Assisting a medical specialist during the performance of a medical technical procedure

- Assist during the replacement of a voice prosthesis (2)
- Assist by taking a biopsy (1/2/6)
- Assist by performance of an endoscopic dilatation (2)
- Assist by the performance of an excision (1/2)
- Assist by a gynaecological examination (4)
- Assist by a drainage of the middle ear (2)

MAKING APPOINTMENTS WITH PATIENTS

During the consultation with a medical specialist at the CD, it is decided by the medical specialist what kinds of appointments have to be made in the care/cure trajectory for the patient. The medical specialist uses the patient route card, which is attached to the patient record, to specify the necessary appointments. When the consultation is finished, a patient will leave the consultation room and bring his/her route card to one of the side desks of the unit. A CHA is then responsible for making the specified appointment(s) in consultation with the patient and to provide necessary information.

The tasks performed by CHAs during the process of making appointments with patients are visually represented in Figure 2.3. When a patient arrives at one of the side desks of a unit after the consultation with a medical specialist is finished, a CHA will collect the patient's route card. The content of the route card should be clear to the consultation assistant. If not, clarification by the medical specialist is required.

The content of the route card shows the CHA the appointments that need to be made for the patient and in which period of time they have to be scheduled. In consultation with the patient, the appointments that can be made instantly are scheduled inside the agenda(s) in CS-EZIS. Note that an appointment can only be made instantly when the appropriate agenda is accessible and a CHA is authorized to make the relevant appointment. When information about the nature and/or content of the scheduled appointment(s) is available/required, this is given to the patient. Information can be provided both orally and on paper. Also additional information about hospital facilities and services can be given to the patient in this stage, like the presence of an information centre, guesthouse and DBO (in Dutch: 'Dienst Begeleiding en Ondersteuning').

Finally, when medical examinations in other departments are (instantly) required or special appointments have to be made for which the appropriate agenda is not accessible and/or CHAs are not authorized to make adjustments in the agenda, a patient is directed to the relevant departments. In the other cases, a patient is able to leave the unit immediately.

Not explicitly part of the process description is the aftercare sometimes provided to the patients by a CHA. The level and amount of aftercare is highly dependent on the medical and mental situation of the patient, and the news he/she received during the consult with the medical specialist. In most cases CHAs can directly start with the necessary appointment making after a consult. But in some cases patients have to be calm downed first or need some empathy from the CHA in the form of a personal conversation.

A major exception on the description of the process of making appointments with patients, as provided in this section, is that medical specialists sometimes do not write the medical care trajectory on the route card at all during the consult. Instead they choose to deliver the required information to a CHA orally. This is not a welcome way of working, since it is a deviation from the departmental rule and can highly disturb the activity at a unit when there is a lot of activity going on.

CHAs estimated that the tasks related to making appointments with patients during the consultation process, as described within this section, consume 1 to 45 minutes per patient. The amount of time spent on this activity is mainly based on the number of appointments that need to be made and the amount of information that need to be provided to the patient. New patients and existing patients consulting a new medical specialty are normally consuming most time.

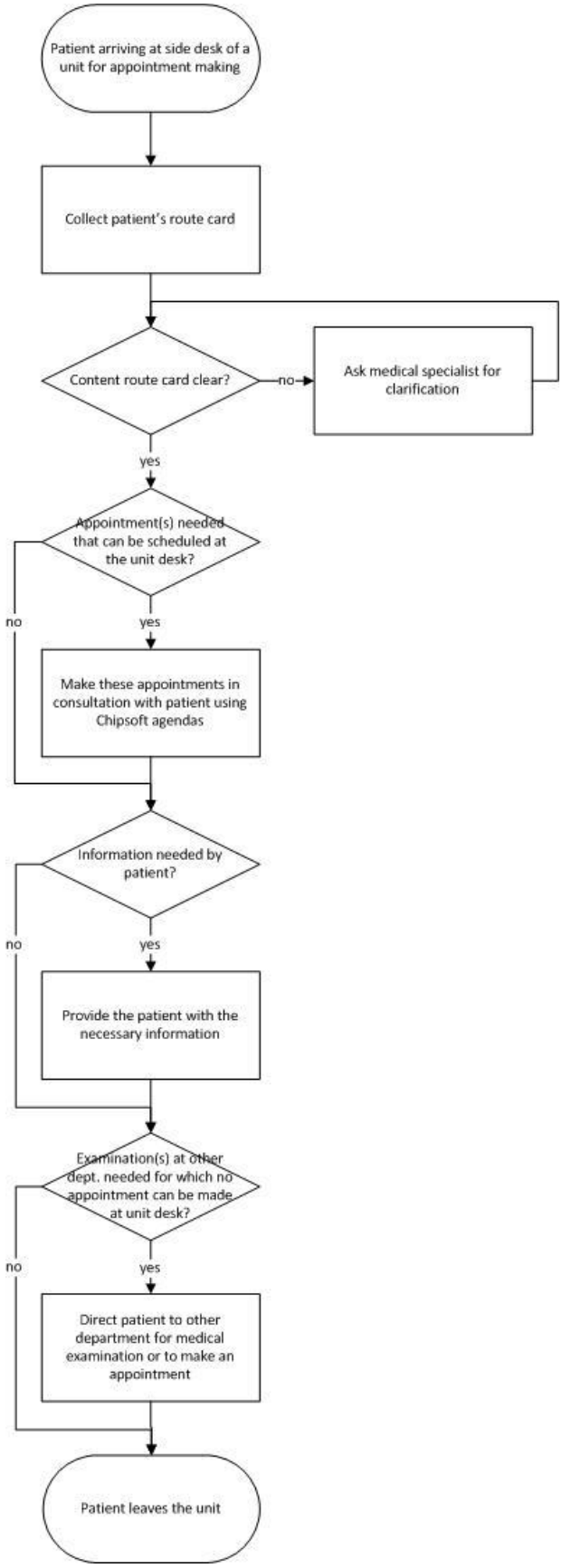

Figure 2.3: Flowchart representing the process for making appointments with patients

ACCOMPANYING PATIENTS ON A STRETCHER

Most patients enter the CD by foot or wheelchair. Patients that arrive on a stretcher need additional care. CHAs are responsible for the accompaniment and support of this type of patients at the CD. Patients on a stretcher are transported to a dedicated room called the stretcher room (in Dutch: 'brancardruimte'), which is situated next to Unit 4. The additional tasks performed by CHAs are the following ones:

- Guide the patient inside the stretcher room
- If necessary, connect the patient to the oxygen supply
- Subscribe the patient to a special registration list at Unit 4
- Take a buzzer to the unit that is responsible for the patient
- Keep an eye on the patient when the patient is not accompanied by another person
- Assist the patient during a visit to the toilet, urinal or bed pan and/or change of clothes
- Arrange an ambulance for transportation after the consult (via online application) and write the time of transport on the list at Unit 4
- Arrange internal transportation when necessary
- Transport patient if no internal transportation can be arranged
- Call the WAN-head (weekend/evening/night–head) after 17:00 hrs to arrange temporary accommodation and deliver the patient at the agreed location.

Since Unit 6 is separated from the main building, CHAs working at that unit cannot be held responsible for the activities taking place in the stretcher room at the CD. Therefore, this activity with corresponding tasks is not part of their job.

SUPPORTING VISITING PATIENTS

The tasks involved in supporting patients are diverse, but the following four are considered to appear most frequently:

- Answer questions from patient
- Accompany a patient through the hospital when needed
- Provide help/support to a patient requiring it
- Empathize with patients before and after a consult when needed

PROVIDING TELEPHONIC SUPPORT

During a working day, the CHA sitting at the front desk of a unit is responsible for handling incoming phone calls. The nature of the incoming phone calls vary and the way of handling the phone calls can be totally different between one another. According to the CHAs, most incoming phone calls concern a physical complaint that a patient wants to discuss with the medical specialist, a question that a patient would like to see answered, or a requests for making or changing an appointment. We will briefly discuss these different types of incoming phone calls.

Physical complaint

In case of a physical complaint it is important to record the name of the patient, date of birth, patient number, responsible medical specialist and a short description of the physical complaint. Next, questions need to be asked to determine the urgency of the physical complaint (fever, failure of body functions, shortage of breath, etc.)

When the medical specialist is working at the unit, additional questions can be asked by the CHA if these are written down on so-called triage list. These lists should be present at the corresponding units. The result of this step should be a clear description of the complaint. Next, the patient is asked to provide a phone number on which the medical specialist can call him/her back and then the phone call is ended. The following step is that a CHA will trace and request the patient' record. When the record is available at the department, the medical specialist is provided with the complaint, phone number of the patient and the patient's record via the file cabinet. The medical specialist is asked to call the patient back.

In case a medical specialist is not available at the unit, the CHA needs to determine if based on the estimated urgency of the call a telephone consult can be planned or the phone call needs to be transferred to the secretary of the medical specialist. When the phone call is transferred, the secretary of course needs to be provided with the name of the patient, the patient number and a short but to the point description of the physical complaint.

Request for making/changing appointment

The Appointments Centre should normally handle incoming phone calls from patients that want to make or change an appointment. In reality, it happens often that a CHA is confronted with this kind of phone calls. Two reasons why this happens are: a CHA provided a patient with a direct phone number of the unit during one of the patient's visits or a phone call is transferred to the unit instead of the Appointments Centre. Since incoming phone calls can highly disturb the activity at a unit when there is a lot of activity going on, it is important that the number of incoming phone calls is reduced to a minimum. To achieve this, it is necessary that CHAs should be advised not to provide patients with direct phone numbers anymore. Also the hospital personnel from other departments should be informed not to transfer patient calls concerning appointments to the CD, but to the Appointments Centre where this type of phone calls initially belongs.

MATCHING WORK ACTIVITIES WITH COLLEAGUES

During a working day at the CD, CHAs and medical specialist are working next to each other, and of course with each other. During the consultation hours, activities have to be matched with colleagues and also with medical specialist. Next to this, tasks have to be transferred between one another when the situation asks for it. Also questions can arise while performing tasks and help of a colleague is required. Help provided is also considered to be part of this activity. Most of the things can be discussed face to face during working time. In situations where this is not possible, a phone call or a note via email or paper is used as a communication tool.

MANAGING THE ITEMS IN STOCK

At every unit desk and consultation room inventory is kept. From envelops to patient information brochures, from medical gloves to tissues. Next to the regular storage capacity at the units and consultation rooms, there is a special larder at Unit 1 for the dermatology clinic. At Unit 2, this is the case for ENT (in Dutch: 'KNO'). Also numerous mobile larders are present at the CD, like the ones for Urology at Unit 3. In all cases, CHAs are responsible for the tasks involved in managing the items in stock. These tasks are the following ones:

- Replenish the items in stock
- Update necessary stock records
- Order items
- Check stock on durability limit

2.2.3 ACTIVITIES AT THE END OF THE MORNING AND AFTERNOON CONSULTATIONS

At 12:30 hrs, the morning consultation hours are officially ended. The afternoon consultations end at 16:30 hrs. A few tasks have to be performed by CHAs to finish these hours administratively, which are:

- Book unregistered supplementary consults for patients in CS-EZIS
- Authorize consultation hours in CS-EZIS
- Rebook the location of patient records in CS-EZIS on request of a medical specialist

BOOK UNREGISTERED SUPPLEMENTARY CONSULTS FOR PATIENTS IN CS-EZIS

It can happen that during a planned consult with a patient another medical specialty is also consulted. Since this consult is unplanned and therefore not scheduled, it has to be booked in CS-EZIS. Otherwise, the relevant insurance company will not reimburse this additional consult.

AUTHORIZE CONSULTATION HOURS IN CS-EZIS

For every scheduled patient, it has to be recorded in CS-EZIS if the patient really attended the planned consultation with a medical specialist. If not, a reason for the absence of the patient has to be entered into CS-EZIS.

REBOOK THE LOCATION OF PATIENT RECORDS IN CS-EZIS ON REQUEST OF A MEDICAL SPECIALIST

When a medical specialist wants to take a patient record from the CD to his/her room for studying or reporting purposes, the new location of the patient record needs to be registered in CS-EZIS. Patient records that are not required by a medical specialist anymore will be set apart and are collected by one of the persons that are responsible for the transportation of patient records to and from the CD. The location of these patient records does not have to be rebooked by CHAs in CS-EZIS, since somebody else does this.

2.2.4 ACTIVITIES AT THE END OF THE DAY

At the end of the day, when the afternoon consultation hours are finished, CHAs working on the late shift are responsible for closing the unit desks and the consultation rooms. The tasks involved are:

- Close the file cabinets with the patient records
- Switch off the computers at the unit desks and inside the consultation rooms
- Tidy up the unit desks and consultation rooms
- Clean unit desks and consultation rooms according to the schedule that is matched with the cleaning team
- Switch off the light when necessary
- Collect the medical instruments that have been used and store them in a special plastic container for sterilization. The necessary paperwork that comes along with the sterilization also needs to be done.
- Bring post to the post boxes at the main reception desk
- Transport cultures collected from patients after 16:00 hrs. to the designated place

Just like the activities at the start of the day, the majority of the tasks are straightforward and require only a small amount of time to be accomplished. Therefore, we will not go into more detail on these activities taking place at the end of the day

2.2.5 TIME LINE OF ACTIVITIES

We finish this section (2.2) with a schematic overview of the activities performed by CHAs during a regular working day. Figure 2.4 provides a time line in which the four described categories of activities are included.

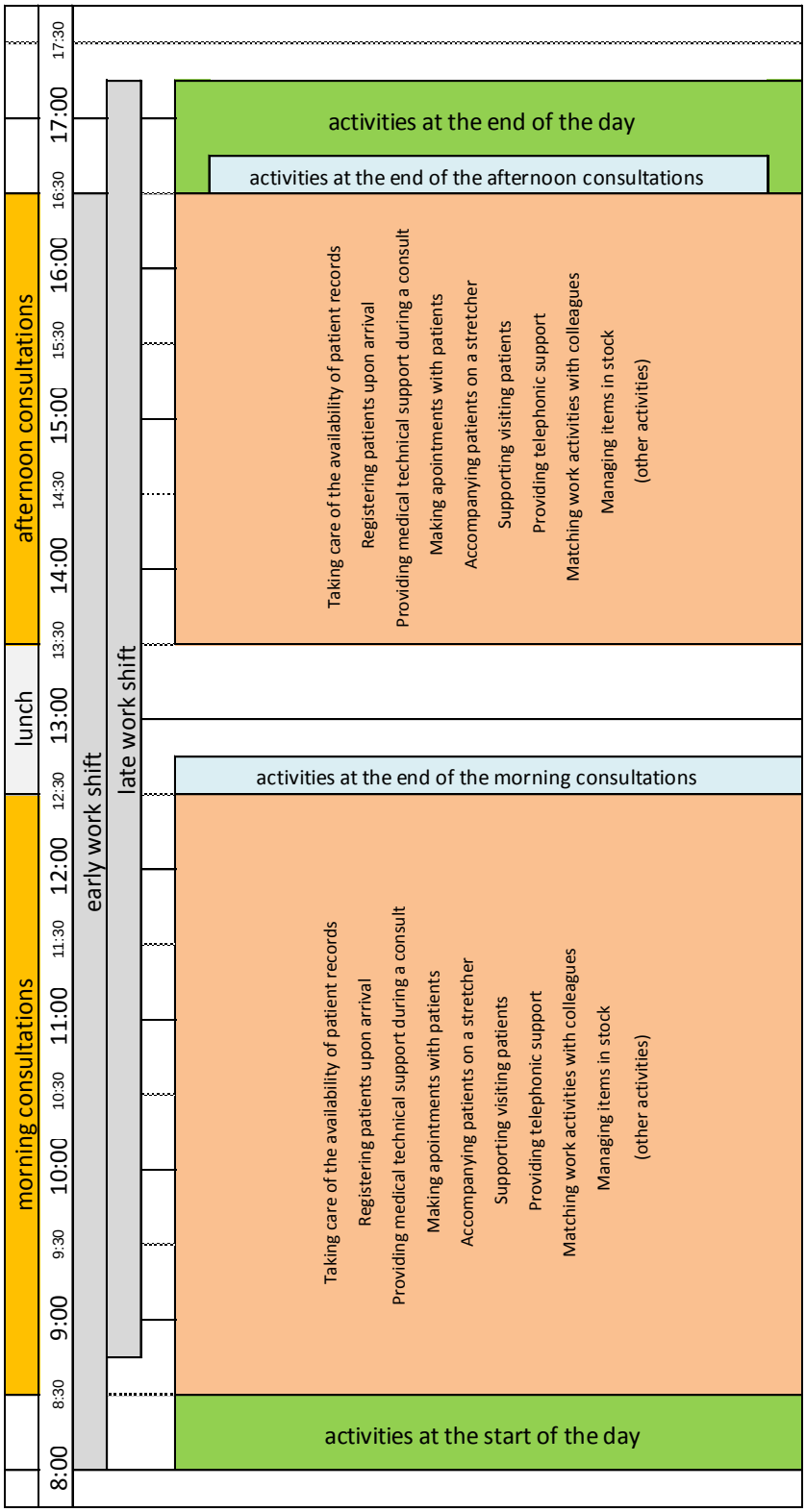

Figure 2.4: Time line of activities performed by CHAs during a working day

2.3 PERFORMANCE MEASUREMENT

A preliminary step towards improving the efficiency of CHAs in supporting medical specialists through a better assignment of tasks, is to determine how CHAs spend their working time. The activities with corresponding tasks that were defined within the previous section (2.2) will be subject to measurement. This section starts with the introduction and discussion of existing work evaluation tools (2.3.1). Next, the procedure that is used within this study to measure current efficiency of the CHAs at the CD is defined and validated (2.3.2).

2.3.1 WORK EVALUATION TOOLS

Different strategies from a broad spectrum of sources have been used over the years to evaluate work. Several work evaluation methodologies that have been applied are (Sittig, 2003):

- Review of departmental records
- Subjective evaluation
- Personal record of activities
- Time-motion analysis
- Work-sampling

The above-mentioned methodologies can all be used in answering questions related to the efficiency of CHAs. Therefore, we will shortly discuss every single one of them, but exaggerate on the ones that seem to be best applicable for quantitatively measuring the efficiency of CHAs at the CD.

Departmental records provide a valuable source of information concerning the overall function of a particular unit or department. Unfortunately they tell little about what employees, or even groups of employees, actual do on a shift-by-shift basis. Therefore, this technique is considered to be inappropriate for this study and will not be discussed in greater detail.

Subjective evaluation is usually done by means of a questionnaire. A questionnaire can provide a personal assessment of activities and estimates of the time spent on completing a task. Severe limitations for using such a technique are: results are based on personal biases, give imprecise measurement of work activities and can be strongly influenced by recent events that may skew the results (Sittig, 1993). Oddone et al. (1993) endorse that it can be dangerous to rely on estimations about the relative amount of time spent by employees on the various activities associated with their job. Employees tend to overestimate their own working day and productive hours. Based on these arguments, subject evaluation should not be used alone. But combined with a more quantitative technique, subjective evaluation can provide important information to the researcher.

A personal record of activities can be established by introducing a log that can be used by employees to record the activities performed and the amount of time spent on each. A major disadvantage of using such a method is that periods of intense activity can easily result in unaccountable behaviour. And if the log is not recorded periodically, a large emphasis is placed on the person's memory (Sittig, 1993). It is obvious that this can easily introduce bias in results.

Time-motion analyses and work-sampling are two widely used techniques for collecting work activity information, also within healthcare (Finkler, 1993). The work-sampling technique collects data at intervals of time. Sometimes the data are collected by observing the worker at the point in time selected for the observation and in other cases the data are recorded by the workers themselves using logs. In time-motion analysis the exact times needed to accomplish a task are recorded. In contrast to the work-sampling technique, the time-motion-analysis requires continuous one-on-one observation.

Both methodologies have of course advantages and limitations. But maybe more important is that time-motion analysis yields a detailed description of the activities of a few workers, whereas work-sampling gives less detail but provides insight in the work activity of a larger sample of workers (Finkler, 1993). So the trade-off between both techniques largely depends on depth and breadth. Since the purpose of this part of the study is to determine how CHAs spend their working time at departmental level, the choice for the work-sampling technique seems legitimate.

Since continuous observation requires an observer for each subject, a time-motion analysis would also consume a lot of time in order to deliver representative results for the entire CD. Since the activity level inside the department differs per unit and per day of the week, it would be necessary to observe CHAs at the different units for more than one day. The time frame for data collection would therefore become significantly longer compared to the application of work-sampling because work-sampling provides the opportunity to observe different CHAs at the same time.

2.3.2 MEASUREMENT PROCEDURE

Based on the arguments provided in the previous section (2.3.1), the measurement procedure chosen to determine how CHAs spend their working at departmental level is work-sampling. Within this section the work-sampling method will be discussed in more detail and the followed measurement procedure will be explained.

DESCRIPTION OF WORK-SAMPLING

The idea behind work-sampling is built on the laws of probability. Work-sampling is a technique in which a large number of observations are made of workers to determine what they are doing at any point in time. These counts can be used to estimate the percentage p that activity x is being performed. It is then concluded that the percentage of time devoted to the activity is equal to p. This idea behind work-sampling originated from the work of L.H.C. Tippett (1934), who published first about it.

Over the years work-sampling techniques have been applied in numerous medical studies to assess the general activities of physicians, nurses, pharmacists and physiotherapists (Miller et al., 1996). How healthcare workers spend their time is of interest to many health services researchers.

Work-sampling collects data at intervals of time. These intervals can be chosen at random or at fixed intervals. This decision is based on the nature of the underlying work. If the activities lack a prominent periodic component, such as most healthcare activities, fixed intervals can be chosen. In case of a regularity or pattern in work activities, sampling intervals should be randomly selected (Sittig, 1993). Sittig (1993) advises to limit the frequency of observations to less than eight per hour. But in practice one rarely sees work-sampling studies that sample more frequently than four times an hour (Finkler, 1993).

Registration at these fixed intervals can take place by the worker themselves or by an observer (Finkler, 1993). Registration by the worker themselves takes place on a paper or electronic document. The intervals of time at which work activities should be recorded are triggered by means of a signal (given by a programmed alarm clock, electronic pager or PDA). Registration by an observer can take place without using a signal, since the observer is able to walk through the department and register frequently the activities that CHAs are performing at those specific moments in time.

Both ways of registration have advantages and limitations. During self-registration, workers may not record the activities on time and/or they may not be entirely honest about the activities that they were performing at the sampling time (Lurie, Rank, Parenti, et al., 1989). In case of the registration by an observer, CHAs may be able to change their work patterns when they are observed. Although it is not likely due to the large number of observations made during a work-sampling study, this so-called “Hawthorne effect” could skew results. (Sittig, 1993). Another disadvantage of registration by an observer is that interpretation problems can arise if it is difficult to visually distinguish tasks from each other. (Guarisco, 1994). The distance between the observer and the observed worker creates limitations in what can be observed (Finkler, 1993). It is clear that in case of self-registration a more detailed distinction between activities can be made. But overall work-sampling studies that rely on the registration by the workers themselves are generally considered to be least reliable (Finkler, 1993).

Work-sampling provides insight in the work activity of a larger sample of workers (Finkler, 1993). Work-sampling is a technique used to estimate how working time is spend. It is worth mentioning that work-sampling does not provide insight in the pace of work, work methods, the quality of resources and knowledge level of the CHAs or the presence of organizational problems.

WORK-SAMPLING APPLIED AT THE CD OF THE NKI-AVL

The work-sampling study at the CD is based on the theory that the percentage of randomly made observations in which CHAs are performing a specific activity, compared to the total number of observations, represents an estimate of how CHAs spend their working day.

Since the work activities at the CD are random, samples are taken at fixed intervals. The time between the intervals is set at 15 minutes, which makes it possible to collect data over the five different units at four points of time each hour. More intervals cannot be selected since the time needed to observe the total number of assistants, who are divided over the five available units inside the department, equals 10-15 minutes. Fewer intervals per hour are not advised because of the law of the large numbers; the more data collected the higher the accuracy of the results. Collecting data at 4 fixed intervals each hour is in line with the rule of thumb provided by Sittig (1993), who advises to limit the frequency of observations to less than 8 per hour.

Within this study it is chosen to let the registration take place by an observer. A major reason for this is the smaller chance of introducing bias because of personal interest of employees in the outcomes. It should be clear-cut that self-registration is more vulnerable to manipulation by a group of workers. During the work-sampling there is still a chance of obtaining skewed results due to the so-called “Hawthorne effect”. This chance is partly reduced since no single worker is under direct observation for extended time periods. Also the large number of observations taken, made it extremely difficult for the entire group of CHAs to manipulate the outcomes. Registration by an observer also results in fewer disturbances of the daily activities performed by the CHAs in comparison with ‘triggered’ self-registration. This is a very welcome advantage, since it is explicitly requested by the Head of Ambulatory Care to minimally interfere with the daily activities at the CD.

Since the end results of the work-sampling study can also be influenced by the interpretation of the independent observer, the following precautions are taken:

- The measured activities are unambiguously defined and classified beforehand (Section 2.2).
- Walking along with CHAs for a considerable amount of time increased the understanding of departmental activities. The observer spent an entire working day at one of the units.

To establish the total length of the study it is important to distinguish some naturally occurring rhythm within the work pattern (Sittig, 1993). The sub cycles that can be distinguished at the CD are:

- 5 day work week (Monday to Friday)
- 2 work shifts during the day
  - Early shift - 08:00 -16:30 hrs.
  - Late shift - 08:45 -17:15 hrs.
- 2 consultation shifts during the day:
  - Morning - 08:30 -12:30 hrs.
  - Afternoon - 13:30 -16:30 hrs.

It is important to make sure that an equal numbers of sub cycles are included in the study. It is decided to let the measurement take place during two weeks from Monday to Friday. It is important that this two-week period reflects “normal” time (Sittig, 1993) in order for the results to be representative. Therefore, the measurement period is verified with one of the team leaders and the Head of Ambulatory Care. Daily measurement starts at 8:30 a.m. and ends at 16:30 hrs. Between 12:30 and 13:30 hrs., no measurement takes place because of the scheduled break between the two consultation shifts. During this break there is always some activity inside the CD because of arriving patients, who have their appointments scheduled in the afternoon, and work done by medical specialists in overtime. But the levels of activity during the break and during the official consultation shift in the morning/afternoon are not comparable. CHAs also schedule their personal lunch break between 12:30 and 13:30 hrs.

Since registration only takes place during the opening hours of the CD, not all activities that make up the job of CHA will be included in the study. In Section 2.2 we introduced four categories of activities that make up the job of CHAs, namely:

1. Activities at the start of the day
2. Activities during the morning and afternoon consultations
3. Activities at the end of the morning and afternoon consultations
4. Activities at the end of the day

Only activities from the third category will be covered by this work-sampling study. As already introduced in Section 2.2, activities with corresponding tasks at the start and end of the day are straightforward. They require only a small amount of time to be accomplished. Next to this, CHAs working on the early shift perform the activities that belong to the start of the day before the late shift starts. CHAs working on the late shift perform the tasks that belong to the end of the day; assistants working the early shift have then already finished their working day. A work-sampling study covering only the third category will therefore be representative for all CHAs working at the CD.

So, during two weeks from Monday to Friday, data are collected seven hours a day (between 8:30-12:30 and 13:30-16:30 hrs.) at 4 fixed intervals each hour. The data collection sheet used for the observations can be found in Appendix 1 and consists of the activities taking place during the morning and afternoon consultations, which are described in Section 2.2.2.

2.4 CURRENT PERFORMANCE

2.4.1 DATA COLLECTION AND ANALYSIS

The measurement procedure, as presented in the previous section (2.3.2), was pilot tested on Monday 15 March 2010. The actual work-sampling study was performed at the works days presented in Table 2.2. During these days an average of 20 assistants were working in the morning and 19 assistants in the afternoon (Appendix 2). This resulted in a total of 5435 planned observations. From the planned observations, 5110 remained for analysis purposes; 78 observations could not be performed and 247 observations were eliminated because the data was unrepresentative of the normal work routine. Normal work routine does not include lunch activity, which was observed 247 times. The cleaned dataset was analysed using Excel spreadsheet software.

Day	*Work-sampling dates*	
Monday	22-mrt	12-apr
Tuesday	16-mrt	23-mrt
Wednesday	17-mrt	24-mrt
Thursday	25-mrt	1-apr
Friday	19-mrt	2-apr

Table 2.2: Work-sampling period

During the data analysis, the sample mean time and the mean percentage of total time spent on the different work-activities were determined. Since these statistics are based on samples taken at intervals of time, they are subject to sampling error. Sampling error refers to random variation that occurs because samples are only taken during subsets of the working time instead of during the entire working time (continuous observation). A confidence interval is computed to provide an estimate of the potential discrepancy between the true and observed rates.

The simplest and most commonly used formula for a binomial confidence interval relies on approximating the binomial distribution with a normal distribution. This approximation is justified by the central limit theorem. The formula is:

$$\hat{p} \pm z_{1-\alpha/2}\sqrt{\frac{\hat{p}\,(1-\hat{p})}{n}} \qquad (1)$$

A 95% confidence interval is used within this study to indicate the range of values within which the statistic would fall 95% of the time if the researcher were to calculate the statistic from an infinite number of samples of the same size, drawn from the same population.

2.4.2 OBSERVED RESULTS

The results presented in this section are representative for the work activity of CHAs during the official opening hours of the CD. The CD at the NKI-AVL is open from Monday to Friday, between 8:30-12:30 and 13:30-16:30 hrs. This means that the results cover 420 minutes of work activity on a daily basis. Since a normal working day for a CHA consist of 8 net working hours including coffee breaks (480 minutes), one hour of work activity per day is not accounted for by this study. In Section 2.3.2 it was explained why the measurement procedure was defined in such a way.

WORK ACTIVITY AT DEPARTMENTAL LEVEL

Table 2.3 gives an overview of the work activity level of CHAs inside the CD of the NKI-AVL. The numbers in the figure represent the sample mean time (including a 95% confidence interval) and the mean percentage of total time spent on the different work-activities that make up the job of CHA at departmental level.

Work activity profile CHAs

Unit number	all
Average number of employees*	19,4

Observations	**Number**	**%**
Used for profiling	5110	94,0%
Eliminated observations	247	4,5%
Missed observations	78	1,4%
Total planned observations	*5435*	*100,0%*

Work activity *Mon-Fri: between 08:30-12:30hr and 13:30-16:30hr*	**%**	**95% Confidence interval** *lower limit*	*upper limit*	**In minutes**	**95% Confidence interval** *lower limit*	*upper limit*
Taking care of the availability of patient records	17,7%	16,6%	18,7%	74,1	69,7	78,5
Registering patients upon arrival	8,6%	7,9%	9,4%	36,3	33,1	39,6
Providing medical technical support	1,5%	1,2%	1,8%	6,3	4,9	7,7
Supporting visiting patients	2,0%	1,6%	2,4%	8,3	6,7	9,9
Making appointments	18,9%	17,8%	20,0%	79,3	74,8	83,8
Matching work activity with colleagues	5,5%	4,9%	6,1%	23,0	20,4	25,6
Accompanying patients on a stretcher	0,2%	0,1%	0,4%	1,0	0,4	1,5
Providing telephonic support	8,5%	7,8%	9,3%	35,8	32,6	39,1
Managing items in stock and cleaning	4,3%	3,7%	4,8%	18,0	15,7	20,3
Non-productive working time	25,7%	24,5%	26,9%	107,8	102,8	112,9
Other	7,1%	6,4%	7,8%	29,9	27,0	32,9
Total	*100,0%*			*420,0*		

Table 2.3: Daily work activity at departmental level, including a 95% confidence level (source: Appendix 4)

From the table we conclude that an average of 6 minutes per CHA is spent on medical technical support daily. As described in Section 1.2, previous internal research at the CD indicated that medical specialists are mainly supported by CHAs in administrative tasks and advisory services to patients during their work shifts at the CD. So, the outcomes of the work-sampling study support this.

When looking at the results, it is maybe more remarkable that the average non-productive working time is 108 minutes per person. Observations showed that the non-productive working time is spread throughout the working day and is a result of the unavailability of work. It may be clear that attention should be given to the reduction of this level of non-productivity. Especially since we know that the 45 minutes lunch break, conform to the collective labour agreement (Section 2.1.5), is not included in the results. But while saying so, we have to keep in mind that an improved utilization of CHAs can also result in the creation of waiting times for medical specialists and patients, because of the supportive nature of the job of CHA.

When a distinction is made between the average work activity of CHAs during the morning and afternoon (Figure 2.5), we conclude that most results remain relative stable. Since morning consultations last 4 hours and the afternoon consultations 3 hours, results are expressed in percentages. In the afternoon less activity is involved in the registration of patients upon arrival. Afternoon consultations are less attended in proportion to the morning consultations (Appendix 3). The same argumentation holds for making appointments. On the

other hand, the percentage of time spent on cleaning tasks and stock related activity increases during the afternoon. This is also the case for patient record related activity. For both categories it is interesting to mention that when expressed in minutes (Appendix 4), comparable amounts of time are spent during the morning and afternoon on the tasks involved. Patient record related activity consumed 38 minutes in the morning and 36 minutes in the afternoon per CHA. Cleaning tasks and stock related activity consumed 8 minutes in the morning and 10 minutes in the afternoon.

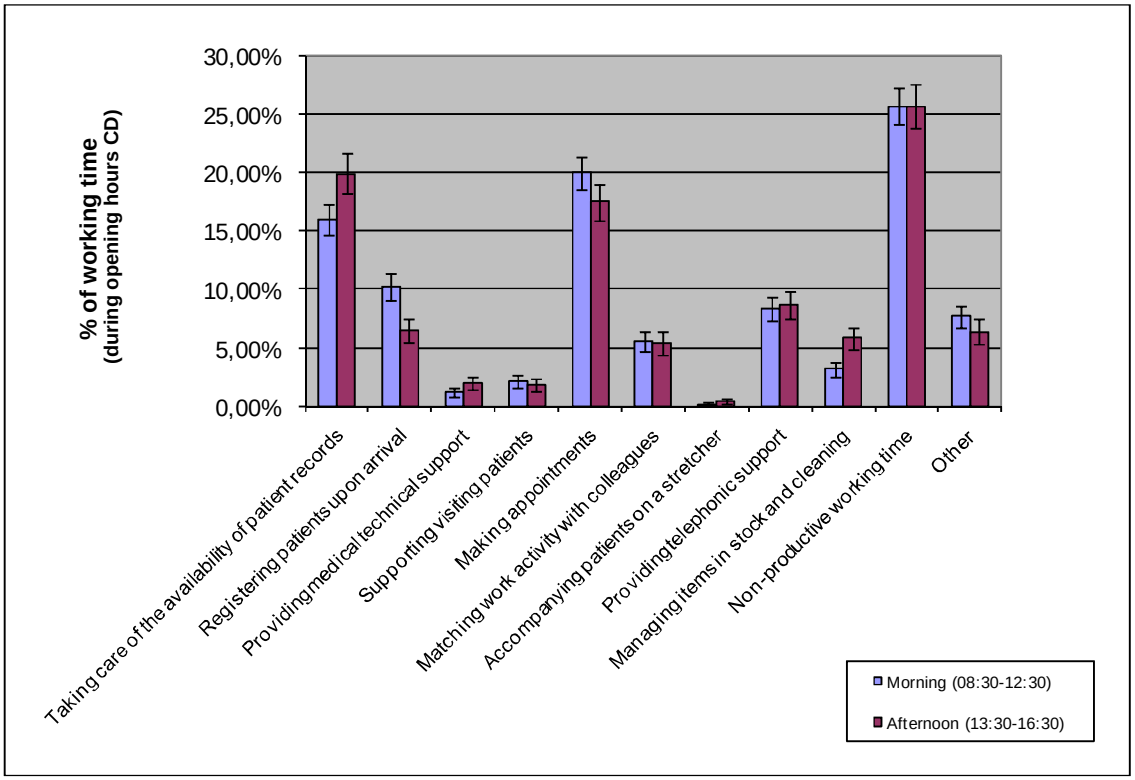

Figure 2.5: Work activity at departmental level during the morning and afternoon, including a 95% confidence level (source: Appendix 4)

WORK ACTIVITY AT UNIT LEVEL

When work activity levels are compared between the different Units, this will result in the histogram as presented in Figure 2.6. In the previous section we mentioned that an average of 6 minutes per person is spent on medical technical support at departmental level daily. Figure 2.6 shows that in reality only Unit 1 receives substantive medical technical support from CHAs. The level of activity in this category of tasks for the other Units is less than 1 minute per person. Also remarkable is that the average non-productive working time is by far the highest for Unit 3 (135 min), and the lowest for Unit 1 (87 min) and Unit 2 (93 min). The remaining activity categories show smaller, in most cases insignificant differences.

In the remainder of this section results for every work activity will be discussed more extensively on a unit level.

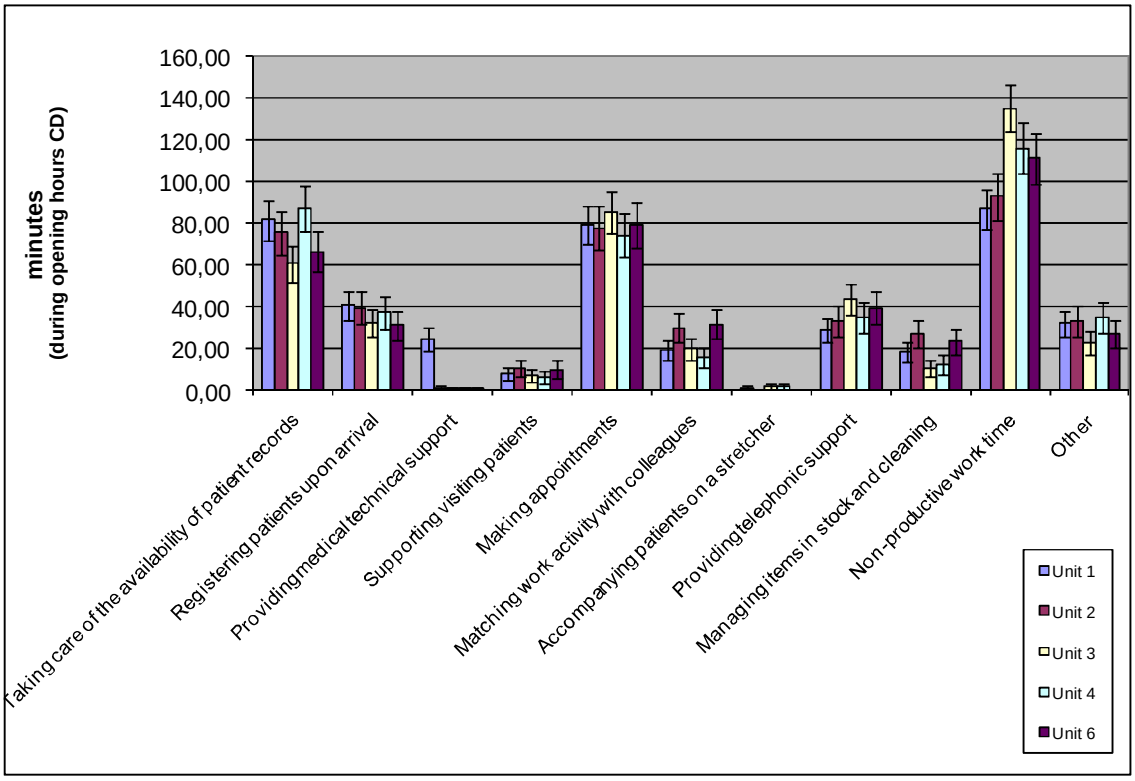

Figure 2.6: Daily Work activity at unit level, including a 95% confidence level (source: Appendix 4)

Taking care of the availability of patient records

Patient record related activities account for 17,7% of the working time (Table 2.3). This means that an average of 74 minutes per person is spent on tasks involving sorting, tracing, acquiring and handling patient records during the opening hours of the CD. It is interesting to notice that CHAs estimated the average amount of time spent on this activity between the 1 and 1,5 hours per person.

During the study, an average of 19,4 CHAs were working per day (Appendix 2). When applying a 95% confidence level, a total between 1350 and 1521 minutes is spent on patient record related activities during the opening hours of the CD. This equals 3,2 - 3,6 FTE[1] of CHAs. Note that this number does not account for any non-productive working time of CHAs during a shift.

When we take a closer look at the average time spent per person at the different units (Table 2.4), we conclude that Unit 3 scores well below the average with 61 min per person. This in contrast to Unit 4, where CHAs spent 87 minutes per person on average. Different reasons can exist why these numbers vary. One of them could be that the number of patient records per CHA differs substantially over the units. From Table 2.6 we conclude that this is indeed the case. But since the corresponding ranking of the units is not consistent with the results from Table 2.4, it does not explain the differences in work activity between the units. When we take a look at the average time spent per patient record (Table 2.6), Unit 3 just seems to be more efficient in performing tasks related to patient records compared than the other units; we consider Unit 4 to be least efficient.

As discussed in Section 2.2.2, the differences between the units can also be explained by the number of missing records on the day of the consultations and the intensity of the search for these missing records. Since no data are available on missing records, it is not possible to test this hypothesis. And also the most logical explanation for the differences cannot be validated, which is that the pace of work and skill level of CHAs are the drivers behind the differences in time spent on patient record related activities at every unit.

	Mean (minutes)	95% Confidence Interval	
		lower limit	*upper limit*
Unit 1	81,3	72,1	90,6
Unit 2	75,3	65,0	85,6
Unit 3	60,7	51,9	69,4
Unit 4	86,8	75,9	97,7
Unit 6	66,6	56,6	76,5

Table 2.4: Average time spent taking care of the availability of patient records per CHA on a daily basis

	Avg # assistants	*Avg time spent per unit*
Unit 1	4,6	377,7
Unit 2	3,6	273,6
Unit 3	4,1	251,4
Unit 4	3,5	304,9
Unit 6	3,4	228,0

Table 2.5: Average time spent taking care of the availability of patient records per unit on a daily basis

	Avg # patient records	*Avg # patient records/assistant*	*Avg time spent per record*
Unit 1	118,2	25,5	3,2
Unit 2	99,1	27,3	2,8
Unit 3	106,8	25,8	2,4
Unit 4	82,0	23,3	3,7
Unit 6	71,8	21,0	3,2

Table 2.6: Average time spent taking care of the availability of a single patient record

1 The opening hours of the CD total 7 hours (=420 minutes). Demand can be expressed in FTEs by dividing the presented number of minutes by 420.

Registering patients upon arrival

The registration of patients upon arrival at the front desk of each unit accounts for 8,6% of the working time (Table 2.3), which equals an average of 36 minutes per person per day. During the study, an average of 19,4 CHAs were working per day (Appendix 2). This means that when applying a 95% confidence interval, a total between 641 and 766 minutes is spent on this activity during the opening hours of the CD. This equals 1,5 - 1,8 FTE[1] of CHAs. Note that this number does not account for any non-productive working time of CHAs during a shift.

Table 2.7 presents the average time spent per CHA on the registration of patients upon arrival for the different units. As we know from Section 2.2.2, the registration of patients upon arrival is not an activity performed by all assistants. The registration takes place at the front desk of a unit. Per unit, one CHA is responsible for performing the corresponding tasks. Table 2.8 presents the average time spent by this single assistant on a daily basis. Unit 1 shows the highest work activity with an average of 189 minutes per day. At Unit 6 the least amount of time is spent on the registration of patients upon arrival (107 minutes).

The total time spent on the registration of patients upon arrival is mainly driven by the total number of patients that are scheduled at each unit on a daily basis. For this reason the average time spent on the registration of a single patient is presented in Table 2.9. Unit 3 seems to be most efficient with an average of 1,3 minutes per patient, but the differences between the units are considered to be insignificant.

	Mean (minutes)	95% Confidence Interval	
		lower limit	*upper limit*
Unit 1	40,7	33,7	47,6
Unit 2	39,6	31,8	47,5
Unit 3	32,2	25,6	38,9
Unit 4	37,1	29,4	44,7
Unit 6	31,2	24,1	38,4

Table 2.7: Average time spent registering patients upon arrival per CHA on a daily basis

	Avg # assistants	*Avg time spent per unit*
Unit 1	4,6	188,8
Unit 2	3,6	144,1
Unit 3	4,1	133,7
Unit 4	3,5	130,2
Unit 6	3,4	106,9

Table 2.8: Average time spent registering patients upon arrival per unit on a daily basis

	Avg # patients	*Avg time spent per patient*
Unit 1	118,2	1,6
Unit 2	99,1	1,5
Unit 3	106,8	1,3
Unit 4	82,0	1,6
Unit 6	71,8	1,5

Table 2.9: Average time spent registering a single patient upon arrival

Providing medical technical support

The medical technical support delivered by CHAs during the opening hours of the CD accounts for 1,5% of the working time (Table 2.3). This equals an average of 6 minutes per person per day. As concluded previously in this section, the CHAs at Unit 1 are the only ones that provide substantive medical technical support and Dermatology is the medical speciality receiving it. Therefore, the mentioned average is not representative for the work activity of CHAs at departmental level and we have to narrow down our focus to Unit 1 in particular.

Table 2.10 shows that the medical technical support delivered by CHAs at Unit 1 average 24 minutes per person per day, which equals 5,8% of their working time. During the study, an average of 4,6 CHAs were working at Unit 1 on a daily basis (Appendix 2). When applying a 95% confidence level[2], a total between 86 and 137 minutes is spent on medical technical support daily. This equals 0,2 - 0,3 FTE[1] of CHAs during the opening hours of the CD.

In the current situation two, sometimes three CHAs provide the necessary support on a daily basis. This means that they can be asked by a medical specialist to assist during a consult when required. If not, they perform the 'regular' CHA activities at the unit desk together with their colleagues. Observations at the workplace and conversations with the relevant CHAs showed that due to this irregular demand for medical technical support, CHAs are primarily focused on the activities taking place at the unit desk. So, as stated by the CHAs themselves: "Problems arise at the desk when assistance is requested for by a medical specialist". This implicates that medical technical support often interferes with the work being done at the unit desk.

	Mean (minutes)	95% Confidence Interval	
		lower limit	*upper limit*
Unit 1	24,3	18,8	29,7
Unit 2	0,9	-0,3	2,1
Unit 3	0,8	-0,3	1,8
Unit 4	0,5	-0,4	1,3
Unit 6	0,5	-0,4	1,4

Table 2.10: Average time spent providing medical technical support per CHA on a daily basis

Supporting visiting patients

The support provided by CHAs to patients during the opening hours of the CD accounts for 2,0% of the working time. This equals an average of 8 minutes per person per day. As we can see from Table 2.11, only minor (insignificant) differences exist between the different units. The observed behaviour in this category consists mainly of tasks like answering patient questions (that fall outside the category of appointment making), providing help/support to patients requiring it and accompanying patients through the hospital when needed. All observed tasks are service related and since only minor time is spent on it, we will not go into further detail.

	Mean (minutes)	95% Confidence Interval	
		lower limit	*upper limit*
Unit 1	8	5	11
Unit 2	11	6	15
Unit 3	7	4	10
Unit 4	6	3	10
Unit 6	10	6	14

Table 2.11: Average time spent supporting visiting patients per CHA on a daily basis

2 The use of the normal approach for estimating the confidence limits resulted in illogical lower limits for the Units 1,2,3,4, since they fall outside the logical domain.

Making appointments

Appointment making with patients accounts for 18,9% of the working time (Table 2.3). This equals an average of 79 minutes per person per day. During the study, an average of 19,4 CHAs were working on a daily basis (Appendix 2). When applying a 95% confidence level, a total between 1448 and 1623 minutes is spent on making appointments with patients daily. This equals 3,4 - 3,9 FTE[1] of CHAs during the opening hours of the CD.

Table 2.12 shows the average amount of time spent per CHA on making appointments for the different units. The total time spent per unit is presented in Table 2.13. Unit 1 shows the highest work activity with an average of 368 minutes per day. At Unit 4, the least amount of time is spent on the registration of patients upon arrival (260 minutes).

The total time spent on appointment making is mainly driven by the total number of patients that are scheduled at each unit on a daily basis. For this reason the average time spent on the registration of a single patient is presented in Table 2.14. It can be seen that the differences between Unit 1,2,3 and 4 are small to inferior (2,8 to 3,3 minutes per patient). With an average of 3,8 minutes per patient, the work activity involved in making appointments with a single patient is the highest at Unit 6.

An important thing to address is that the amount of time spent on appointment making with a single patient is driven by the required number of appointments and the amount of information that needs to be provided to the patient. Therefore, the amount of time spent on appointment making between different patients can vary heavily. Every unit is confronted with recurring patients, new patients and existing patients consulting a new medical specialty. As mentioned in Section 2.2.2, new patients (and existing patients consulting a new medical specialty) are normally consuming more time than recurring patients, since they require more appointments and information. And patients involved in fast-track diagnostics require more time for appointment making than new patients.

	Mean (minutes)	95% Confidence Interval	
		lower limit	*upper limit*
Unit 1	79,3	70,1	88,5
Unit 2	77,5	67,1	87,9
Unit 3	85,6	75,6	95,6
Unit 4	74,1	63,8	84,4
Unit 6	79,0	68,3	89,6

Table 2.12: Average time spent making appointments per CHA on a daily basis

	Avg # assistants	*Avg time spent per unit*
Unit 1	4,6	368,2
Unit 2	3,6	281,7
Unit 3	4,1	354,8
Unit 4	3,5	260,4
Unit 6	3,4	270,4

Table 2.13: Average time spent making appointments per unit on a daily basis

	Avg # patients	*Avg # patients/assistant*	*Avg time spent per patient*
Unit 1	118,2	25,5	3,1
Unit 2	99,1	27,3	2,8
Unit 3	106,8	25,8	3,3
Unit 4	82,0	23,3	3,2
Unit 6	71,8	21,0	3,8

Table 2.14: Average time spent making appointments with a single patient

Matching work activity with colleagues

Professional communication between CHAs and their colleagues or medical specialists accounts for 5,5% of the working time (Table 2.3). This equals an average of 23 minutes per person per day. We conclude from Table 2.15 that Unit 2 (30 minutes) and Unit 6 (32 minutes) spent most time on matching work activity with colleagues. According to the CHAs from Unit 6, this is caused by the fast-track diagnostics for breast cancer that are scheduled at their unit on Monday and Thursday. The fast-track diagnostics for breast cancer require more extensive consultation moments between them and the medical specialists. A lot of things (like appointments) have to be arranged and checked for the consulting patients. Unfortunately, the data are not adequate enough to formally test hypotheses of this kind.

	Mean (minutes)	95% Confidence Interval	
		lower limit	*upper limit*
Unit 1	19,5	14,5	24,4
Unit 2	29,8	23,0	36,7
Unit 3	20,0	14,7	25,3
Unit 4	15,8	10,7	21,0
Unit 6	31,7	24,5	38,9

Table 2.15: Average time spent matching work activity with colleagues per CHA on a daily basis

Accompanying patients on a stretcher

With an average of 1 minute per CHA per day (Table 2.16), accompanying patients on a stretcher account for 0,2% of the working time. Since the work activity is surprisingly low for this category of tasks, we will not go into more detail.

	Mean (minutes)	95% Confidence Interval	
		lower limit	*upper limit*
Unit 1	1,4	0,0	2,7
Unit 2	0,0	0,0	0,0
Unit 3	1,5	0,0	3,0
Unit 4	1,8	0,0	3,6
Unit 6	0,0	0,0	0,0

Table 2.16: Average time spent accompanying patients on a stretcher per CHA on a daily basis

Providing telephonic support

The telephonic support provided by CHAs during the opening hours of the CD account for 8,5% of the working time (Table 2.3). This equals an average of 36 minutes per person per day. Table 2.17 and Table 2.18 show the results for the different units. An important thing to mention is that during the work-sampling study it was not possible to distinguish incoming and outgoing phone calls from each other. Next to this, telephonic support provided at the front desk and telephonic support provided at the side desks were not separately measured. The dataset therefore makes it impossible to make a thorough analysis, which could explain the differences observed.

	Mean (minutes)	95% Confidence Interval	
		lower limit	*upper limit*
Unit 1	28,7	22,8	34,6
Unit 2	33,4	26,2	40,7
Unit 3	43,8	36,2	51,4
Unit 4	34,8	27,4	42,3
Unit 6	39,5	31,5	47,4

Table 2.17: Average time spent providing telephonic support per CHA on a daily basis

	Avg # assistants	*Avg time spent per unit*
Unit 1	4,6	133,3
Unit 2	3,6	121,4
Unit 3	4,1	181,4
Unit 4	3,5	122,3
Unit 6	3,4	135,2

Table 2.18: Average time spent providing telephonic support per unit on a daily basis

Managing items in stock and cleaning

Cleaning tasks and stock related activities account for 4,3% of the working time (Table 2.3). This equals an average of 18 minutes per person per day. As we can see from Table 2.19, Unit 2 and Unit 6 spent most time on the tasks involved. The former spent 27 minutes per person per day, the latter 23 minutes. We have to be careful with drawing conclusions about the results, since work activity within this category is also taking place after the opening hours of the CD. For example, during the study it was observed that Unit 2 was able to thoroughly clean some consultation rooms because they were not in use for a while during the consultation hours. This was not observed at other units during the study because most rooms had to be cleaned after 16:30 hrs., since they were almost continually occupied during the day. This example shows that results on a unit level are distorted. But the average of 18 minutes per person per day on departmental level is still considered to be representative.

	Mean (minutes)	95% Confidence Interval	
		lower limit	*upper limit*
Unit 1	18,1	13,3	22,9
Unit 2	27,2	20,6	33,8
Unit 3	10,4	6,5	14,2
Unit 4	12,2	7,7	16,7
Unit 6	23,4	17,2	29,7

Table 2.19: Average time spent managing items in stock and cleaning per CHA on a daily basis

	Avg # assistants	*Avg time spent per unit*
Unit 1	4,6	84,1
Unit 2	3,6	98,8
Unit 3	4,1	43,0
Unit 4	3,5	42,9
Unit 6	3,4	80,2

Table 2.20: Average time spent managing items in stock and cleaning per unit on a daily basis

Non-productive working time

Personal activities account for 25,7% of the working time, which equals an average of 108 minutes per person per day. When applying the 95% confidence level, a total between 1990 and 2185 minutes is spent on non-work related activities daily. This equals 4,7 - 5,2 FTE[1] of CHAs during the opening hours of the CD

In Table 2.21 the average non-productive working time per CHA on a daily basis is presented for the different units. As already mentioned in the beginning of this section, it is remarkable that the average non-productive working time is by far the highest for Unit 3 (135 min) and the lowest for Unit 1 (87 min) and Unit 2 (93 min).

The average non-productive working time per unit on a daily basis is presented in Table 2.22. With an average of 560 minutes, Unit 3 is performing the worst. An average work capacity of 1,3 FTE[1] remains untouched per day at Unit 3. The least amount of non-productive working time is observed at Unit 2. But an average of 337 minutes per day still equals 0,8 FTE[1]. It is clear that attention should be paid to the reduction of this level. But we have to keep in mind that an improved utilization of CHAs can also result in the creation of waiting times for medical specialists and patients. This because of the supportive nature of the job of CHA.

	Mean (minutes)	95% Confidence Interval	
		lower limit	*upper limit*
Unit 1	86,8	77,3	96,3
Unit 2	92,6	81,5	103,8
Unit 3	135,1	123,5	146,8
Unit 4	115,7	103,7	127,8
Unit 6	111,1	99,1	123,1

Table 2.21: Average non-productive working time per CHA on a daily basis

	Avg # assistants	*Avg time spent per unit*
Unit 1	4,6	403,1
Unit 2	3,6	336,8
Unit 3	4,1	560,1
Unit 4	3,5	406,5
Unit 6	3,4	380,5

Table 2.22: Average non-productive working time per unit on a daily basis

Other activities

The activities and tasks that are not part of the previously mentioned activities, are clustered in the category 'other activities', which account for7,1% of the working time (30 minutes per person). Table 2.23 shows some differences between the units, but they are considered to be minor and the departmental average of 30 minutes seems representative for all. Observations during the work-sampling study assured the researcher that no structural activities from CHAs were included in this category. Some activities, like sending medical prescriptions to patients on request of a medical specialist, were observed more often than for instance bringing coffee to medical specialists inside consultation rooms. But overall, no structural work behaviour could be identified.

	Mean (minutes)	95% Confidence Interval	
		lower limit	*upper limit*
Unit 1	32,1	25,9	38,4
Unit 2	33,0	25,7	40,2
Unit 3	23,0	17,4	28,7
Unit 4	34,8	27,4	42,3
Unit 6	27,1	20,4	33,8

Table 2.23: Average time spent on 'other activities' per CHA on a daily basis

	Avg # assistants	*Avg time spent per unit*
Unit 1	4,6	149,2
Unit 2	3,6	119,8
Unit 3	4,1	95,5
Unit 4	3,5	122,3
Unit 6	3,4	92,8

Table 2.24: Average time spent on 'other activities' per unit on a daily basis

2.4.3 VERIFICATION OF RESULTS

To ensure that the measured work activity as presented in the previous section adequately reflects the job of CHAs, it is important to verify that the circumstances under which the study was performed are representative for "normal" working time. Next to this, CHAs should be able to identify themselves with the results from the study.

NUMBER OF PATIENT VISITS

As we already know, the work activity level of CHAs is highly dependent on the number of consultations planned at the CD. Table 2.25 shows the number of appointments during the work-sampling study. An average of 478 appointments was scheduled on a daily basis. When we compare this number to the average number of appointments during March, April, May and June 2010 (458 appointments), as presented in Table 2.26, we conclude that the workload of CHAs during the measurement period is highly representative.

date	*day*	*number of appointments*		
		morning	*afternoon*	*daily*
16-mrt-10	Tuesday	337	232	569
17-mrt-10	Wednesday	243	187	430
19-mrt-10	Friday	295	194	489
22-mrt-10	Monday	309	158	467
23-mrt-10	Tuesday	334	213	547
24-mrt-10	Wednesday	196	185	381
25-mrt-10	Thursday	276	156	432
1-apr-10	Thursday	293	145	438
2-apr-10	Friday	324	199	523
12-apr-10	Monday	294	209	503
	average:	*290*	*188*	*478*

Table 2.25: Number of CD appointments during the work-sampling study (source: Appendix 3)

month	*average number of appointments*		
	morning	*afternoon*	*daily*
March '10	274	185	459
April '10	286	183	469
May '10	280	186	465
June '10	272	167	439
total	278	180	458

Table 2.26: Average number of CD appointments during March, April, May and June 2010 (source: Appendix 5)

NUMBER OF CHAS

As observed by the researcher, an average of 19,4 CHAs was working per day during the study (Appendix 2). Table 2.25 shows the composition of the workforce including registered leave due to sickness and vacation. The content of the table is defined by combining secondary data from paper work rosters and the software program Rostar Flex. Due to rounding, a small difference exists between the average amount of CHAs working per day resulting from this data (19,6) and the 19,4 CHAs that were observed by the researcher during the study.

The table shows an average sick leave of 14,5% during the morning and 16,6% during the afternoon. Vacation leave accounted for approximately 9,4% on a daily basis. Especially the percentage of sick leave is alarming since the norm lies beneath the 5%. The registered level of absenteeism during the study is considered to be high and probably an overestimation for "normal" working time. To be sure, it is advised to perform a more detailed study to map trend behaviour.

Assuming an overestimated level of absenteeism, it is expected that the average non-productive working time under CHAs is even higher than presented in Section 2.4.2 (25,7%). When the level of absenteeism drops, more personnel become available to divide workload. We previously concluded that the workload of CHAs during the measurement period was highly representative for "normal" working time.

	16-mrt	17-mrt	19-mrt	22-mrt	23-mrt	24-mrt	25-mrt	1-apr	2-apr	12-apr	*period average*	
MORNING												
scheduled on contractual basis	26	21	23	23	26	21	24	24	23	24	23,5	
sick leave	-7	-3	-4	-1	-4	-3	-4	-4	-3	-1	-3,4	(14,5%)
vacation leave	-3	-2	-3		-1		-1	-5	-3	-4	-2,2	(9,4%)
subtotal	*16*	*16*	*16*	*22*	*21*	*18*	*19*	*15*	*17*	*19*	17,9	
additional personnel:												
extra work day (out of contract)		2	1					1	1	1	0,6	(3,0%)
zero-hours contractual arrangement	1		1		1	1	1		1		0,6	(3,0%)
on-call employee	1					1		1	2		0,5	(2,5%)
other	2			1							0,3	(1,5%)
total available	*20*	*18*	*18*	*23*	*22*	*20*	*20*	*17*	*21*	*20*	19,9	
AFTERNOON												
scheduled on contractual basis	26	21	23	23	26	21	24	24	23	24	23,5	
sick leave	-7	-4	-4	-2	-5	-4	-4	-4	-3	-2	-3,9	(16,6%)
vacation leave	-3	-3	-3		-1	-1	-1	-4	-3	-4	-2,3	(9,8%)
subtotal	*16*	*14*	*16*	*21*	*20*	*16*	*19*	*16*	*17*	*18*	17,3	
additional personnel:												
extra work day (out of contract)		2	1					1	1	1	0,6	(3,1%)
zero-hours contractual arrangement	1		1		1	1	1		1		0,6	(3,1%)
on call employee	1	1			1	1			2	1	0,7	(3,6%)
other	1										0,1	(0,5%)
total available	*19*	*17*	*18*	*21*	*22*	*18*	*20*	*17*	*21*	*20*	19,3	
daily average	*19,5*	*17,5*	*18,0*	*22,0*	*22,0*	*19,0*	*20,0*	*17,0*	*21,0*	*20,0*	19,6	

Table 2.25: Workforce composition during the work-sampling study, including registered absenteeism (source: realized planning data from Rostar Flex and printed work schedules)

DATA CHECK UNDER PERSONNEL

The primary data collected during the study was crosschecked with the Head of Ambulatory Care and with CHAs from each unit. Results were also presented to all CD personnel during a half-yearly meeting at the 6th of July 2010. Next to this, the researcher collected estimations about work activity prior to the work-sampling study. These estimations closely match the measured work activity inside the department during the work-sampling study. It is therefore concluded that the CHAs can identify themselves with the work-activity profile as presented in Section 2.4.2.

3 IMPROVING EFFICIENCY AND DEALING WITH GROWTH

In this chapter different strategies are presented to improve the efficiency of CHAs in supporting medical specialists while dealing with growth. First, the most influential areas for improvement are identified (3.1). Second, the current demand and expected growth are presented (3.2). Next, different improvement scenarios are discussed (3.3-3.5). This chapter is concluded with a final thought about improvement (3.6).

3.1 IDENTIFICATION OF THE MOST INFLUENTIAL AREAS FOR IMPROVEMENT

To identify possibilities to improve the efficiency of CHAs in supporting medical specialists, we should focus on the most influential areas. For this reason a Pareto-diagram is constructed and presented in Figure 3.1. The percentages used for the construction of the graph were derived from Table 2.3. We conclude from Figure 3.1 that 80% of the work activity during the opening hours of the CD is clustered in the following 5 categories:

- Non-productive working time (25,7%)
- Making appointments (17,9%)
- Taking care of the availability of patient records (17,7%)
- Registering patients upon arrival (8,6%)
- Providing telephonic support (8,5%)

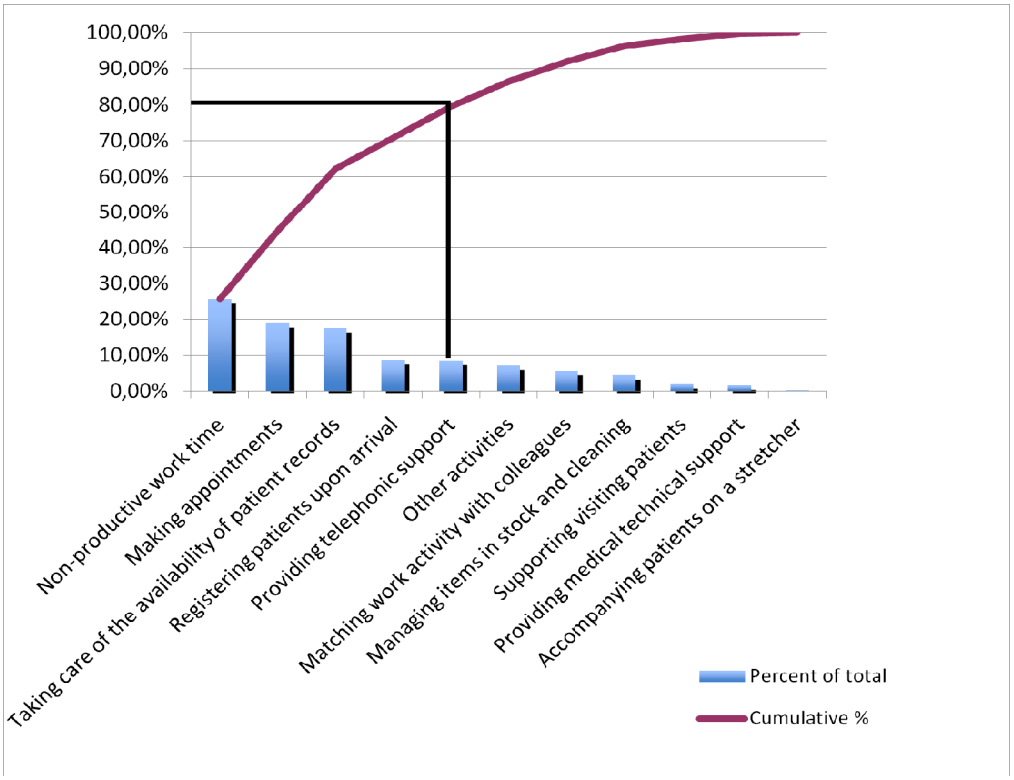

Figure 3.1: Pareto diagram of the work activity of CHAs during the work-sampling study

3.2 CURRENT DEMAND AND EXPECTED GROWTH

Up to the year 2020 a sustained growth of 45% is planned for the NKI-AVL. Since the CD fulfils a central role within the patient flow process through the hospital, it is assumed that the number of consultations scheduled at the CD will also grow with 45%. As concluded in the previous chapter, the work activity of CHAs is highly correlated with the number of consultations at the CD.

As illustrated in Table 3.1, during the work-sampling study an average of 6044 minutes was spent by CHAs on the different work activities. This amount of time coincides with an average of 478 consultations that were observed during the study on a daily basis. From this we conclude that an average of 12,6 minutes of work is performed by CHAs on a single consultation during the opening hours of the CD.

Work activity	**%**	**minutes**	**95% Confidence interval**	
Mon-Fri: between 08:30-12:30hr & 13:30-16:30hr			*lower limit*	*upper limit*
Making appointments	18,9%	1536	1448	1623
Taking care of the availablity of patient records	17,7%	1435	1350	1521
Registering patients upon arrival	8,6%	703	641	766
Providing telephonic support	8,5%	694	632	756
Other activities	7,1%	579	522	637
Matching work activity with colleagues	5,5%	446	395	496
Managing items in stock and cleaning	4,3%	349	303	394
Supporting visiting patients	2,0%	161	130	192
Providing medical technical support	1,5%	123	95	150
Accompanying patients on a stretcher	0,2%	19	8	30
Total productive work time	*74,3%*	*6044*		
Non-productive work time	25,7%	2088	1990	2185
Total work time	*174,3%*	*8132*		

Table 3.1: Work-sampling results, based on an average of 19,4 FTE of CHAs and 478 consultations per day

If we assume a 45% linear growth of the number of consultations up to the year 2020, the corresponding demand for CHAs during the opening hours of the CD is expected to behave like the graph presented in Figure 3.2. The presented demand figure does not account for economies of scale. In reality, the demand for CHAs is expected to grow at a slightly smaller rate than the number of consultations; work is done more efficiently when the amount of work increases.

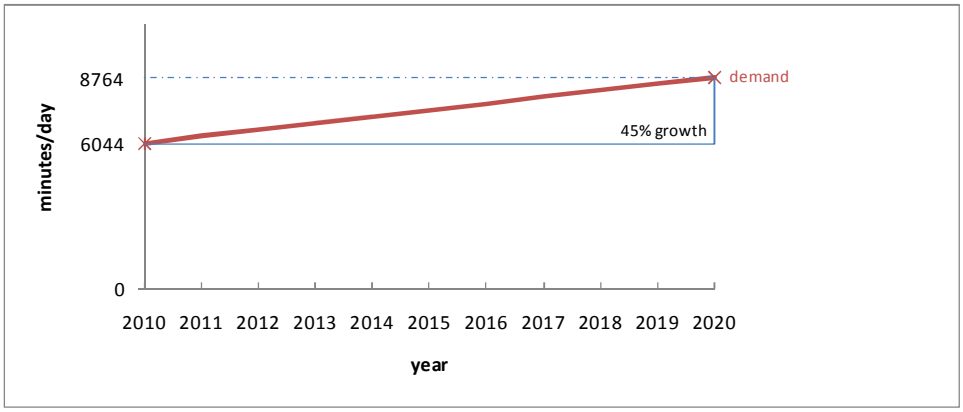

Figure 3.2: Average demand for CHAs in minutes per day when work activities remain unchanged (45% growth)

Since the opening hours of the CD total 7 hours, demand for CHAs can be expressed in FTEs by dividing the numbers presented in Figure 3.2 by 420 minutes. This means that in the current situation 14.4 FTE are on average needed per day (year 2010). As observed during the work-sampling study, 19.4 FTE are on average used to fulfil demand. As showed in Figure 3.3, this implies that if current work activities and working methods remain unchanged, 28.1 FTE of CHAs are used on a daily basis in the year 2020 to fulfil demand.

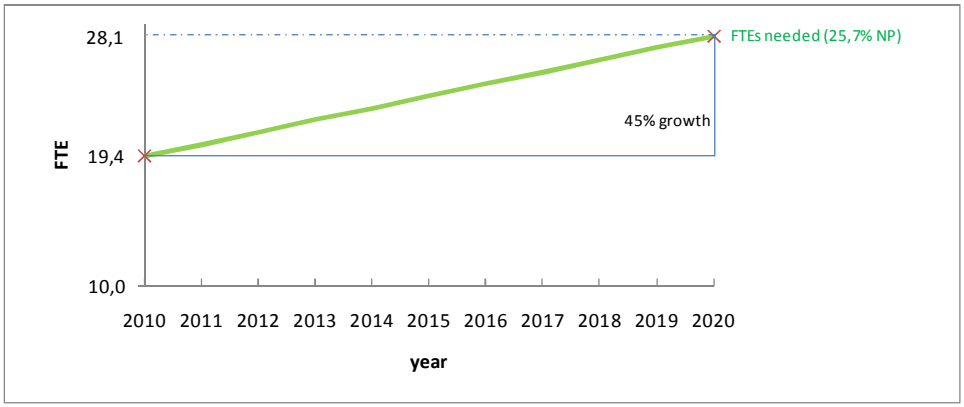

Figure 3.3: FTEs needed to fulfil demand when work activities remain unchanged (45% growth, 25,7% NP)

It is important to mention that the FTE numbers to fulfil demand represent net employment. The numbers do not account for sick leave and holiday leave. This is also the case for the FTE numbers presented in the remaining sections of this chapter.

To evaluate the impact of the following improvement strategies, we compute the Euros saved by reducing the CHA FTEs. Alternatively these FTEs could be redeployed to provide more (medical technical) support to medical specialists during the consultations when this is considered to be beneficial. To illustrate the idea, Appendix 6 provides an analysis of the possibilities for support by CHAs to anaesthesiologists during the Pre-operative Screening. We conclude that the POS-capacity can be increased by 33% when 180 minutes of support is provided by CHAs per day. This amount of support from CHAs is based on current demand. Since anaesthesiologists are confronted with capacity shortages and increased work pressure, the support is considered as very welcome.

3.3 IMPROVEMENT STRATEGY 1

REDUCE NON-PRODUCTIVITY TO 10%

In the current situation, 25,7% of the working time during the opening hours of the CD is spent non-productively (Table 3.1). Maintaining a NP-level of 25,7% is not advised, since this level is considered too high. We would rather advise to aim for a NP-level of 10%, which is supported by the Head of Ambulatory Care. Pursuing a NP-level lower than 10% is considered to be unfeasible since substantial waiting times for medical specialists and patients can (easily) result from this. This because of the supportive nature of the job of CHA.

For now, assuming that current work activities remain unchanged and the NP-level is reduced from 25,7% to 10% by adjusting dedicated labour capacity, the FTEs needed to fulfil current and future demand (45% growth up to 2020) are presented in Figure 3.4. From the corresponding table (3.2) we conclude that the current net amount of staff (19.4 FTE), as observed during the work-sampling study, should be enough to fulfil demand up to the year 2015.

45% GROWTH SCENARIO

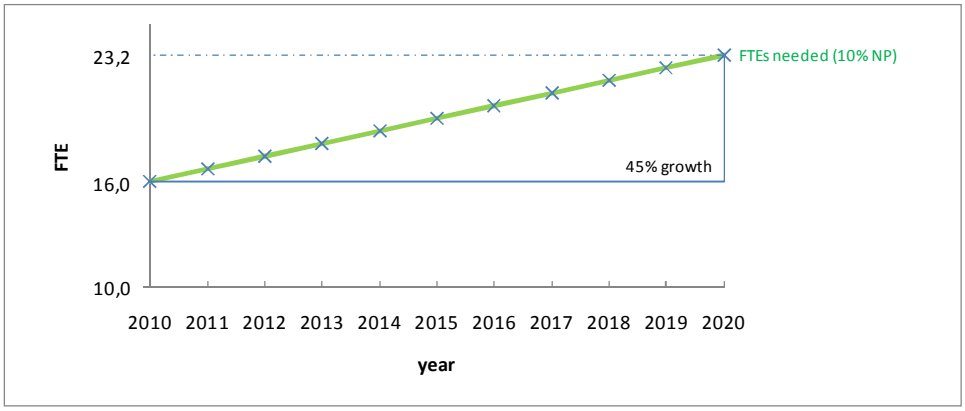

Figure 3.4: FTEs needed to fulfil demand when work activities remain unchanged (45% growth, 10% NP)

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
average number of consults per day	478	500	521	543	564	586	607	629	650	672	693
corresponding work demand CHAs (min.)	6044	6316	6588	6860	7132	7404	7676	7948	8220	8492	8764
FTEs needed (incl. 10% NP)	16,0	16,7	17,4	18,1	18,9	19,6	20,3	21,0	21,7	22,5	23,2

Table 3.2: FTEs needed to fulfil demand when work activities remain unchanged (45% growth, 10% NP)

Estimated savings

When we compare the numbers from Figure 3.3 and Figure 3.4, we conclude that decreasing the NP-level from 25,7% to 10% will result in a reduction of 3,4 FTE in 2010. When management is able to free the surplus of CHA capacity, estimated savings are €131.464 for the year 2010.

To determine the average costs for employing 1 FTE of CHAs, an estimation of the average salary scale was made in consult with the Head of Ambulatory Care. FWG-class 40(7) is assumed to be most representative. The associated costs were provided by Salary Administration and are €38.666,= for the year 2010. These costs are based on one full time employee and include holiday pay and year-end bonus. It was validated with the budget overview of 2010 that this estimation for the departmental average is reasonable.

Different growth scenarios

This section (3.3) is concluded with the presentation of two growth scenarios other than the planned scenario of 45%. We will consider linear growth rates of 30% and 60% up to year 2020. Each scenario will provide estimates for the average FTE numbers needed on a daily basis to fulfil demand considering a NP-level of 10%.

30% GROWTH SCENARIO

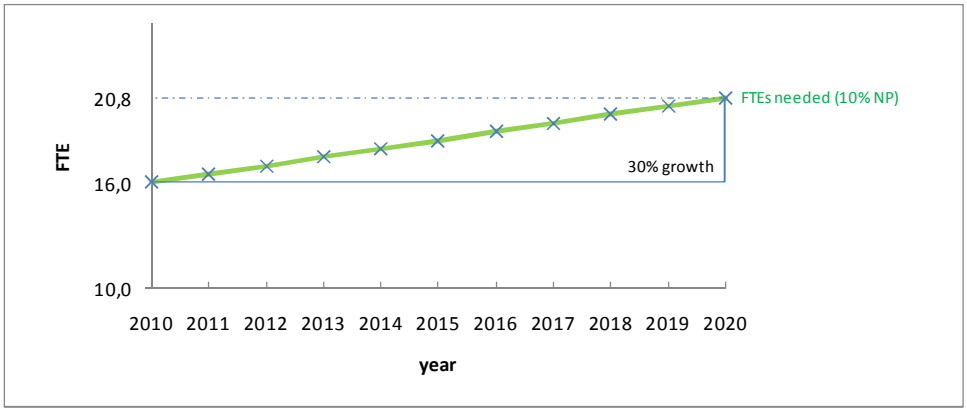

Figure 3.5: FTEs needed to fulfil demand when work activities remain unchanged (30% growth, 10% NP)

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
average number of consults per day	478	492	507	521	535	550	564	578	593	607	621
corresponding work demand CHAs (min.)	6044	6225	6407	6588	6769	6951	7132	7313	7495	7676	7857
FTEs needed (incl. 10% NP)	16,0	16,5	16,9	17,4	17,9	18,4	18,9	19,3	19,8	20,3	20,8

Table 3.3: FTEs needed to fulfil demand when work activities remain unchanged (30% growth, 10% NP)

60% GROWTH SCENARIO

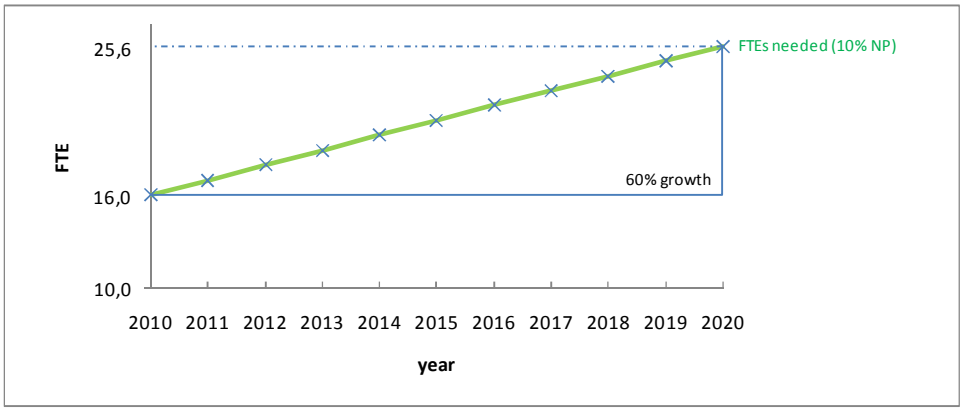

Figure 3.6: FTEs needed to fulfil demand when work activities remain unchanged (60% growth, 10% NP)

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
average number of consults per day	478	507	535	564	593	621	650	679	707	736	765
corresponding work demand CHAs (min.)	6044	6407	6769	7132	7495	7857	8220	8582	8945	9308	9670
FTEs needed (incl. 10% NP)	16,0	16,9	17,9	18,9	19,8	20,8	21,7	22,7	23,7	24,6	25,6

Table 3.4: FTEs needed to fulfil demand when work activities remain unchanged (60% growth, 10% NP)

3.4 IMPROVEMENT STRATEGY 2

DIGITALIZE MEDICAL RECORD AND NURSING RECORD

Taking care of the availability of patient records accounts for 17,7% of the working time of CHAs during the opening hours of the CD (Table 3.1). From conversations with CHAs we understood that the paper record is a source of frustration for them and that they would not feel disappointed if tasks like sorting, tracing, acquiring and handling patient records would not be a part of their work activity anymore. The patient record consists of a medical record and a nursing record, which are both available on paper.

The NKI-AVL is currently exploring the possibility to incorporate the content of the paper patient record in CS-EZIS. When the medical record and nursing record are digitalized, the need for a paper record will disappear. Taking care of the availability of patient records at the CD during the consultations, will in this case no longer be an activity of CHAs. The corresponding tasks for CHAs, as defined in Section 2.2.2, will completely disappear. If we assume that no new category of tasks is introduced for CHAs along with the introduction of this part of the Electronic Health Record, a substantive drop in work activity will arise.

During the work-sampling study an average of 1435 minutes was spent by CHAs on taking care of the availability of patient records. When the medical record and nursing record are digitalized, and the other work activities performed by CHAs remain unchanged, the demand for CHAs during the opening hours of the CD is expected to change like presented in Figure 3.7. The graph includes the 45% growth scenario up to the year 2020.

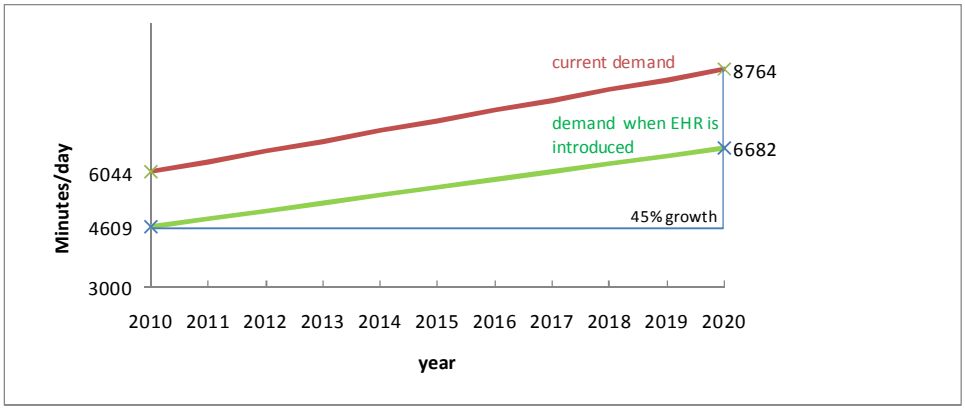

Figure 3.7: Average demand for CHAs in minutes per day when patient records are digitalized (45% growth)

The average number of FTEs needed to fulfil this demand on a daily basis, considering a desired NP-level of 10%, is presented in Figure 3.8. Next to the 45% growth scenario, the figure also includes a 30% and 60% growth scenario.

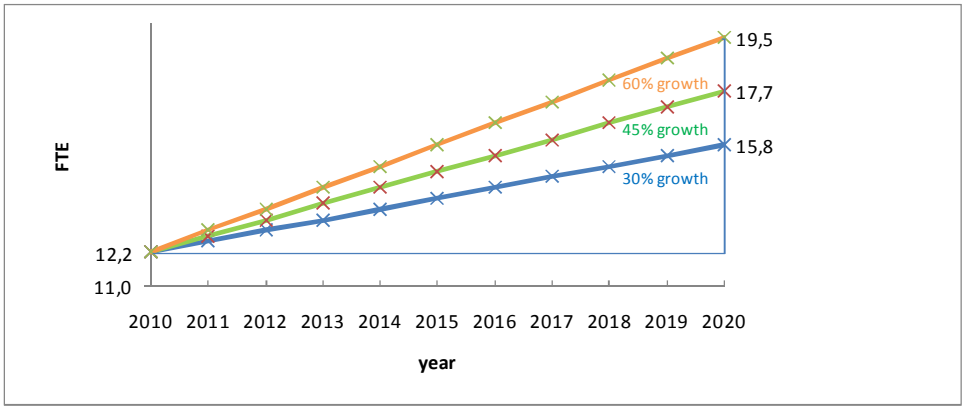

Figure 3.8: FTEs needed to fulfil demand when patient records are digitalized (30/45/60% growth, 10% NP)

The numbers that correspond with Figure 3.8 can be found in the tables below. Next to the number of FTEs needed to fulfil demand, also an estimation of savings is provided for each grow scenario when patient records are digitalized. These savings are expressed in FTEs and corresponding employment costs. As presented in Section 3.3, the average costs for employing 1 FTE of CHAs are estimated at €38.666 for the year 2010. This amount is also applied to the upcoming years.

If management is able to free the presented labour capacity when patient records are digitalized, the savings can be used to (partly) finance this improvement strategy.

45% GROWTH SCENARIO

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
average number of consults per day	478	500	521	543	564	586	607	629	650	672	693
corresponding w ork demand CHAs (min.)	4609	4816	5023	5231	5438	5646	5853	6060	6268	6475	6682
FTEs needed (incl. 10% NP)	12,2	12,7	13,3	13,8	14,4	14,9	15,5	16,0	16,6	17,1	17,7

Table 3.5: FTEs needed to fulfil demand when patient records are digitalized (45% growth, 10% NP)

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
estimated savings (FTE)	3,8	4,0	4,1	4,3	4,5	4,7	4,8	5,0	5,2	5,3	5,5
estimated savings (ú)	146.788	153.437	160.085	166.632	173.281	179.828	186.477	193.125	199.672	206.321	212.868

Table 3.6: Estimated savings when patient records are digitalized (45% growth, 10% NP) – Comparing Tables 3.2 & 3.5

30% GROWTH SCENARIO

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
average number of consults per day	478	492	507	521	535	550	564	578	593	607	621
corresponding w ork demand CHAs (min.)	4609	4747	4885	5023	5162	5300	5438	5576	5715	5853	5991
FTEs needed (incl. 10% NP)	12,2	12,6	12,9	13,3	13,7	14,0	14,4	14,8	15,1	15,5	15,8

Table 3.7: FTEs needed to fulfil demand when patient records are digitalized (30% growth, 10% NP)

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
estimated savings (FTE)	3,8	3,9	4,0	4,1	4,3	4,4	4,5	4,6	4,7	4,8	4,9
estimated savings (ú)	146.788	151.186	155.687	160.085	164.484	168.882	173.281	177.679	182.078	186.477	190.875

Table 3.8: Estimated savings when patient records are digitalized (30% growth, 10% NP) – Comparing Tables 3.3 & 3.7

60% GROWTH SCENARIO

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
average number of consults per day	478	507	535	564	593	621	650	679	707	736	765
corresponding w ork demand CHAs (min.)	4609	4885	5162	5438	5715	5991	6268	6544	6821	7097	7374
FTEs needed (incl. 10% NP)	12,2	12,9	13,7	14,4	15,1	15,8	16,6	17,3	18,0	18,8	19,5

Table 3.9: FTEs needed to fulfil demand when patient records are digitalized (60% growth, 10% NP)

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
estimated savings (FTE)	3,8	4,0	4,3	4,5	4,7	4,9	5,2	5,4	5,6	5,8	6,1
estimated savings (ú)	146.788	155.687	164.484	173.281	182.078	190.875	199.672	208.469	217.266	226.165	234.962

Table 3.10: Estimated savings when patient records are digitalized (60% growth, 10% NP) - Comparing Tables 3.4 & 3.9

3.5 IMPROVEMENT STRATEGY 3

AUTOMATE CHECK-IN PROCEDURE FOR PATIENTS

Registering patients upon arrival accounts for 8,6% of the working time of CHAs during the opening hours of the CD (Table 3.1). As described in Section 2.2.2, the current check-in procedure requires several handlings by a CHA at the front desk of a unit for which a punch card needs to be provided by the patient. In the current situation, one CHA is dedicated per unit to perform this activity, which he/she normally combines with telephonic support. In Section 2.4.2 we have shown that current demand is not enough to meet the dedicated capacity. As a result of this, the CHA is often performing other tasks that could easily conflict with the primary activity (the registration of patient upon arrival) or the CHA is being non-productive.

Existing technology makes it possible that the (purely administrative) check-in procedure of a patient is fully automated. A patient chip card or card with barcode can replace the 'old fashioned' punch card. This new personal card can be used by a patient to check-in upon arrival at a dedicated registration system without the intervention of a CHA being needed. The patient presents his/her card to a scan device and personal data are verified with the appointment system within CS-EZIS. Appointment details are shown to the patient, his/her presence is registered in the system and the patient is asked to take a seat in the appropriate waiting room before the medical specialist will collect him/her.

During the work-sampling study, an average of 703 minutes was spent by CHAs on registering patients upon arrival. When the registration of patients upon arrival is automated, and the other work activities performed by CHAs remain unchanged, the demand for CHAs during the opening hours of the CD is expected to change like presented in Figure 3.9. The graph includes the 45% growth scenario up to the year 2020.

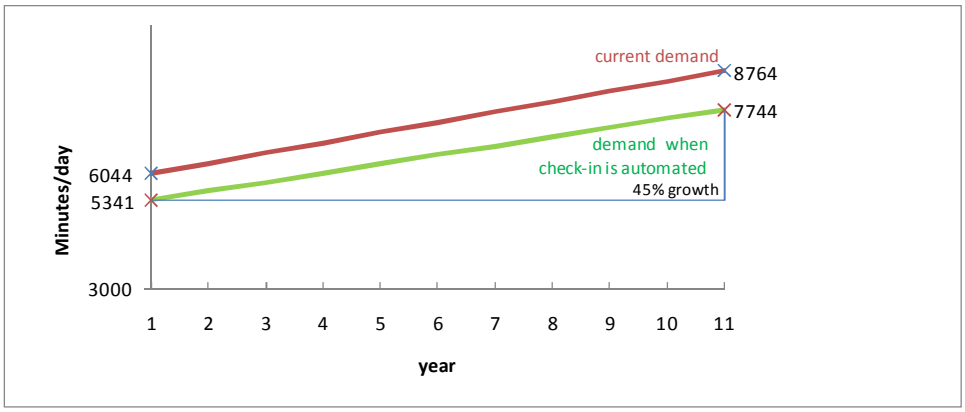

Figure 3.9: Average demand for CHAs in minutes per day when patient check-in is automated (45% growth)

The average number of FTEs needed on a daily basis to fulfil the demand, considering a desired NP-level of 10%, is presented in Figure 3.10. Next to the 45% growth scenario, the figure also includes a 30% and 60% growth scenario.

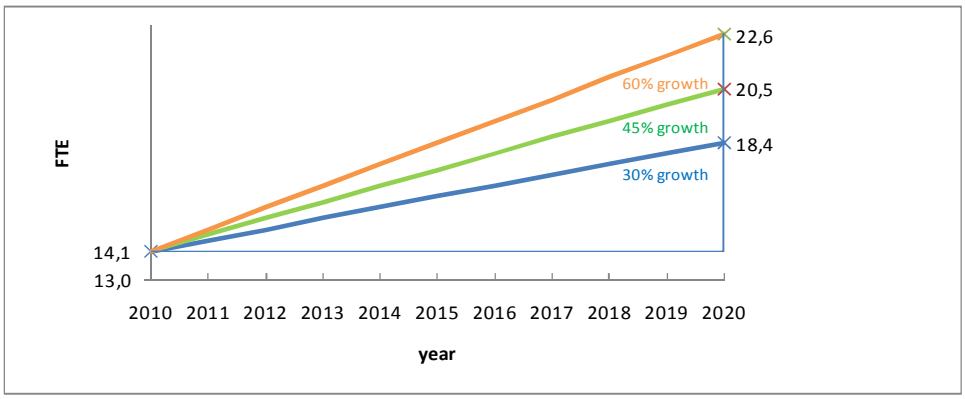

Figure 3.10: FTEs needed to fulfil demand when patient check-in is automated (30/45/60% growth, 10% NP)

The numbers that correspond with Figure 3.10 can be found in the tables below. Next to the number of FTEs needed to fulfil demand, also an estimation of savings is provided for each grow scenario when the patient check-in is automated. These savings are expressed in FTEs and corresponding employment costs. As presented in Section 3.3, the average costs for employing 1 FTE of CHAs are estimated at €38.666 for the year 2010. This amount is also applied to the upcoming years.

45% GROWTH SCENARIO

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
average number of consults per day	478	500	521	543	564	586	607	629	650	672	693
corresponding work demand CHAs (min.)	5341	5581	5822	6062	6302	6543	6783	7023	7264	7504	7744
FTEs needed (incl. 10% NP)	14,1	14,8	15,4	16,0	16,7	17,3	17,9	18,6	19,2	19,9	20,5

Table 3.11: FTEs needed to fulfil demand when patient check-in is automated (45% growth, 10% NP)

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
estimated savings (FTE)	1,9	1,9	2,0	2,1	2,2	2,3	2,4	2,4	2,5	2,6	2,7
estimated savings (ú)	71.911	75.184	78.355	81.628	84.902	88.073	91.346	94.517	97.790	101.064	104.235

Table 3.12: Estimated savings when patient check-in is automated (45% growth, 10% NP) - Comparing Tables 3.2 & 3.11

30% GROWTH SCENARIO

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
average number of consults per day	478	492	507	521	535	550	564	578	593	607	621
corresponding work demand CHAs (min.)	5341	5501	5661	5822	5982	6142	6302	6463	6623	6783	6943
FTEs needed (incl. 10% NP)	14,1	14,6	15,0	15,4	15,8	16,2	16,7	17,1	17,5	17,9	18,4

Table 3.13: FTEs needed to fulfil demand when patient check-in is automated (30% growth, 10% NP)

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
estimated savings (FTE)	1,9	1,9	2,0	2,0	2,1	2,1	2,2	2,3	2,3	2,4	2,4
estimated savings (ú)	71.911	74.059	76.207	78.355	80.503	82.651	84.902	87.050	89.198	91.346	93.494

Table 3.14: Estimated savings when patient check-in is automated (30% growth, 10% NP) - Comparing Tables 3.3 & 3.13

60% GROWTH SCENARIO

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
average number of consults per day	478	507	535	564	593	621	650	679	707	736	765
corresponding work demand CHAs (min.)	5341	5661	5982	6302	6623	6943	7264	7584	7905	8225	8546
FTEs needed (incl. 10% NP)	14,1	15,0	15,8	16,7	17,5	18,4	19,2	20,1	20,9	21,8	22,6

Table 3.15: FTEs needed to fulfil demand when patient check-in is automated (60% growth, 10% NP)

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
estimated savings (FTE)	1,9	2,0	2,1	2,2	2,3	2,4	2,5	2,6	2,8	2,9	3,0
estimated savings (ú)	71.911	76.207	80.503	84.902	89.198	93.494	97.790	102.086	106.383	110.781	115.077

Table 3.16: Estimated savings when patient check-in is automated (60% growth, 10% NP) - Comparing Tables 3.4 & 3.15

Automating the check-in procedure will result in less personal contact between CHAs and the patients. Since hospitality to their patients is an important trademark of the NKI-AVL, it has to be considered if no new job should be introduced while automating the check-in procedure at the CD. For instance, a host/hostess could be employed to welcome patients upon arrival, to instruct patients how to use the registration system, and to provide patients with the necessary information. Alternatively, people working at the central registration desk of the hospital could be made (partly) responsible for this. In general, it is important to be aware of the consequences that the introduction of such a system will have, since not only CHAs are confronted with it.

3.6 FINAL THOUGHT

Within the previous sections (3.3/3.4/3.5), three improvement strategies were introduced. The first strategy involves structurally lowering the non-productivity (NP) from 25,7% (which resulted from the work-sampling study) to a desired level of 10%. Considering the current demand this would result in an estimated saving of 3,4 FTE (Section 3.3). When management is able to free this surplus of CHA capacity, estimated savings are €131.464.

The advised NP-level of 10% should be maintained while introducing the second and/or third improvement strategy: digitalizing the medical record and nursing record, and automating the patient check-in procedure. If both of these strategies are introduced and the other work activities remain unchanged, the demand for CHAs during the opening hours of the CD is expected to change like presented in Figure 3.11..

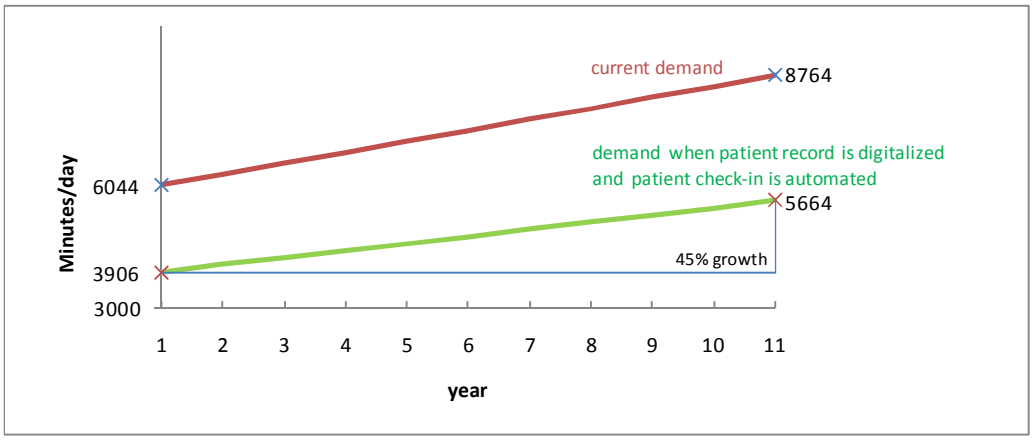

Figure 3.11: Average demand for CHAs in minutes per day when patient records are digitalized and patient check-in is automated (45% growth)

The average number of FTEs needed on a daily basis to fulfil the demand when the medical record and nursing record are digitalized, and the patient check-in is automated, are presented in Figure 3.12.

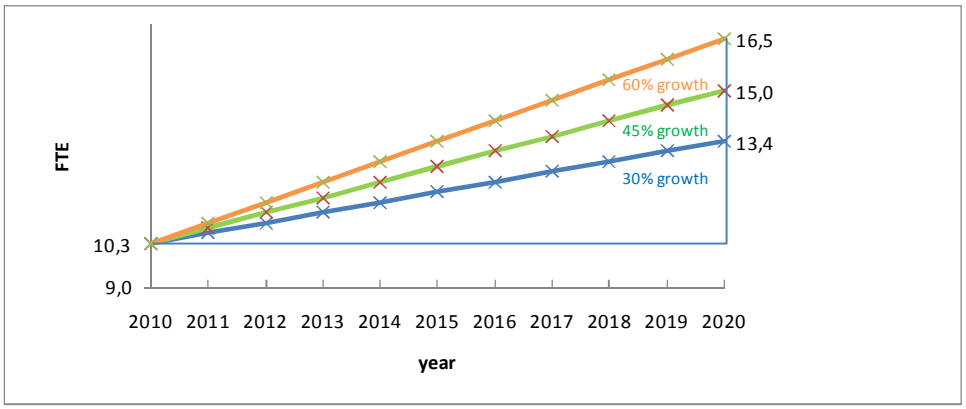

Figure 3.12: FTEs needed to fulfil demand when patient records are digitalized and patient check-in is automated (30/45/60% growth, 10% NP)

The numbers that correspond with Figure 3.12 can be found in the tables on the next page. Next to the number of FTEs needed to fulfil demand, also an estimation of savings is provided for each grow scenario when the patient records are digitalized and patient check-in is automated. These savings are expressed in FTEs and corresponding employment costs. As presented in Section 3.3, the average costs for employing 1 FTE of CHAs are estimated at €38.666 for the year 2010. This amount is also applied to the upcoming years.

45% GROWTH SCENARIO

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
average number of consults per day	478	500	521	543	564	586	607	629	650	672	693
corresponding w ork demand CHAs (min.)	3906	4082	4258	4433	4609	4785	4961	5136	5312	5488	5664
FTEs needed (incl. 10% NP)	10,3	10,8	11,3	11,7	12,2	12,7	13,1	13,6	14,1	14,5	15,0

Table 3.17: FTEs needed to fulfil demand when patient records are digitalized and patient check-in is automated (45% growth, 10% NP)

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
estimated savings (FTE)	5,7	5,9	6,2	6,4	6,7	6,9	7,2	7,4	7,7	7,9	8,2
estimated savings (ú)	218.698	228.540	238.381	248.222	258.064	267.905	277.747	287.588	297.430	307.271	317.112

Table 3.18: Estimated savings when patient records are digitalized and patient check-in is automated (45% growth, 10% NP) – Comparing Tables 3.2 & 3.17

30% GROWTH SCENARIO

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
average number of consults per day	478	492	507	521	535	550	564	578	593	607	621
corresponding w ork demand CHAs (min.)	3906	4023	4140	4258	4375	4492	4609	4726	4843	4961	5078
FTEs needed (incl. 10% NP)	10,3	10,6	11,0	11,3	11,6	11,9	12,2	12,5	12,8	13,1	13,4

Table 3.19: FTEs needed to fulfil demand when patient records are digitalized and patient check-in is automated (30% growth, 10% NP)

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
estimated savings (FTE)	5,7	5,8	6,0	6,2	6,3	6,5	6,7	6,8	7,0	7,2	7,4
estimated savings (ú)	218.698	225.259	231.820	238.381	244.942	251.503	258.064	264.625	271.186	277.747	284.308

Table 3.20: Estimated savings when patient records are digitalized and patient check-in is automated (30% growth, 10% NP) – Comparing Tables 3.3 & 3.19

60% GROWTH SCENARIO

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
average number of consults per day	478	507	535	564	593	621	650	679	707	736	765
corresponding w ork demand CHAs (min.)	3906	4140	4375	4609	4843	5078	5312	5547	5781	6015	6250
FTEs needed (incl. 10% NP)	10,3	11,0	11,6	12,2	12,8	13,4	14,1	14,7	15,3	15,9	16,5

Table 3.21: FTEs needed to fulfil demand when patient records are digitalized and patient check-in is automated (60% growth, 10% NP)

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
estimated savings (FTE)	5,7	6,0	6,3	6,7	7,0	7,4	7,7	8,0	8,4	8,7	9,0
estimated savings (ú)	218.698	231.820	244.942	258.064	271.186	284.308	297.430	310.551	323.673	336.795	349.917

Table 3.22: Estimated savings when patient records are digitalized and patient check-in is automated (60% growth, 10% NP) – Comparing Tables 3.4 & 3.21

4 MANAGING CHANGE

Within the previous chapter, the management of the CD is confronted with proposals for change that will impact with the current work activities performed by consultation hour assistants (CHAs). Porras and Robertson (1992) state that the core of organizational change is found in individual organizational member's behaviour. This implies that a focus on the people side of change is therefore necessary in order to make change successful. This chapter starts with the introduction of theory behind behavioural change and its link with organizational change (4.1). This theory will be translated into practice (4.2) and illustrated by observations at the CD of the NKI-AVL (4.3).

4.1 THEORY ON MANAGING CHANGE

According to Winum, Ryterband and Stephensen (1997), most attempts to implement organizational change fail because principles and knowledge about the psychology of change are violated or ignored. Porras and Robertson (1992) believe that the absence of a broad, widely accepted, usable and change-based model of organizational development is a major weakness in the field. The Transtheoretical Model (TTM) has the potential to fill this gap in organizational change; it can do what it has done for the field of individual behaviour change (Prochaska et al., 2002).

According to Prochaska et al. (2002), TTM integrates a number of theoretical constructs central to change: stages of change, decisional balance, process of change. They state that especially the stages-of-change dimension can be used to integrate principles and processes of change from divergent models of change. Practically, the ideas behind the change dimensions can be applied by leaders to reduce resistance to change, increase participation in change, reduce dropouts from change, increase progress and enhance implementation of organizational change initiatives.

The central construct in TTM are the stages of change. People progress through a series of five stages when modifying behaviour on their own or with help of formal interventions (Prochaska and Di Clemente, 1983):

1. Precontemplation - not intending to take action within the next 6 months
2. Contemplation - intending to take action within the next 6 months
3. Preparation - intending to take action in the next 30 days
4. Action - made overt changes less than 6 months ago
5. Maintenance - made overt changes more than 6 months ago

People in Precontemplation and Contemplation are likely to see changes as imposed and can become resistant if forced to take action before they are prepared. Research showed that the balance of pros and cons of changing is systematically related to the stage of change (Prochaska et al., 1994). During the Precontemplation Stage, the cons of changing outweigh the pros; in the middle stages, a cross exist between the pros and cons of change; and in the action stage the pros outweighed the cons.

TTM research has shown that stage-matched interventions can have a far greater impact than action-oriented programs, by increasing participation and increasing the like hood that individuals will progress to action (Prochaska et al., 2002).

4.2 THEORY INTO PRACTICE

The ways in which changes are produced in a hospital setting vary. Some changes arise at the work floor, others are introduced by hospital management. In all cases, a climate for change has to be created in order for initiatives to be successful.

It has to be prevented that change leaders confront employees with action initiatives who are not prepared for it. They will get surprised by how much resistance to change is created during such a process. Change leaders should be aware of the need of all stakeholders to be part of the process of change, and the need for them to

progress through the presented series of five stages when modifying behaviour. It is Important to know that not every employee will progress through the different stages at the same time. Problem owners are expected to progress faster than people that initially do not see why change is needed. Change leaders should monitor the different stakeholders and their progress of behavioural change, and introduce individualized stage-matched interventions to prepare them well. The more people are prepared to take action, the higher the chance of success of an action initiative.

INVOLVING PHYSICIANS AS STAKEHOLDERS

Physicians have a special relationship with hospitals, which is important to be aware of when discussing change initiatives. Physicians are both customer and stakeholder in the organization. They are stakeholder because the quality of care provided by them is determined by how the hospital functions. With respect to this, it is important to know that although physicians work as individuals, they have great influence on hospital operations through medical staff committees.

Physicians are customer in the way that they evaluate the hospital as a workplace. They choose to practice in one organization over another, and they are customers of (human) resources and management. Their satisfaction affects the service they provide to their patients, and this eventually affects patient satisfaction

As any other, physicians have to progress through the presented series of five stages when modifying behaviour. But when trying to gain their support in change efforts, it is important to recognize their dual nature as stakeholder and customer, and address their needs in both roles.

For every change initiative, it is important to be clear about the level of participation needed from physicians, and the role they should play in the change process. A stakeholder analysis can be used as a tool to determine the appropriate level. A careful planning can lead to an efficient use of physicians' time and an increased level of their support.

In some cases, no active involvement by physicians is needed. In other cases, including a well respected member of the physician group or medical staff as a 'change champion' in the change team, can be of great help to prepare individual physicians and the group as a whole. This person should throw his support and influence behind the change initiative. And since this person speaks the physician's language, he can get through his colleagues more easily than outsiders. He is able to use both formal and informal mechanisms for approaching them about a change initiative, and for assessing attitudes toward the change initiative. He can act as a role model to his colleagues and contribute his expertise regarding the initiative to the change team.

4.3 OBSERVATIONS AT THE CD

We will illustrate the presented ideas behind behavioural change, by providing a description of observations at the CD of the NKI-AVL. These observations coincide with the proposed improvement strategies, which were presented in Chapter 3.

REDUCE NON-PRODUCTIVITY TO 10%

Based on the results from the work-sampling study, we concluded earlier that in the current situation the non-productivity (NP) level of CHAs is on average 25,7% (Section 2.4.2). Before the outcomes of the study were available, observations by the researcher and personal conversation with CHAs did not provide any indication that CHAs were intending to take action to lower the non-productivity level. Therefore, CHAs were considered to be in the Precontemplation Stage at this particular moment in time. CD management was considered to be in the Contemplation Stage, because they were expecting a substantial level of non-productivity and that maybe something should be done about it.

The results of the work-sampling study were presented by the researcher to CD management first. Since the current NP-level was even higher than they expected, this staged-matched intervention helped them to progress to the Preparation Stage immediately because they felt that something should be done to reduce the level within a reasonable amount of time. As a result, CD management presented the observed NP-level to all CHAs during a half-yearly meeting (Section 2.4.3). We observed that CHAs were not shocked by the outcomes

and probably even expecting such a level. Therefore, this stage-matched intervention was considered to be an appropriate one to help most CHAs progress to the Contemplation Stage.

Now it is advised to reduce the NP-level to 10% by adjusting dedicated labour capacity (Section 3.3). CD management should be preparing the content of the change initiative and it is important that as much CHAs as possible will also progress to the Preparation Stage. This can be done by updating them about the proposed intervention and giving them the opportunity to respond on it. This will increase their involvement in the change process. Listening to their suggestions on how labour capacity should be divided in the optimal situation can also help management mastering the details of the plan and to progress to the Action Stage. But next to this, it is very important for CD management to keep focussing on the people that are in still remaining in the earlier behavioural stages with respect to the proposed change and to help them progress to a next stage. If too many CHAs are not prepared to take action, decreasing non-productivity by adjusting labour capacity can easily result in dropouts and an increased level of sick leave.

DIGITALIZE MEDICAL RECORD AND NURSING RECORD

From conversations with CHAs we understood that the paper patient record is a source of frustration for them and that they would not feel disappointed if tasks like sorting, tracing, acquiring and handling patient records would not be a part of their work activity anymore. There was no CHA disputing this. In their perception, the pros of digitalizing the patient record clearly outweigh the cons with respect to the work activity performed by them. So, CHAs clearly progressed collectively through the Precontemplation and Contemplation Stage, and are prepared to take action now. Resistance from their side is therefore expected to be small. A stage-matched intervention at this stage could be that management informs them about the progress being made on digitalizing patient records.

But next to CHAs, other stakeholders are involved. It is likely that they can be found in other behavioural stages and thus require different stage-matched interventions. For instance, medical specialists are also (majorly) effected by digitalizing patient record. We expect that a part of them is still in the Precontemplation Stage, because they think that benefits from the planned change may not be great enough. The NKI-AVL can facilitate consciousness-raising (e.g. by communicating information about the consequences of change) to help them progress to the Contemplation Stage. This example shows that stage-matched interventions allow all staff to participate in the change process, even they are not prepared to take action.

AUTOMATE THE CHECK-IN PROCEDURE FOR PATIENTS

The idea of automating the check-in procedure, as described in Section 3.5, originated from discussions with the Head of Ambulatory Care. CHAs were not involved in the development of this idea and there is no reason to believe that they consider it as an improvement. From personal conversations with CHAs it became clear that some of them are convinced that personal contact between them and the patients is more desirable than ever in this digital era. From this we conclude that automating the check-in procedure, which will result in less personal contact between them and the patients, can be seen as a threat. We therefore expect that they are still in the Precontemplation Stage. It is important for management to help them progress to the Contemplation Stage, by communicating information about the consequences of automating the check-in procedure and failure to change. For management itself it is important to debate the pros and cons of the proposed change in more detail, by reading materials on the subject, talking to suppliers, evaluate the short-term disruption and long-term savings etc. This should be done in order for them to progress to the Preparation Stage. Again, in this stage it is important for management to involve CHAs in this process when they are ready for it and prepare others that are not.

4.4 CONCLUSION

Within this chapter we have created some understanding about the modification of employees' behaviour that is needed for change initiatives to be successful. The five stages of behavioural change derived from TTM can be applied by leaders during the implementation of organizational change. It can be used as a practical tool to reduce resistance to change and to increase participation of employees. The examples from the CD of the NKI-AVL show that every change process is unique and should be treated in such a way. There is no prescribed sequence of steps that can be followed every time again in order to become successful.

5 CONCLUSIONS AND RECOMMENDATIONS

In this chapter the conclusions of this research are presented (5.1). Following these conclusions, recommendations for future research are provided (5.2).

5.1 CONCLUSIONS

The results from the work-sampling study that guided this research, provided us with the insight that 80% of the activity of CHAs during an average working day, is found in the following 5 categories:

- Non-productive working time (25,7%)
- Making appointments with patients (17,9%)
- Taking care of the availability of patient records (17,7%)
- Registering patients upon arrival (8,6%)
- Providing telephonic support (8,5%)

Improvement scenarios focussing on these areas will have the highest impact on the support delivered by consultation hour assistants at the CD.

First, we conclude that the amount of non-productive working time of CHAs is too high in the current situation. Maintaining an NP-level of 25,7% is not advised, since valuable money is spent. We would rather advise to aim for a NP-level of 10%. Pursuing a NP-level lower than 10% is considered to be unfeasible since substantial waiting times for medical specialists and patients can (easily) result from this. This is because of the supportive nature of the job of CHA. We estimate that decreasing the NP-level from 25,7% to 10% will result in a reduction of 3,4 FTE, based on this year's demand (2010). Corresponding costs are estimated at €131.464. Since demand is expected to grow with 45% up to 2020, postponing the reduction of non-productivity will results in even higher amounts of money that could be saved on a yearly basis. To effect the reduction of non-productivity to a level of 10%, management of the CD is advised to adjust the dedicated labour capacity of CHAs. The management of the CD should be aware of the major impact this change will have on CHAs and that resistance can be expected.

Second, we conclude that digitalizing the patient records, which are currently available on paper, will result in a substantive drop in work activity at the side of the CHAs. Since the NKI-AVL is currently exploring the possibility to incorporate the content of the paper patient record in CS-EZIS, the influence of such a change cannot be neglected. Based on an estimated growth of demand by 45% up to 2020 and a NP-level of 10% at the side of CHAs, on average 3,8 FTE in 2010 up to 5,5 FTE in 2020 can be saved. If management is able to free this amount of capacity, estimated savings approach €2.000.000 over the next 10 years. These savings can be invested in the development of the digital patient record. Resistance from CHAs to this change are expected to be small, since their current job in taking care of the availability of the records is a source of frustration. The introduction of the digital patient record is expected to receive a warm welcome from their side.

Third, existing technology makes it possible that the (purely administrative) check-in procedure of a patient is fully automated. In the current situation one CHA is dedicated per unit to register patients upon arrival, which is normally combined with telephone support. We have shown that current demand is not enough to meet the dedicated capacity. As a result of this, the CHAs in charge of the registration process are often performing other tasks that could easily conflict with the primary activity, or the CHAs are being non-productive. So, when the registration of patients upon arrival is automated, variability at the desk is reduced. If the patient check-in is automated and the other work activities performed by CHAs remain unchanged, the demand for CHAs during the opening hours of the CD is expected to change significantly. Based on an estimated growth of demand by 45% up to 2020 and a NP-level of 10% at the side of CHAs, on average 1,9 FTE in 2010 up to 2,7 FTE in 2020 can be saved. If management is able to free this amount of capacity, estimated savings approach €1.000.000 over the next 10 years. These savings can be invested in the development and introduction of the automated patient check-in. From conversation with CHAs it became clear that some of them are convinced that personal contact between them and the patients is more desirable than ever in this digital era. From this we conclude that automating the check-in procedure, which will result in less personal contact between them

and the patients, can be seen as a threat. It is important for CD management to be aware of that while considering this improvement scenario.

Fourth, we conclude that if the non-productivity is reduced to 10%, the digital patient record is introduced, the patient check-in is automated, and other work activities remain unchanged, 5.7 FTE in 2010 to 8,2 FTE in 2020 can be saved. Considering a growth of demand by 45% up to 2020, expected demand can at the end be fulfilled by only 15 FTE of CHAs. In comparison, 19.4 FTE was on average at work during the work-sampling study. If nothing changes up to 2020, we estimate that 28,1 FTE will be needed at that time to cope with demand.

The mentioned improvement strategies result in a reduction of CHA FTEs needed on a daily basis. Alternatively these FTEs could be redeployed to provide more medical technical support to medical specialists during the consultations when this is considered to be beneficial. In the current situation a minor amount of time spent on this activity. To illustrate the idea, we show within this report that increased support delivered by CHAs to anaesthesiologists during the Pre-operative Screening (POS) can result in an increase of POS-capacity by 33%. The corresponding work activity for CHAs, based on the current number of screenings, is estimated at an average of 180 minutes on a daily basis.

While considering these and other change initiatives to improve the support delivered by CHAs to medical specialist during the consultation hours at the CD, insights gained from research within the field of behavioural science can be of valuable help to change leaders. The five stages of behavioural change that were presented in the final part of this report can be used as a practical tool to reduce resistance to change and to increase participation of employees. It has to be prevented that change leaders confront employees with action initiatives who are not prepared for it. Change leaders should be aware of the need of all stakeholders to be part of the process of change, and that they have to progress through the presented series of five stages when modifying behaviour. Not every employee will be ready for change at the same time. Change leaders should monitor the different stakeholders and their progress of behavioural change, and introduce individualized stage-matched interventions to prepare them well. The more people are prepared to take action, the higher the chance of success of a change initiative.

5.2 RECOMMENDATIONS

Improvement strategies that were presented within this study deal with three of the five most influential areas for change when looking at the work performed by CHAs. The two areas that weren't considered are:

1. Making appointments with patients
2. Providing telephonic support

The recommendations following this research will therefore focus on these 2 areas. Next to this, a recommendation is made about the registered level of sick leave during the work-sampling study.

MAKING APPOINTMENTS WITH PATIENTS

Making appointments with patients averagely takes 1536 minutes over all units during the opening hours of the CD (Table 3.1), and therefore it is the most time consuming activity performed by CHAs. During this research it became clear that a lot of variability is involved in the process around appointment making. To deal with this variability and to overcome waiting times for patients, CHA capacity is buffered in the current situation. At the side of CHAs this results in underutilization, as showed within this research.

To improve the performance within the department, we recommend that the opportunities to reduce the variability within the appointment making process are explored. The field of Operations Management can provide valuable insight with respect to this.

PROVIDING TELEPHONIC SUPPORT

Providing telephonic support averagely takes 694 minutes over all units during the opening hours of the CD (Table 3.1). Conversations with CHAs provided us with the information that especially incoming phone calls can highly disturb the work process at a unit desk. Reducing the number of incoming phone calls to a minimum is therefore advisable.

During the work-sampling study, no distinction was made between incoming and outgoing phone calls. Next to this, telephonic support provided at the front desk and telephonic support provided at the side desks was not separately measured. The existing dataset is therefore not appropriate to make a thorough analysis of it, and to pinpoint exactly what change initiatives could be best implemented. We therefore recommend to perform a more detailed study on the nature of incoming and outgoing phone calls.

Some practical recommendations that can be introduced at once are that CHAs should not provide patients with direct phone numbers anymore, and the hospital personnel from other departments should be informed not to transfer patient calls concerning appointments to the CD, but to the Appointments Centre where this type of phone calls initially belongs.

SICK LEAVE

As described within Section 2.4.3, during the work-sampling study an average sick leave of 14,5% during the morning and 16,6% during the afternoon was registered under CHAs. These percentages are alarming, since the norm lies beneath the 5%. Assuming an overestimated level of absenteeism, we expect that the average non-productive working time under CHAs is even higher than the presented 25,7% within this thesis. When the level of absenteeism drops, more personnel becomes available to divide workload. We concluded in section 2.4.3 that the workload of CHAs during the measurement period was highly representative for "normal" working time. So, when the same amount of work is done by more people, non-productivity will increase.

We therefore highly recommended to perform a more detailed study on the percentages of sick leave at the CD to map trend behaviour. If results show that the registered percentage of sick leave during the work-sampling study is not an exception, underlying causes should be identified in order to look for opportunities to improve. When the registered level of sick leave is considered to be an exception, the pressure on CD management to reduce the level of non-productivity even further increases.

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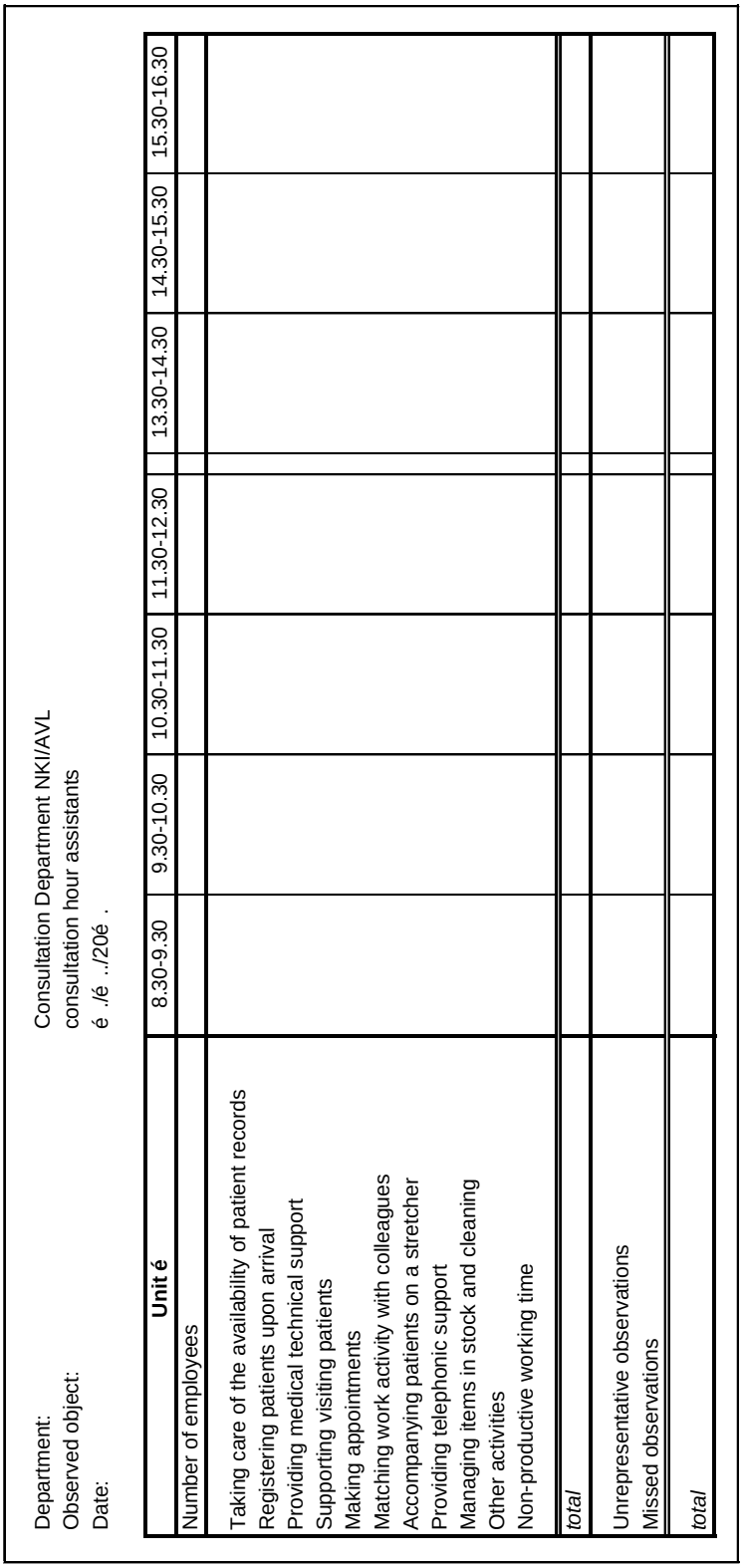
APPENDICES

APPENDIX 1: DATA COLLECTION SHEET WORK-SAMPLING STUDY

The figure below represents the data collection sheet that was used during the work-sampling study. It contains the activities that are performed by CHAs during the opening hours of the CD. A description of the activities and corresponding tasks can be found in Section 2.2.2.



Department: Consultation Department NKI/AVL
Observed object: consultation hour assistants
Date: é ./é ../20é .

Unit é	8.30-9.30	9.30-10.30	10.30-11.30	11.30-12.30		13.30-14.30	14.30-15.30	15.30-16.30
Number of employees								
Taking care of the availability of patient records								
Registering patients upon arrival								
Providing medical technical support								
Supporting visiting patients								
Making appointments								
Matching work activity with colleagues								
Accompanying patients on a stretcher								
Providing telephonic support								
Managing items in stock and cleaning								
Other activities								
Non-productive working time								
total								
Unrepresentative observations								
Missed observations								
total								

APPENDIX 2: AVERAGE STAFFING DURING WORK-SAMPLING STUDY

The tables presented in this appendix provide an overview of the average numbers of CHAs that were at work during the work-sampling study. The numbers are based on observations made by the researcher every quarter of an hour.

date	*unit*	*average number of assistants*		
		morning	*afternoon*	*daily*
Tuesday 16-3-2010	1,0	4,9	4,0	4,4
	2,0	4,0	5,0	4,5
	3,0	4,8	5,0	4,9
	4,0	2,9	3,0	3,0
	6,0	3,0	2,0	2,5
	all units	19,6	19,0	19,3

date	*unit*	*average number of assistants*		
		morning	*afternoon*	*daily*
Wednesday 24-3-2010	1,0	5,2	5,0	5,1
	2,0	2,9	2,3	2,6
	3,0	3,9	4,0	3,9
	4,0	3,4	3,3	3,4
	6,0	4,0	2,5	3,3
	all units	19,4	17,2	18,3

date	*unit*	*average number of assistants*		
		morning	*afternoon*	*daily*
Wednesday 17-3-2010	1,0	4,9	4,0	4,4
	2,0	3,0	3,0	3,0
	3,0	3,9	4,0	4,0
	4,0	2,9	4,0	*3,5*
	6,0	3,0	2,0	2,5
	all units	17,8	17,0	17,4

date	*unit*	*average number of assistants*		
		morning	*afternoon*	*daily*
Thursday 25-3-2010	1,0	4,0	4,0	4,0
	2,0	2,8	3,0	2,9
	3,0	4,0	4,0	4,0
	4,0	3,9	4,0	3,9
	6,0	4,9	4,7	4,8
	all units	19,6	19,7	19,6

date	*unit*	*average number of assistants*		
		morning	*afternoon*	*daily*
Friday 19-3-2010	1,0	4,8	5,0	4,9
	2,0	4,9	5,0	4,9
	3,0	3,9	4,0	4,0
	4,0	3,0	3,0	3,0
	6,0	2,0	2,0	2,0
	all units	18,6	19,0	18,8

date	*unit*	*average number of assistants*		
		morning	*afternoon*	*daily*
Thursday 1-4-2010	1,0	4,9	4,0	4,4
	2,0	1,9	2,0	2,0
	3,0	3,4	4,0	3,7
	4,0	3,1	3,0	3,1
	6,0	4,0	4,0	4,0
	all units	17,3	17,0	17,2

date	*unit*	*average number of assistants*		
		morning	*afternoon*	*daily*
Monday 22-3-2010	1,0	4,8	4,0	4,4
	2,0	3,0	3,0	3,0
	3,0	4,9	5,0	4,9
	4,0	3,9	4,0	4,0
	6,0	5,8	5,0	5,4
	all units	22,3	21,0	21,7

date	*unit*	*average number of assistants*		
		morning	*afternoon*	*daily*
Friday 2-4-2010	1,0	5,8	5,7	5,7
	2,0	4,9	6,0	5,4
	3,0	3,9	3,0	3,4
	4,0	4,0	4,0	4,0
	6,0	2,0	2,0	2,0
	all units	20,6	20,7	20,6

date	*unit*	*average number of assistants*		
		morning	*afternoon*	*daily*
Tuesday 23-3-2010	1,0	6,0	4,3	5,2
	2,0	5,0	5,0	5,0
	3,0	5,0	4,3	4,7
	4,0	3,0	3,7	3,3
	6,0	3,0	2,7	2,8
	all units	22,0	20,0	21,0

date	*unit*	*average number of assistants*		
		morning	*afternoon*	*daily*
Monday 12-4-2010	1,0	3,8	4,0	3,9
	2,0	3,0	3,0	3,0
	3,0	3,9	4,0	4,0
	4,0	4,0	4,0	4,0
	6,0	5,3	4,7	5,0
	all units	20,0	19,7	19,8

unit	*total average number of assistants*		
	morning	*afternoon*	*daily*
1	4,9	4,4	4,6
2	3,5	3,7	3,6
3	4,2	4,1	4,1
4	3,4	3,6	3,5
6	3,7	3,2	3,4
all units	19,7	19,0	19,4

APPENDIX 3: AVERAGE NUMBER OF APPOINTMENTS DURING WORK-SAMPLING STUDY

The tables presented in this appendix provide an overview of the number of appointments at the CD during the work-sampling study. The content is derived from CS-EZIS (Chipsoft electronic Care Information System) at 3 August 2010.

date	*unit*	*number of appointments*		
		morning	*afternoon*	*daily*
Tuesday 16-3-2010	1	80	66	146
	2	71	79	150
	3	88	55	143
	4	49	24	73
	6	49	8	57
	all units	337	232	569

date	*unit*	*number of appointments*		
		morning	*afternoon*	*daily*
Wednesday 24-3-2010	1	71	43	114
	2	21	24	45
	3	37	73	110
	4	40	35	75
	6	27	10	37
	all units	196	185	381

date	*unit*	*number of appointments*		
		morning	*afternoon*	*daily*
Wednesday 17-3-2010	1	86	42	128
	2	22	39	61
	3	43	56	99
	4	30	44	*74*
	6	62	6	68
	all units	243	187	430

date	*unit*	*number of appointments*		
		morning	*afternoon*	*daily*
Thursday 25-3-2010	1	44	59	103
	2	47	10	57
	3	81	23	104
	4	54	44	98
	6	50	20	70
	all units	276	156	432

date	*unit*	*number of appointments*		
		morning	*afternoon*	*daily*
Friday 19-3-2010	1	74	43	117
	2	81	83	164
	3	67	32	99
	4	44	28	72
	6	29	8	37
	all units	295	194	489

date	*unit*	*number of appointments*		
		morning	*afternoon*	*daily*
Thursday 1-4-2010	1	49	61	110
	2	28	9	37
	3	89	21	110
	4	46	34	80
	6	81	20	101
	all units	293	145	438

date	*unit*	*number of appointments*		
		morning	*afternoon*	*daily*
Monday 22-3-2010	1	59	41	100
	2	47	25	72
	3	61	18	79
	4	58	42	100
	6	84	32	116
	all units	309	158	467

date	*unit*	*number of appointments*		
		morning	*afternoon*	*daily*
Friday 2-4-2010	1	101	52	153
	2	72	79	151
	3	63	30	93
	4	65	27	92
	6	23	11	34
	all units	324	199	523

date	*unit*	*number of appointments*		
		morning	*afternoon*	*daily*
Tuesday 23-3-2010	1	78	41	119
	2	91	65	156
	3	82	53	135
	4	52	38	90
	6	31	16	47
	all units	334	213	547

date	*unit*	*number of appointments*		
		morning	*afternoon*	*daily*
Monday 12-4-2010	1	53	39	92
	2	58	40	98
	3	57	39	96
	4	30	36	66
	6	96	55	151
	all units	294	209	503

unit	*average number of appointments*		
	morning	*afternoon*	*daily*
1	70	49	118
2	54	45	99
3	67	40	107
4	47	35	82
6	53	19	72
all units	290	188	478

APPENDIX 4: RESULTS WORK-SAMPLING STUDY

The tables presented in this appendix provide an overview of the results of the work-sampling study. The numbers in the figure represent the sample mean time including a 95% confidence interval, and the mean percentage of total time spent on the different work-activities that make up the job of CHA at the CD.

The results presented are representative for the work activity of CHAs during the official opening hours of the CD. The CD at the NKI-AVL is open from Monday to Friday, between 8:30-12:30 and 13:30-16:30 hrs. This means that the results cover 420 minutes of work activity on a daily basis (240 min. during the morning and 180 min. during the afternoon). Since a normal working day for CHAs consist of 8 net working hours including coffee breaks (480 minutes), one hour of work activity per day is not accounted for by this study. In Section 2.3.2 it was explained why the measurement procedure was defined in such a way.

ALL UNITS

Results for the morning

Work activity profile consultation hour assistants

Unit number	all
Average number of employees*	19,7

Observations	**Number**	**%**
Used for profiling	2922	92,7%
Eliminated observations	191	6,1%
Missed observations	40	1,3%
Total planned observations	*3153*	*100,0%*

Workactivity *Mon-Fri: between 08:30-12:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	15,9%	14,6%	17,3%	38,3	35,1	41,5
Registering patients upon arrival	10,2%	9,1%	11,3%	24,6	21,9	27,2
Providing medical technical support	1,2%	0,8%	1,6%	2,8	1,9	3,7
Supporting visiting patients	2,1%	1,6%	2,6%	5,1	3,8	6,3
Making appointments	20,0%	18,5%	21,4%	47,9	44,4	51,4
Matching work activity with colleagues	5,5%	4,7%	6,4%	13,3	11,3	15,3
Accompanying patients on a stretcher	0,1%	0,0%	0,3%	0,3	0,0	0,7
Providing telephonic support	8,4%	7,4%	9,4%	20,2	17,8	22,6
Managing items in stock and cleaning	3,1%	2,5%	3,8%	7,6	6,0	9,1
Non-productive work time	25,7%	24,1%	27,3%	61,6	57,8	65,4
Other activities	7,7%	6,7%	8,6%	18,4	16,1	20,7
Total	*100,0%*			*240,0*		

Results for the afternoon

Work activity profile consultation hour assistants

Unit number	all
Average number of employees*	19,0

Observations	**Number**	**%**
Used for profiling	2188	95,9%
Eliminated observations	56	2,5%
Missed observations	38	1,7%
Total planned observations	*2282*	*100,0%*

Workactivity *Mon-Fri: between 13:30-16:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	19,9%	18,3%	21,6%	35,9	32,9	38,9
Registering patients upon arrival	6,5%	5,5%	7,6%	11,8	9,9	13,6
Providing medical technical support	2,0%	1,4%	2,5%	3,5	2,5	4,6
Supporting visiting patients	1,8%	1,2%	2,3%	3,2	2,2	4,2
Making appointments	17,5%	15,9%	19,0%	31,4	28,6	34,3
Matching work activity with colleagues	5,4%	4,4%	6,3%	9,7	8,0	11,4
Accompanying patients on a stretcher	0,4%	0,1%	0,6%	0,7	0,2	1,1
Providing telephonic support	8,7%	7,5%	9,9%	15,6	13,5	17,8
Managing items in stock and cleaning	5,8%	4,8%	6,8%	10,4	8,7	12,2
Non-productive work time	25,7%	23,9%	27,5%	46,2	42,9	49,5
Other activities	6,4%	5,4%	7,4%	11,5	9,7	13,4
Total	*100,0%*			*180,0*		

Results for the entire day

Work activity profile consultation hour assistants

Unit number	all
Average number of employees*	19,4

Observations	**Number**	**%**
Used for profiling	5110	94,0%
Eliminated observations	247	4,5%
Missed observations	78	1,4%
Total planned observations	*5435*	*100,0%*

Workactivity *Mon-Fri: between 08:30-12:30hr & 13:30-16:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	17,7%	16,6%	18,7%	74,1	69,7	78,5
Registering patients upon arrival	8,6%	7,9%	9,4%	36,3	33,1	39,6
Providing medical technical support	1,5%	1,2%	1,8%	6,3	4,9	7,7
Supporting visiting patients	2,0%	1,6%	2,4%	8,3	6,7	9,9
Making appointments	18,9%	17,8%	20,0%	79,3	74,8	83,8
Matching work activity with colleagues	5,5%	4,9%	6,1%	23,0	20,4	25,6
Accompanying patients on a stretcher	0,2%	0,1%	0,4%	1,0	0,4	1,5
Providing telephonic support	8,5%	7,8%	9,3%	35,8	32,6	39,1
Managing items in stock and cleaning	4,3%	3,7%	4,8%	18,0	15,7	20,3
Non-productive work time	25,7%	24,5%	26,9%	107,8	102,8	112,9
Other activities	7,1%	6,4%	7,8%	29,9	27,0	32,9
Total	*100,0%*			*420,0*		

UNIT 1

Results for the morning

Work activity profile consultation hour assistants

Unit number	1
Average number of employees*	4,9

Observations	**Number**	**%**
Used for profiling	733	93,7%
Eliminated observations	39	5,0%
Missed observations	10	1,3%
Total planned observations	*782*	*100,0%*

Workactivity *Mon-Fri: between 08:30-12:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	17,3%	14,6%	20,1%	41,6	35,0	48,2
Registering patients upon arrival	11,2%	8,9%	13,5%	26,8	21,4	32,3
Providing medical technical support	4,4%	2,9%	5,8%	10,5	6,9	14,0
Supporting visiting patients	1,9%	0,9%	2,9%	4,6	2,2	7,0
Making appointments	20,1%	17,2%	23,0%	48,1	41,2	55,1
Matching work activity with colleagues	4,4%	2,9%	5,8%	10,5	6,9	14,0
Accompanying patients on a stretcher	0,4%	-0,1%	0,9%	1,0	-0,1	2,1
Providing telephonic support	7,2%	5,4%	9,1%	17,4	12,9	21,9
Managing items in stock and cleaning	3,4%	2,1%	4,7%	8,2	5,0	11,3
Non-productive work time	22,4%	19,4%	25,4%	53,7	46,5	60,9
Other activities	7,4%	5,5%	9,3%	17,7	13,1	22,2
Total	*100,0%*			*240,0*		

Results for the afternoon

Work activity profile consultation hour assistants

Unit number	1
Average number of employees*	4,4

Observations	**Number**	**%**
Used for profiling	496	93,9%
Eliminated observations	24	4,5%
Missed observations	8	1,5%
Total planned observations	*528*	*100,0%*

Workactivity *Mon-Fri: between 13:30-16:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	22,4%	18,7%	26,0%	40,3	33,7	46,9
Registering patients upon arrival	7,5%	5,1%	9,8%	13,4	9,3	17,6
Providing medical technical support	7,9%	5,5%	10,2%	14,2	9,9	18,4
Supporting visiting patients	1,8%	0,6%	3,0%	3,3	1,2	5,4
Making appointments	17,1%	13,8%	20,5%	30,8	24,9	36,8
Matching work activity with colleagues	5,0%	3,1%	7,0%	9,1	5,6	12,5
Accompanying patients on a stretcher	0,2%	-0,2%	0,6%	0,4	-0,3	1,1
Providing telephonic support	6,3%	4,1%	8,4%	11,3	7,4	15,1
Managing items in stock and cleaning	5,6%	3,6%	7,7%	10,2	6,5	13,8
Non-productive work time	18,1%	14,8%	21,5%	32,7	26,6	38,8
Other activities	8,1%	5,7%	10,5%	14,5	10,2	18,8
Total	*100,0%*			*180,0*		

Results for the entire day

Work activity profile consultation hour assistants

Unit number	1
Average number of employees*	4,6

Observations	**Number**	**%**
Used for profiling	1229	93,8%
Eliminated observations	63	4,8%
Missed observations	18	1,4%
Total planned observations	*1310*	*100,0%*

Workactivity *Mon-Fri: between 08:30-12:30hr & 13:30-16:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	19,4%	17,2%	21,6%	81,3	72,1	90,6
Registering patients upon arrival	9,7%	8,0%	11,3%	40,7	33,7	47,6
Providing medical technical support	5,8%	4,5%	7,1%	24,3	18,8	29,7
Supporting visiting patients	1,9%	1,1%	2,6%	7,9	4,7	11,0
Making appointments	18,9%	16,7%	21,1%	79,3	70,1	88,5
Matching work activity with colleagues	4,6%	3,5%	5,8%	19,5	14,5	24,4
Accompanying patients on a stretcher	0,3%	0,0%	0,6%	1,4	0,0	2,7
Providing telephonic support	6,8%	5,4%	8,2%	28,7	22,8	34,6
Managing items in stock and cleaning	4,3%	3,2%	5,4%	18,1	13,3	22,9
Non-productive work time	20,7%	18,4%	22,9%	86,8	77,3	96,3
Other activities	7,6%	6,2%	9,1%	32,1	25,9	38,4
Total	*100,0%*			*420,0*		

UNIT 2

Results for the morning

Work activity profile consultation hour assistants

Unit number	2
Average number of employees*	3,5

Observations	**Number**	**%**
Used for profiling	523	92,4%
Eliminated observations	35	6,2%
Missed observations	8	1,4%
Total planned observations	*566*	*100,0%*

Workactivity *Mon-Fri: between 08:30-12:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	16,6%	13,4%	19,8%	39,9	32,3	47,6
Registering patients upon arrival	11,5%	8,7%	14,2%	27,5	21,0	34,1
Providing medical technical support	0,4%	-0,1%	0,9%	0,9	-0,4	2,2
Supporting visiting patients	2,5%	1,2%	3,8%	6,0	2,8	9,2
Making appointments	18,4%	15,0%	21,7%	44,1	36,1	52,0
Matching work activity with colleagues	6,9%	4,7%	9,1%	16,5	11,3	21,7
Accompanying patients on a stretcher	0,0%	0,0%	0,0%	0,0	0,0	0,0
Providing telephonic support	6,1%	4,1%	8,2%	14,7	9,8	19,6
Managing items in stock and cleaning	5,2%	3,3%	7,1%	12,4	7,8	16,9
Non-productive work time	23,1%	19,5%	26,7%	55,5	46,9	64,2
Other activities	9,4%	6,9%	11,9%	22,5	16,5	28,5
Total	*100,0%*			*240,0*		

Results for the afternoon

Work activity profile consultation hour assistants

Unit number	2
Average number of employees*	3,7

Observations	**Number**	**%**
Used for profiling	420	93,8%
Eliminated observations	18	4,0%
Missed observations	10	2,2%
Total planned observations	*448*	*100,0%*

Workactivity *Mon-Fri: between 13:30-16:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	19,5%	15,7%	23,3%	35,1	28,3	42,0
Registering patients upon arrival	6,9%	4,5%	9,3%	12,4	8,1	16,8
Providing medical technical support	0,0%	0,0%	0,0%	0,0	0,0	0,0
Supporting visiting patients	2,6%	1,1%	4,1%	4,7	2,0	7,5
Making appointments	18,6%	14,9%	22,3%	33,4	26,7	40,1
Matching work activity with colleagues	7,4%	4,9%	9,9%	13,3	8,8	17,8
Accompanying patients on a stretcher	0,0%	0,0%	0,0%	0,0	0,0	0,0
Providing telephonic support	10,2%	7,3%	13,1%	18,4	13,2	23,6
Managing items in stock and cleaning	8,1%	5,5%	10,7%	14,6	9,9	19,3
Non-productive work time	20,7%	16,8%	24,6%	37,3	30,3	44,3
Other activities	6,0%	3,7%	8,2%	10,7	6,6	14,8
Total	*100,0%*			*180,0*		

Results for the entire day

Work activity profile consultation hour assistants

Unit number	2
Average number of employees*	3,6

Observations	**Number**	**%**
Used for profiling	943	93,0%
Eliminated observations	53	5,2%
Missed observations	18	1,8%
Total planned observations	*1014*	*100,0%*

Workactivity *Mon-Fri: between 08:30-12:30hr & 13:30-16:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	17,9%	15,5%	20,4%	75,3	65,0	85,6
Registering patients upon arrival	9,4%	7,6%	11,3%	39,6	31,8	47,5
Providing medical technical support	0,2%	-0,1%	0,5%	0,9	-0,3	2,1
Supporting visiting patients	2,5%	1,5%	3,6%	10,7	6,5	14,9
Making appointments	18,5%	16,0%	20,9%	77,5	67,1	87,9
Matching work activity with colleagues	7,1%	5,5%	8,7%	29,8	23,0	36,7
Accompanying patients on a stretcher	0,0%	0,0%	0,0%	0,0	0,0	0,0
Providing telephonic support	8,0%	6,2%	9,7%	33,4	26,2	40,7
Managing items in stock and cleaning	6,5%	4,9%	8,0%	27,2	20,6	33,8
Non-productive work time	22,1%	19,4%	24,7%	92,6	81,5	103,8
Other activities	7,8%	6,1%	9,6%	33,0	25,7	40,2
Total	*100,0%*			*420,0*		

UNIT 3

Results for the morning

Work activity profile consultation hour assistants

Unit number	3
Average number of employees*	4,2

Observations	**Number**	**%**
Used for profiling	612	92,0%
Eliminated observations	43	6,5%
Missed observations	10	1,5%
Total planned observations	*665*	*100,0%*

Workactivity *Mon-Fri: between 08:30-12:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	12,9%	10,3%	15,6%	31,0	24,6	37,4
Registering patients upon arrival	8,8%	6,6%	11,1%	21,2	15,8	26,6
Providing medical technical support	0,0%	0,0%	0,0%	0,0	0,0	0,0
Supporting visiting patients	2,1%	1,0%	3,3%	5,1	2,4	7,8
Making appointments	21,1%	17,8%	24,3%	50,6	42,8	58,3
Matching work activity with colleagues	4,7%	3,1%	6,4%	11,4	7,3	15,4
Accompanying patients on a stretcher	0,2%	-0,2%	0,5%	0,4	-0,4	1,2
Providing telephonic support	11,4%	8,9%	14,0%	27,5	21,4	33,5
Managing items in stock and cleaning	1,1%	0,3%	2,0%	2,7	0,7	4,8
Non-productive work time	32,5%	28,8%	36,2%	78,0	69,1	86,9
Other activities	5,1%	3,3%	6,8%	12,2	8,0	16,3
Total	*100,0%*			*240,0*		

Results for the afternoon

Work activity profile consultation hour assistants

Unit number	3
Average number of employees*	4,1

Observations	**Number**	**%**
Used for profiling	482	97,2%
Eliminated observations	4	0,8%
Missed observations	10	2,0%
Total planned observations	*496*	*100,0%*

Workactivity *Mon-Fri: between 13:30-16:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	16,4%	13,1%	19,7%	29,5	23,6	35,5
Registering patients upon arrival	6,2%	4,1%	8,4%	11,2	7,3	15,1
Providing medical technical support	0,4%	-0,2%	1,0%	0,7	-0,3	1,8
Supporting visiting patients	1,0%	0,1%	1,9%	1,9	0,2	3,5
Making appointments	19,5%	16,0%	23,0%	35,1	28,7	41,5
Matching work activity with colleagues	4,8%	2,9%	6,7%	8,6	5,2	12,0
Accompanying patients on a stretcher	0,6%	-0,1%	1,3%	1,1	-0,1	2,4
Providing telephonic support	9,1%	6,6%	11,7%	16,4	11,8	21,1
Managing items in stock and cleaning	4,1%	2,4%	5,9%	7,5	4,3	10,7
Non-productive work time	31,7%	27,6%	35,9%	57,1	49,7	64,6
Other activities	6,0%	3,9%	8,1%	10,8	7,0	14,7
Total	*100,0%*			*180,0*		

Results for the entire day

Work activity profile consultation hour assistants

Unit number	3
Average number of employees*	4,1

Observations	**Number**	**%**
Used for profiling	1094	94,2%
Eliminated observations	47	4,0%
Missed observations	20	1,7%
Total planned observations	*1161*	*100,0%*

Workactivity *Mon-Fri: between 08:30-12:30hr & 13:30-16:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	14,4%	12,4%	16,5%	60,7	51,9	69,4
Registering patients upon arrival	7,7%	6,1%	9,3%	32,2	25,6	38,9
Providing medical technical support	0,2%	-0,1%	0,4%	0,8	-0,3	1,8
Supporting visiting patients	1,6%	0,9%	2,4%	6,9	3,7	10,1
Making appointments	20,4%	18,0%	22,8%	85,6	75,6	95,6
Matching work activity with colleagues	4,8%	3,5%	6,0%	20,0	14,7	25,3
Accompanying patients on a stretcher	0,4%	0,0%	0,7%	1,5	0,0	3,0
Providing telephonic support	10,4%	8,6%	12,2%	43,8	36,2	51,4
Managing items in stock and cleaning	2,5%	1,5%	3,4%	10,4	6,5	14,2
Non-productive work time	32,2%	29,4%	34,9%	135,1	123,5	146,8
Other activities	5,5%	4,1%	6,8%	23,0	17,4	28,7
Total	*100,0%*			*420,0*		

UNIT 4

Results for the morning

Work activity profile consultation hour assistants

Unit number	4
Average number of employees*	3,4

Observations	**Number**	**%**
Used for profiling	508	92,7%
Eliminated observations	34	6,2%
Missed observations	6	1,1%
Total planned observations	*548*	*100,0%*

Workactivity *Mon-Fri: between 08:30-12:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	21,3%	17,7%	24,8%	51,0	42,5	59,6
Registering patients upon arrival	10,6%	7,9%	13,3%	25,5	19,1	31,9
Providing medical technical support	0,0%	0,0%	0,0%	0,0	0,0	0,0
Supporting visiting patients	1,8%	0,6%	2,9%	4,3	1,5	7,0
Making appointments	17,9%	14,6%	21,2%	43,0	35,0	51,0
Matching work activity with colleagues	3,9%	2,2%	5,6%	9,4	5,4	13,5
Accompanying patients on a stretcher	0,0%	0,0%	0,0%	0,0	0,0	0,0
Providing telephonic support	8,1%	5,7%	10,4%	19,4	13,7	25,1
Managing items in stock and cleaning	2,8%	1,3%	4,2%	6,6	3,2	10,0
Non-productive work time	24,8%	21,0%	28,6%	59,5	50,5	68,5
Other activities	8,9%	6,4%	11,3%	21,3	15,3	27,2
Total	*100,0%*			*240,0*		

Results for the afternoon

Work activity profile consultation hour assistants

Unit number	4
Average number of employees*	3,6

Observations	**Number**	**%**
Used for profiling	421	97,5%
Eliminated observations	5	1,2%
Missed observations	6	1,4%
Total planned observations	*432*	*100,0%*

Workactivity *Mon-Fri: between 13:30-16:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	20,0%	16,1%	23,8%	35,9	29,0	42,8
Registering patients upon arrival	6,7%	4,3%	9,0%	12,0	7,7	16,3
Providing medical technical support	0,2%	-0,2%	0,7%	0,4	-0,4	1,3
Supporting visiting patients	1,2%	0,2%	2,2%	2,1	0,3	4,0
Making appointments	17,3%	13,7%	21,0%	31,2	24,7	37,7
Matching work activity with colleagues	3,6%	1,8%	5,3%	6,4	3,2	9,6
Accompanying patients on a stretcher	1,0%	0,0%	1,9%	1,7	0,0	3,4
Providing telephonic support	8,6%	5,9%	11,2%	15,4	10,6	20,2
Managing items in stock and cleaning	3,1%	1,4%	4,7%	5,6	2,6	8,5
Non-productive work time	30,9%	26,5%	35,3%	55,6	47,6	63,5
Other activities	7,6%	5,1%	10,1%	13,7	9,1	18,2
Total	*100,0%*			*180,0*		

Results for the entire day

Work activity profile consultation hour assistants

Unit number	4
Average number of employees*	3,5

Observations	**Number**	**%**
Used for profiling	929	94,8%
Eliminated observations	39	4,0%
Missed observations	12	1,2%
Total planned observations	*980*	*100,0%*

Workactivity *Mon-Fri: between 08:30-12:30hr & 13:30-16:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	20,7%	18,1%	23,3%	86,8	75,9	97,7
Registering patients upon arrival	8,8%	7,0%	10,7%	37,1	29,4	44,7
Providing medical technical support	0,1%	-0,1%	0,3%	0,5	-0,4	1,3
Supporting visiting patients	1,5%	0,7%	2,3%	6,3	3,0	9,6
Making appointments	17,7%	15,2%	20,1%	74,1	63,8	84,4
Matching work activity with colleagues	3,8%	2,5%	5,0%	15,8	10,7	21,0
Accompanying patients on a stretcher	0,4%	0,0%	0,9%	1,8	0,0	3,6
Providing telephonic support	8,3%	6,5%	10,1%	34,8	27,4	42,3
Managing items in stock and cleaning	2,9%	1,8%	4,0%	12,2	7,7	16,7
Non-productive work time	27,6%	24,7%	30,4%	115,7	103,7	127,8
Other activities	8,3%	6,5%	10,1%	34,8	27,4	42,3
Total	*100,0%*			*420,0*		

UNIT 6

Results for the morning

Work activity profile consultation hour assistants

Unit number	6
Average number of employees*	3,7

Observations	**Number**	**%**
Used for profiling	546	92,2%
Eliminated observations	40	6,8%
Missed observations	6	1,0%
Total planned observations	*592*	*100,0%*

Workactivity *Mon-Fri: between 08:30-12:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	11,9%	9,2%	14,6%	28,6	22,1	35,1
Registering patients upon arrival	9,0%	6,6%	11,4%	21,5	15,8	27,3
Providing medical technical support	0,0%	0,0%	0,0%	0,0	0,0	0,0
Supporting visiting patients	2,4%	1,1%	3,7%	5,7	2,6	8,8
Making appointments	22,0%	18,5%	25,5%	52,7	44,4	61,1
Matching work activity with colleagues	8,2%	5,9%	10,5%	19,8	14,2	25,3
Accompanying patients on a stretcher	0,0%	0,0%	0,0%	0,0	0,0	0,0
Providing telephonic support	9,2%	6,7%	11,6%	22,0	16,2	27,8
Managing items in stock and cleaning	3,5%	1,9%	5,0%	8,4	4,7	12,0
Non-productive work time	25,6%	22,0%	29,3%	61,5	52,7	70,3
Other activities	8,2%	5,9%	10,5%	19,8	14,2	25,3
Total	*100,0%*			*240,0*		

Results for the afternoon

Work activity profile consultation hour assistants

Unit number	6
Average number of employees*	3,2

Observations	**Number**	**%**
Used for profiling	369	97,6%
Eliminated observations	5	1,3%
Missed observations	4	1,1%
Total planned observations	*378*	*100,0%*

Workactivity *Mon-Fri: between 13:30-16:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	21,7%	17,5%	25,9%	39,0	31,5	46,6
Registering patients upon arrival	5,1%	2,9%	7,4%	9,3	5,2	13,3
Providing medical technical support	0,3%	-0,3%	0,8%	0,5	-0,5	1,4
Supporting visiting patients	2,4%	0,9%	4,0%	4,4	1,6	7,2
Making appointments	14,1%	10,5%	17,6%	25,4	19,0	31,8
Matching work activity with colleagues	6,5%	4,0%	9,0%	11,7	7,2	16,2
Accompanying patients on a stretcher	0,0%	0,0%	0,0%	0,0	0,0	0,0
Providing telephonic support	9,8%	6,7%	12,8%	17,6	12,1	23,0
Managing items in stock and cleaning	8,7%	5,8%	11,5%	15,6	10,4	20,8
Non-productive work time	27,6%	23,1%	32,2%	49,8	41,5	58,0
Other activities	3,8%	1,8%	5,7%	6,8	3,3	10,3
Total	*100,0%*			*180,0*		

Results for the entire day

Work activity profile consultation hour assistants

Unit number	6
Average number of employees*	3,4

Observations	**Number**	**%**
Used for profiling	915	94,3%
Eliminated observations	45	4,6%
Missed observations	10	1,0%
Total planned observations	*970*	*100,0%*

Workactivity *Mon-Fri: between 08:30-12:30hr & 13:30-16:30hr*	**%**	**95% Confidence interval** *left limit*	 *right limit*	**in minutes**	**95% Confidence interval** *left limit*	 *right limit*
Taking care of the availability of patient records	15,8%	13,5%	18,2%	66,6	56,6	76,5
Registering patients upon arrival	7,4%	5,7%	9,1%	31,2	24,1	38,4
Providing medical technical support	0,1%	-0,1%	0,3%	0,5	-0,4	1,4
Supporting visiting patients	2,4%	1,4%	3,4%	10,1	5,9	14,3
Making appointments	18,8%	16,3%	21,3%	79,0	68,3	89,6
Matching work activity with colleagues	7,5%	5,8%	9,3%	31,7	24,5	38,9
Accompanying patients on a stretcher	0,0%	0,0%	0,0%	0,0	0,0	0,0
Providing telephonic support	9,4%	7,5%	11,3%	39,5	31,5	47,4
Managing items in stock and cleaning	5,6%	4,1%	7,1%	23,4	17,2	29,7
Non-productive work time	26,4%	23,6%	29,3%	111,1	99,1	123,1
Other activities	6,4%	4,9%	8,0%	27,1	20,4	33,8
Total	*100,0%*			*420,0*		

APPENDIX 5: HISTORICAL DATA OF APPOINTMENT NUMBERS AT THE CD

The tables presented in this appendix provide an overview of the number of appointments at the CD of the NKI-AVL during March, April, May and June 2010. The content is derived from CS-EZIS (Chipsoft electronic Care Information System) at 3 August 2010.

date	*day*	*number of appointments*		
		morning	*afternoon*	*daily*
1-3-2010	Monday	274	162	436
2-3-2010	Tuesday	324	248	572
3-3-2010	Wednesday	200	163	363
4-3-2010	Thursday	209	169	378
5-3-2010	Friday	255	162	417
6-3-2010	Saturday			
7-3-2010	Sunday			
8-3-2010	Monday	303	213	516
9-3-2010	Tuesday	279	224	503
10-3-2010	Wednesday	237	179	416
11-3-2010	Thursday	277	163	440
12-3-2010	Friday	281	174	455
13-3-2010	Saturday			
14-3-2010	Sunday			
15-3-2010	Monday	303	180	483
16-3-2010	Tuesday	337	232	569
17-3-2010	Wednesday	243	187	430
18-3-2010	Thursday	231	145	376
19-3-2010	Friday	295	194	489
20-3-2010	Saturday			
21-3-2010	Sunday			
22-3-2010	Monday	309	158	467
23-3-2010	Tuesday	334	213	547
24-3-2010	Wednesday	196	185	381
25-3-2010	Thursday	276	156	432
26-3-2010	Friday	305	178	483
27-3-2010	Saturday			
28-3-2010	Sunday			
29-3-2010	Monday	280	176	456
30-3-2010	Tuesday	279	230	509
31-3-2010	Wednesday	269	161	430
	average	*274*	*185*	*459*

date	*day*	*number of appointments*		
		morning	*afternoon*	*daily*
1-4-2010	Thursday	293	145	438
2-4-2010	Friday	324	199	523
3-4-2010	Saturday			
4-4-2010	Sunday			
5-4-2010	Monday	Easter Monday		
6-4-2010	Tuesday	331	279	610
7-4-2010	Wednesday	243	176	419
8-4-2010	Thursday	299	157	456
9-4-2010	Friday	262	161	423
10-4-2010	Saturday			
11-4-2010	Sunday			
12-4-2010	Monday	294	209	503
13-4-2010	Tuesday	331	215	546
14-4-2010	Wednesday	237	134	371
15-4-2010	Thursday	296	164	460
16-4-2010	Friday	262	158	420
17-4-2010	Saturday			
18-4-2010	Sunday			
19-4-2010	Monday	306	187	493
20-4-2010	Tuesday	343	243	586
21-4-2010	Wednesday	248	187	435
22-4-2010	Thursday	311	181	492
23-4-2010	Friday	218	131	349
24-4-2010	Saturday			
25-4-2010	Sunday			
26-4-2010	Monday	277	202	479
27-4-2010	Tuesday	322	198	520
28-4-2010	Wednesday	227	172	399
29-4-2010	Thursday	294	164	458
30-4-2010	Friday	Queen's Day		
	average	*286*	*183*	*469*

date	day	number of appointments		
		morning	afternoon	daily
1-5-2010	Saturday			
2-5-2010	Sunday			
3-5-2010	Monday	235	161	396
4-5-2010	Tuesday	256	242	498
5-5-2010	Wednesday	Liberation Day		
6-5-2010	Thursday	231	146	377
7-5-2010	Friday	264	176	440
8-5-2010	Saturday			
9-5-2010	Sunday			
10-5-2010	Monday	285	188	473
11-5-2010	Tuesday	291	194	485
12-5-2010	Wednesday	225	196	421
13-5-2010	Thursday	Ascension Day		
14-5-2010	Friday	266	158	424
15-5-2010	Saturday			
16-5-2010	Sunday			
17-5-2010	Monday	335	207	542
18-5-2010	Tuesday	326	262	588
19-5-2010	Wednesday	234	189	423
20-5-2010	Thursday	269	150	419
21-5-2010	Friday	286	134	420
22-5-2010	Saturday			
23-5-2010	Sunday			
24-5-2010	Monday	Whit Monday		
25-5-2010	Tuesday	374	205	579
26-5-2010	Wednesday	228	174	402
27-5-2010	Thursday	331	183	514
28-5-2010	Friday	276	191	467
29-5-2010	Saturday			
30-5-2010	Sunday			
31-5-2010	Monday	320	190	510
	average	*280*	*186*	*465*

date	day	number of appointments		
		morning	afternoon	daily
1-6-2010	Tuesday	372	260	632
2-6-2010	Wednesday	269	157	426
3-6-2010	Thursday	207	87	294
4-6-2010	Friday	249	143	392
5-6-2010	Saturday			
6-6-2010	Sunday			
7-6-2010	Monday	296	120	416
8-6-2010	Tuesday	341	191	532
9-6-2010	Wednesday	223	137	360
10-6-2010	Thursday	295	136	431
11-6-2010	Friday	296	176	472
12-6-2010	Saturday			
13-6-2010	Sunday			
14-6-2010	Monday	305	190	495
15-6-2010	Tuesday	316	240	556
16-6-2010	Wednesday	256	160	416
17-6-2010	Thursday	251	104	355
18-6-2010	Friday	290	99	389
19-6-2010	Saturday			
20-6-2010	Sunday			
21-6-2010	Monday	258	214	472
22-6-2010	Tuesday	320	225	545
23-6-2010	Wednesday	184	166	350
24-6-2010	Thursday	248	159	407
25-6-2010	Friday	221	160	381
26-6-2010	Saturday			
27-6-2010	Sunday			
28-6-2010	Monday	227	174	401
29-6-2010	Tuesday	346	229	575
30-6-2010	Wednesday	204	150	354
	average	*272*	*167*	*439*

month	average number of appointments		
	morning	afternoon	daily
March '10	274	185	459
April '10	286	183	469
May '10	280	186	465
June '10	272	167	439
total	278	180	458

APPENDIX 6: BUSINESS CASE

DELIVERING SUPPORT TO MEDICAL SPECIALIST DURING THE PRE-OPERATIVE SCREENING

Patients requiring surgery have to be seen by an anaesthesiologist at the CD prior to their hospitalization. This planned consultation is called the preoperative screening (POS). During the POS the anaesthesiologist will take notice of the physical condition of the patient, relevant details and risks of surgery. The anaesthesiologist will also make decisions about the content of the anaesthesia care plan and will inform the patient about it.

In the current situation, CHAs are responsible for making appointments with patients for the POS and anaesthesiologist are responsible for the tasks included in the screening. Due to work pressure and capacity shortages, anaesthesiologists are willing to receive more support from CHAs during the pre-operative screening. This chapter creates insight in the current process design (1) and explores the possibilities for support by CHAs during the POS including expected gains (2). Next, the preferred improvement scenario is introduced and a more detailed description of the expected gains is provided (3). Finally, boundary conditions under which preferred process changes can be implemented will be discussed (4).

1 CURRENT PROCESS DESIGN

1.1 ROUTINES AT THE POS

When a patient at the CD is diagnosed to undergo surgery, a CHA at the corresponding unit has the task to immediately plan an appointment for the POS at Unit 4. This appointment is made in the agenda module of CS-EZIS. The patient is planned on the first available slot that is suitable for him/her. Finally, the patient is provided with a questionnaire, which they have to fill-in at home. The questionnaire contains questions about:

- Height and weight
- Physical fitness
- Previous surgery and applied anaesthetics
- Physical complaints for which treatment is/was given or medication is provided
- Chronic infections
- Current/previous treatments with cytostatics
- Current/previous treatments with radiation
- Allergies
- Smoking and/or drugs habits
- Consumption of alcohol
- Use of medication
- Dental health
- Nausea

At the day of their appointment, patients announce themselves at the front desk of Unit 4 and their presence is registered by a CHA. The CHAs already arranged the availability of the patient's record at this stage. The patient takes place in the waiting room until an anaesthesiologist will collect him/her. The anaesthesiologist is provided with the medical record and he/she often will take a couple of minutes to work his/her way through the medical history of the patient before the patient is collected for the screening.

At the start of the screening, the patient is asked to deliver the completed questionnaire and the next step is to enter the answers to the questions in Metavision, an anaesthesia information management system in use by the anaesthesiologists at the NKI. Together with the data available in the patient's record, this should provide the anaesthesiologist with the necessary information for anamnesis.

Next, the anaesthesiologist will perform a physical examination of the patient, which includes:

- Measuring blood pressure
- Measuring height and weight (only if unknown)
- Listening to the patient's heart and lungs
- Inspecting mouth and throat to predict the difficulty of tracheal intubation

The obtained information is added to the earlier entered data in Metavision. Based on the information gathered at this stage, the anaesthesiologist decides if the patient is approved for surgery. If so, the content of the anaesthesia care plan is determined, recorded in Metavision and discussed with the patient. When the patient is provided with all the necessary information, the preoperative screening is finished and the patient will leave the consultation room. If desirable, an anaesthesiologist will request additional examinations to acquire some extra information about the patient's medical condition. These examinations will take place after the screening has finished and can include:

- An ECG
- An X-ray of the lungs
- A measurement of the lung function
- An exercise test
- A blood test

Exceptions to the routine

In some cases (±10%), patients have to be seen by an anaesthesiologist at the current day because their surgery is planned on a short notice. Since these patients are not scheduled for a preoperative screening, they are referred to the front desk of Unit 4. A CHA will ask the anaesthesiologist on duty (when he/she leaves the room after a consult has finished) if it is possible/allowed to schedule the unplanned patient.

During the morning, two slots are always blocked for this kind of patients. If the anaesthesiologist gives approval, the Planning Department is contacted to schedule the patient on one of the two blocked slots during the morning. In case the agenda is full, the anaesthesiologist is asked if an overbooking for this patient is allowed.

1.2 PROCESS DURATION

Each screening will averagely take 20 minutes per patient, which is confirmed by the anaesthesiologists and by observations from the researcher. This coincides with the length of the available slots in the planning of the POS.

1.3 STAFF AND ROOM CAPACITY

The NKI currently employs 9 anaesthesiologists who together take responsibility for the preoperative screenings at the Consultation Department (CD). During the mornings there is one room available for the POS at Unit 4, and during the afternoon there are two dedicated rooms. The extra room in the afternoon will only be staffed by a second anaesthesiologist if necessary, otherwise this room remains empty. From the perspective of efficient use of room capacity this way of working is considered to be questionable.

1.4 PRODUCTION CAPACITY

Preoperative screenings take place from Monday to Friday, during the morning (08:30-12:30 hr) and afternoon (13:30-16:30 hr). Considering the use of one room per shift and a screening duration of 20 minutes, 3 screenings can be done per hour. This means that during the morning, the maximum capacity equals 12 (=4 hours * 3 consults) and during the afternoon the maximum capacity equals 9 screenings (=3 hours * 3 consults).

In reality, anaesthesiologists restrict the available capacity to the numbers presented in Table 1. As we can see, the maximum capacity in the morning still equals 12 screenings. In the afternoon the maximum capacity is 15 instead of 9 screenings, except on Mondays (12). This means that when more than 9 patients are attending the

POS in the afternoon, an extra anaesthesiologist is asked to join his colleague at the CD. He/she will make use of the second room available to the POS.

Day of the week	Capacity during the Morning (08:30-12:30 hrs)	Capacity during the Afternoon (13:30-16:30 hrs)
Monday	12	12
Tuesday	12	15
Wednesday	12	15
Thursday	12	15
Friday	12	15

Table 1: Available capacity preoperative screening (POS)

1.5 CURRENT PERFORMANCE

In the current situation an average of 18 screenings are done on a daily basis (Table 2). Based on a capacity of 27 POS consults per day (Table 1), the current utilization is therefore 67%.

Descriptive statistics	Consults
Mean	17,7
Standard deviation	4,7
Minimum	10
Maximum	27

Table 2: Descriptive statistics of the number of POS consults
(source: CS-EZIS production data, 25 May 2010 until 21 June 2010, n=354)

2 POSSIBLE INTERVENTIONS AND EXPECTED GAINS

In the current situation, anaesthesiologists perform all of the activities and task included in the preoperative screening. It lies in their interest to explore the possibilities to shift tasks to CHAs in order to reduce work pressure and to deal with existing capacity shortages under anaesthesiologists. From the management point of view it is interesting to explore the possibilities to save valuable time of anaesthesiologist and to reinvest that time in an efficient way. If this can be managed by introducing more support from CHAs (which in turn reduces their non-productive working time), a win-win situation is created.

Table 3 provides an overview of the activities and tasks that are performed during the POS, and indicates which activities and tasks could be exchanged between anaesthesiologists and CHAs. The content of the table is defined in consultation with the anaesthesiologists. Walking along with an anaesthesiologist for a considerable amount of time increased the understanding of activities by the researcher.

Tasks performed by an anaesthesiologist	Could be performed by a CHA
Create patient profile in Metavision	X
Insert patient data from questionnaire in Metavision	X
Review medical history	
Measure patient's height and weight (if unknown)	X
Measure blood pressure	X
Listen to patient's heart and lungs	
Inspect patient's mouth and throat for tracheal intubation	
Insert additional patient data in Metavision	
Request additional medical examination(s) if necessary)	
Approve patient for surgery	
Define content anaesthesia care plan	
Inform patient about anaesthesia care plan and pre-surgery requirements	

Table 3: Activities and tasks that could be exchanged between anaesthesiologists and CHAs

In the remainder of this section, the 4 identified activities/tasks that could be exchanged between anaesthesiologists and CHAs will be discussed in more detail including expected gains.

1. Create patient profile in Metavision

For every new patient visiting the POS a profile has to be created in Metavision. The barcode, which is available on a sticker on the patient record, is scanned to create a new case and a few personal details need to be entered into the system (name, sex, date of birth, etc.). The anaesthesiologists estimate that this could save them 1 minute per consult. When patients have undergone surgery in the NKI-AVL before, data from an already existing profile in Metavision can be imported into the new case. While scanning the barcode it will become clear if a patient profile is already present in Metavision.

So shifting the task of creating a patient profile in Metavision from anaesthesiologists to CHAs solely will create minor efficiency gains since we know that the total screening time of 20 minutes will only be reduced with 1 minute (5%).

2. Insert patient data from questionnaire in Metavision

In the current situation, patient data from the questionnaire is entered into Metavision by an anaesthesiologist during the POS-consult in the presence of the patient. The reason why it is done in such a way is based on a decision made in the past: patients should be requested to bring the filled-in questionnaire with them to the preoperative screening. Purely looking at the nature of the task, entering patient data into Metavision is a typical back-office activity. It involves only administrative work and the presence of the patient is not required.

As indicated by the anaesthesiologists most gains from support by CHAs can be expected from CHAs when they enter the patient data from the questionnaire into Metavision. The anaesthesiologists estimate that this could save them at least 5 minutes per consult, which equals 25% of the total screening time. This gain could be used to perform an extra screening per hour; instead of 20 minutes per appointment an anaesthesiologist will require only 15 minutes. The work performed by CHAs should take 5-10 minutes, depending on their working speed and skill level.

It is important to address that patient data from the questionnaire can only be entered into Metavision by CHAs if a patient profile is already available in the anaesthesia information management system. Therefore, it is interesting to combine the creation of a patient profile in Metavision with the entry of the patient data from the questionnaire when shifting tasks from anaesthesiologists to CHAs.

3. Measure patient's height and weight

Patients are asked in the questionnaire for their height and weight. From conversations with anaesthesiologist and observation at the POS, it became clear that it is more exception than rule that during the POS the height and weight of patients have to be determined. In most cases, the patients themselves neatly provide this information. Next to this, the current situation at the CD does not provide the CHAs with space and equipment in order to weigh patients and to determine their length. We conclude that the gains in providing this kind of support to anaesthesiologists by CHAs are minimal. Investments in resources for providing this kind of support do not provide value for money if they are hardly utilized.

4. Measure blood pressure

During each preoperative screening, the blood pressure of a patient is measured. This averagely takes 1 minute and is combined with listening to the patient's heart and lungs, and the inspection of the patient's mouth and throat for tracheal intubation. Anaesthesiologists estimate that when this task is transferred to CHAs, this would save them 1 minute per consult. This number is confirmed by observations from the researcher. For measuring blood pressure, space and equipment should also become available to CHAs when they perform the task instead of anaesthesiologists. We conclude that investments in these resources cannot be justified by the gains expected from shifting the task. This is still the case when measuring blood pressure is combined with measuring a patient's height and weight.

3 IMPROVEMENT SCENARIO

From the previous section we conclude that most efficiency gains are expected from shifting the following two tasks from anaesthesiologists to CHAs:

- Creating new patient profiles in Metavision;
- And subsequently entering the patient data from the questionnaires in Metavision

These activities also conflict with the competence profile of anaesthesiologists, since only administrative work is involved that could also be performed by supportive personnel. CHAs seem to perfectly fit the job. The results from the work-sampling study (Section 3.4.2) showed that in the current situation CHAs are confronted with a considerable amount of non-productive working time due to an irregular supply of work. This time can be used to deliver more support to medical specialists, in this case to anaesthesiologists during the POS.

PREFERRED IMPROVEMENT SCENARIO

The advised improvement scenario to accomplish the changes, as mentioned previously, is defined as follows:

The current paper questionnaire is replaced by an electronic form available at the website of the NKI-AVL. When an appointment is made for the POS, the patient is requested to fill-in the form at the website. Alternatively, a paper version of the questionnaire can be provided to the patient with an (franked) envelope. Patients should be advised to return the information via the hospital's website (or by post) as soon as possible, but one week prior to the POS-appointment at the latest. The results to the questionnaire are made available to Unit 4. The responsible CHA at this unit will create a profile for every scheduled patient in Metavision (if not present) and add the answers of the questionnaire in the patient's profile. The planning overview is used to mark the patients that returned their questionnaire and of which the data entry in Metavision is completed. In this way an anaesthesiologist can immediately access a patients' profile in Metavision at the start of a new preoperative screening, and perform the required anamnesis and physical examination to approve a patient for surgery.

EXPECTED GAINS

When the preferred improvement scenario is implemented, an increase of POS-capacity and a reduction of non-productive working time of CHAs are expected.

Increase of POS capacity

The gain of 5 minutes per consult will result in the possibility to perform an extra screening per hour; instead of 20 minutes per appointment an anaesthesiologist will require only 15 minutes. The maximum capacity during the morning increases from 12 to 16 consultations (=4 hours * 4 consults). During the afternoon the maximum capacity will equal 12 consultations (=3 hours * 4 consults), instead of 9. These numbers are based on the occupation of one consultation room by one anaesthesiologist.

During the afternoon an extra room is available to the POS and the maximum capacity is currently restricted to a total of 15 consultations. When the improvement scenario is implemented, 20 consultations will become the new maximum capacity during the afternoon.

So the total daily capacity for the POS increases with 33%. Since the current capacity is not fully utilized at the POS (averagely 67%), we strongly advise to take a critical look at the planning of consults when the preferred improvement scenario is introduced. This to prevent the CD for an increased underutilization of dedicated consultation rooms.

Reduction of non-productive working time of CHAs

The work involved for CHAs can be performed next to the current activities that make up the job of CHA. Since no direct patient contact is involved, the tasks can be done at any time and therefore they do not conflict with the activities that require immediate attention when they present themselves at the unit desk (like making appointments with patients).

The expected time involved in performing the new tasks by CHAs at Unit 4 is 180 minutes on a daily basis. This number is based on the average daily number of POS-consults done between 25-05-2010 and 21-06-2010 (=18) and the estimated amount of time involved in processing one questionnaire (=10 minutes).

4 IMPLEMENTATION

For the implementation of the preferred scenario, as described in the previous section, some conditions have to be satisfied. These conditions will be clarified within this section.

ANALYSE CURRENT QUESTIONNAIRE

It is worth the effort to carefully analyse the current questions asked to patients within the questionnaire. Most of the questions are (partially) open ended, which gives patients the opportunity to provide a lot of information and which can result in interpretation problems at the side of CHAs during the entry of the data in Metavision. Instead of (partially) open-ended questions, multiple-choice questions can be used to reduce the variety in answers. Since an online questionnaire has the opportunity to incorporate extensive lists with answer possibilities (which is much more difficult to include in a paper version), a more detailed questionnaire can increase quality and reduce changes of making data entry mistakes. The anaesthesiologists should perform the analyses of the current questionnaire.

DEVELOP ONLINE QUESTIONNAIRE

An online questionnaire should be developed and made accessible to patients who are provided with an appointment at the POS. Since this questionnaire will contain personal details about a patient's health condition, the privacy of the online transfer of data should be guaranteed. If problems will arise concerning the development of an online questionnaire that are too difficult to overcome and/or the development is expected to be too costly, the alternative for an online questionnaire is a paper version that could be returned to the hospital by postal services. A paper version should in all cases be available to patients that do not have the opportunity to make use of the Internet.

Local research on the Internet showed that an online version of a POS questionnaire is already available at the University Medical Centre of Utrecht[3]. Therefore, their experience and knowledge could be requested by the development of an online questionnaire if necessary.

ARRANGE ACCESS TO METAVISION AT THE DESK OF UNIT 4

In the current situation Metavision can be accessed inside every consultation room at Unit 4. Metavision is currently not available at the computers located at the workplace of CHAs. We advise that at least two computers at the desk of Unit 4 are provided with access to Metavision and a barcode scanner.

CREATE DATA ENTRY FORM IN METAVISION

A data entry form needs to be created inside Metavision for entering the answers to the questions from the questionnaire. The layout of this data entry form should be similar to the layout of the questionnaire to reduce the chance of making input mistakes. Peter Schutte is the anaesthesiologist that is able to change the layout of Metavision.

PROVIDE TRAINING TO CHAS AT UNIT 4

We advise the staff of the CD to create a worker pool with CHAs that will support the anaesthesiologists during the POS. This worker pool should include buffer capacity to overcome sick leave and holidays. Each working day one CHA should be scheduled to deliver the requested support.

3 The POS questionnaire at the UMC Utrecht can be accessed via:
http://www.umcutrecht.nl/zorg/patienten/poliklinieken/P/preoperatievescreening/hetbezoekaandearts.htm

The CHAs included in the worker pool have to learn how to:

- Enter new patients into Metavision
- Import already existing data into Metavision from previous surgery
- Enter answers to the questions from the questionnaire into Metavision

This training should be provided by one of the anaesthesiologists. This person should also be available during the implementation to answer questions that arise at the side of the CHAs.

MAKE LIST OF DESIRABLE NOTATIONS IN METAVISION

It is important to assure that the available medical knowledge under CHAs is of such a level that clinical pictures and medications are entered properly into Metavision. In order to stimulate this, we advise the anaesthesiologists to create an extensive list with examples in order to stimulate standardized notation under CHAs. This list should be available to the CHAs before the tasks are transferred.

PERFORM A PILOT TEST

Pilot testing may prevent costly mistakes. We advise the staff of the CD and the anaesthesiologists to provide the trained CHAs with a couple of filled-in questionnaires, which they have to enter into Metavision. The CHAs should be provided with feedback in order to create awareness about possible pitfalls.

REDUCE SLOT LENGTH OF APPOINTMENTS AFTER IMPLEMENTATION

When the changes are implemented, the length of the appointment slot for the preoperative screening should be decreased from 20 minutes to 15 minutes. In this way the efficiency gains created by the extra support of CHAs during the POS can be used to increase capacity. If the slot length remains 20 minutes, created gains are expected to vanish.