



Improving elective OR planning at general ORs of Medisch Spectrum Twente

-Appendix-

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Appendix A. Process description planning process

A.1 Operational offline resource capacity planning

Appendix A describes how the first stage of the operational offline resource capacity planning differs between specialties. Although the steps patients take through the process shows similarities among specialties, the administrative steps in resource capacity planning show large differences.

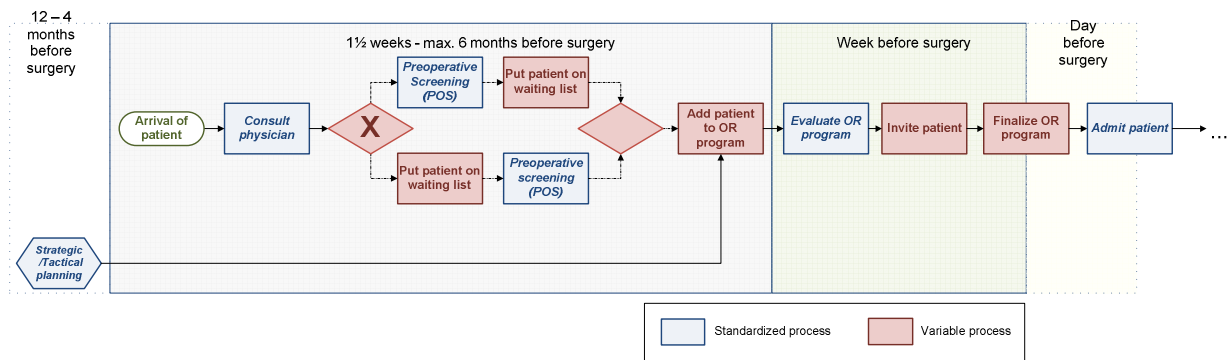


Figure A-1 Simplification of administrative steps in patient scheduling

Figure A-1 shows the administrative steps in operational offline capacity planning. The variable processes differ between specialties. We consider two different groups:

- Patient scheduling by specialty's secretariat
- Patient scheduling by central admission office

Scheduling by specialty's secretariat

Specialties that perform patient scheduling themselves are ear-nose-throat surgery, jaw surgery, neurosurgery, and urology. These different specialties use different tools to schedule patients (eg. Excel, analog planning board, where cards are placed in physical slots to indicate a slot is reserved). However, except for neurosurgery, the interactions between specialty's secretariat, central admission office, and OR secretaries are comparable. Patient scheduling starts the moment the patient visits the secretariat in order to make an appointment for surgery. If possible, the patient immediately receives a date of surgery. After entering the patient's personal information, the secretary places the patient on the specialist's waiting list. After the patient visits POS, the POS secretariat sends the patient charts to the central admission office, where patient, surgery and anesthetic information is entered in the waiting list registration system (WLRs), which is a module of "X-care", the hospital information system used in MST. The central admission office sends a printout of the waiting list to the specialty's secretariat. Based on this printout the specialist's secretary adjusts or reenters the patient information in the tool used for offline OR scheduling. The secretary consults the specialist in order to come up with the preferred sequence of surgeries. After completing the schedule, the secretary sends the program to the admission office. The admission office uses the information in the WLRs to reproduce

the schedule based on the information provided by the specialty's secretariat. This schedule is finally entered in ORSuite, the OR planning software. After the OR committee approves the program, the central admission office informs patients on their admission date and time. Neurosurgery differs from the other specialties by the fact that they do not provide their OR program to the OR secretaries until the day before surgery. This means that the OR committee is not able to examine the program during the program evaluation meeting. This evaluation is therefore performed by the day coordinator, the moment the program is available. The short planning horizon prevents the central admission office to make appointments with patients and is therefore performed by the specialty's secretariat. Appendix A.2 gives an example of patient scheduling by a specialty's secretariat by describing the case of ENT surgery.

Scheduling by central admission office

While some specialties choose to perform patient scheduling themselves, other specialties outsource this function to the central admission office. General surgery, the largest specialty, is one of these specialties. Since the location of general surgery's outpatient clinic is close to the central admission office, patients visit the admission office before they proceed to POS. The admission office adds patient information to the WLRS. If a patient has a high priority, the staff member immediately adds the patient to an OR program and provides the patient with the surgery date, otherwise the patient has to wait for an invitation for surgery. After screening, POS sends the patient's charts back to the admission office. The admission office adds the required information to the patient file in X-care and changes the status of the patient to indicate that the patient can be scheduled for surgery. Every week, the central admission office prints out waiting list information and adds patients to OR programs. Every Tuesday, the week before surgery, the central planner scans the programs for required capacity and missing information. After the OR committee approves the program, the admission office invites patients for surgery. Although the sequence of the surgeries is not yet determined, personal experience of staff members makes it possible to already provide certain types of patients with admission times (e.g. outpatients, clinical patients that are admitted one day in advance). One day before surgery, the OR secretariat contacts the specific surgeons to discuss the sequence of surgeries. Next, the admission office is able to inform patients that did not yet receive their admission time. Appendix A.3 gives a schematic overview of the planning process for general surgery. Other specialties that outsource patient scheduling are gynecology, and orthopedic surgery.

Aside from the location in Enschede, there also is an admission office in Oldenzaal. This office deals with the specialties eye surgery and plastic surgery. Besides a central admission office in Enschede, there is a small admission office in Oldenzaal. The admission office in Oldenzaal deals with specialties that have their establishment in Oldenzaal (Plastic surgery and eye surgery). Since POS is only in Enschede, patients that visit the outpatient departments in Oldenzaal first visit the admission office in Oldenzaal. The difference between eye surgery and other specialties is that in eye surgery

most surgeries are performed using topical anesthesia. This means that a patient does not have to visit POS. In contrast to the central admission office in Enschede, the admission office in Oldenzaal determines the sequence of surgeries itself, after consulting with the specific surgeons. Appendix A.3 and Appendix A.5 show an overview of both the planning process for eye surgery and plastic surgery as well as the steps that fundamentally differ from other specialties.

Surgery loading and sequencing

During the first stage of the operational offline planning, a planner generally adds high urgent patients to an (empty) OR program right away. In the subsequent planning process, less urgent elective patients complete the program. The planner generally schedules these patients using a first-come-first-served strategy (FCFS). Planners make an exception to this FCFS strategy when a patient indicates that he or she is in a lot of pain or when a specialist indicates the planner has to schedule the patient on a short term.

Planners schedule surgeries using expected surgery durations. The expected duration of a surgery is partly determined by the surgeon's estimated incision time and partly by historical surgery times. The OR planning software (ORSuite) keeps track of historical incision times per specialist per type of surgery. The same holds for preparation time and the time for inducing anesthetics (see also **SectionError! Reference source not found.**). When scheduling a certain type of surgery, the planning tool automatically matches the expected duration of the specific surgery for the specific surgeon, including preparation and anesthetics time. If the incision time does not correspond to the time the surgeon has filled out at the admission form, the planner can adjust the section time manually.

The sequence of surgeries depends on a number of factors, which may vary in importance depending on the specific situation. Generally the following factors determine the sequence of surgeries:

- Multiple surgeons (or external firms) involved
- Age (children before adults)
- Type of patient (outpatients at the beginning of a program)
- Preparation time required to install specific equipment (long preparation time at beginning of program)
- Type of anesthetic (short induction time for first patient on program)
- Availability of resources (avoid resource conflicts)
- Preference of surgeon
- Batching of similar types of surgeries (e.g. batching of left-hand and right-hand)

Additionally, there can be specialty specific factors that influence the sequence of the OR program. The sequence in which for example ENT surgeries take place depends on the expected level of

severity of the surgery. By scheduling ear surgeries before nose surgeries before throat surgeries, an ENT specialist performs the more invasive and bloody surgeries at the end of the day.

A.2 ENT surgery

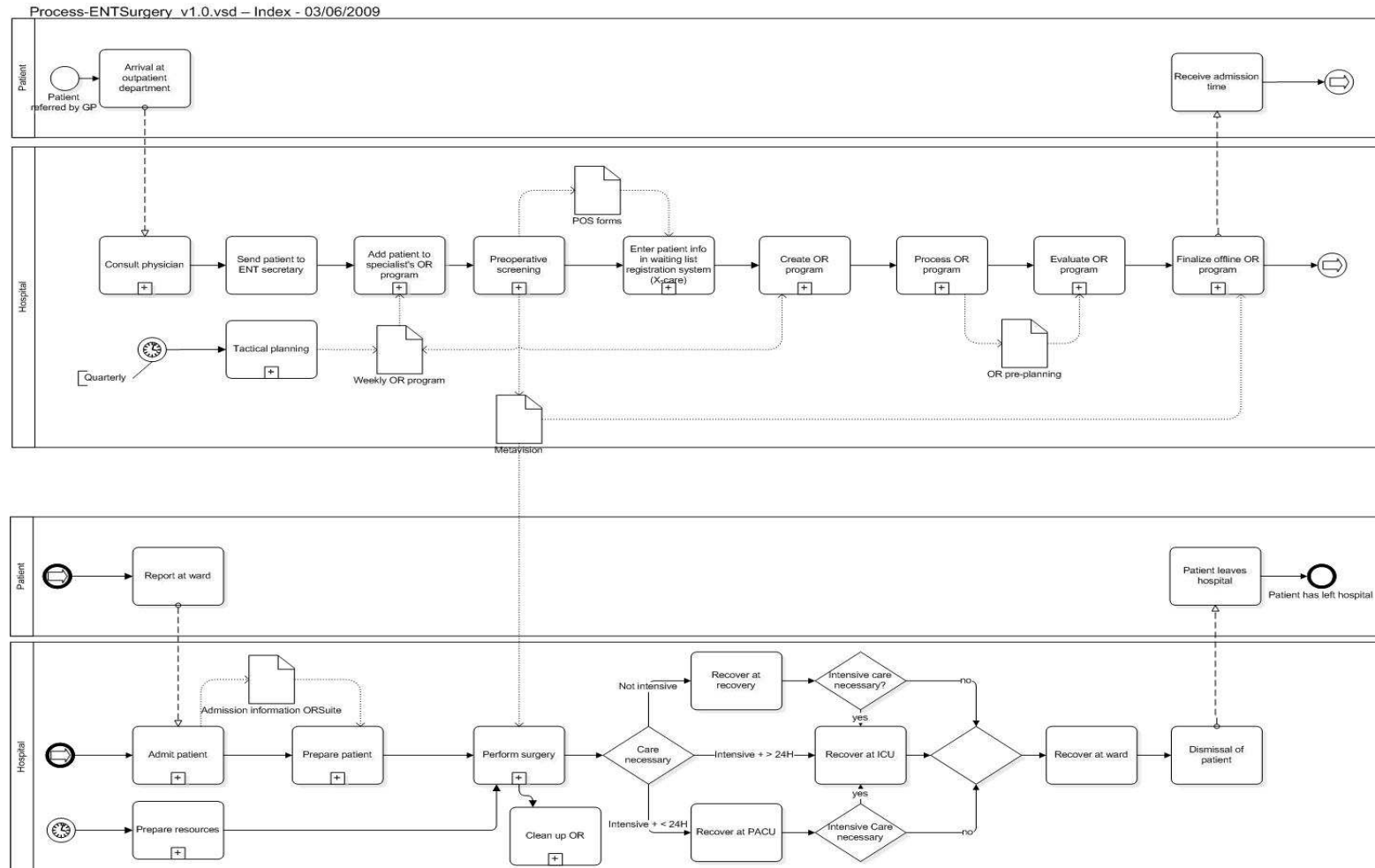


Figure A-2 Overview planning process ENT

Process-ENTsurgery_v1.0.vsd – Consult physician - 03/06/2009

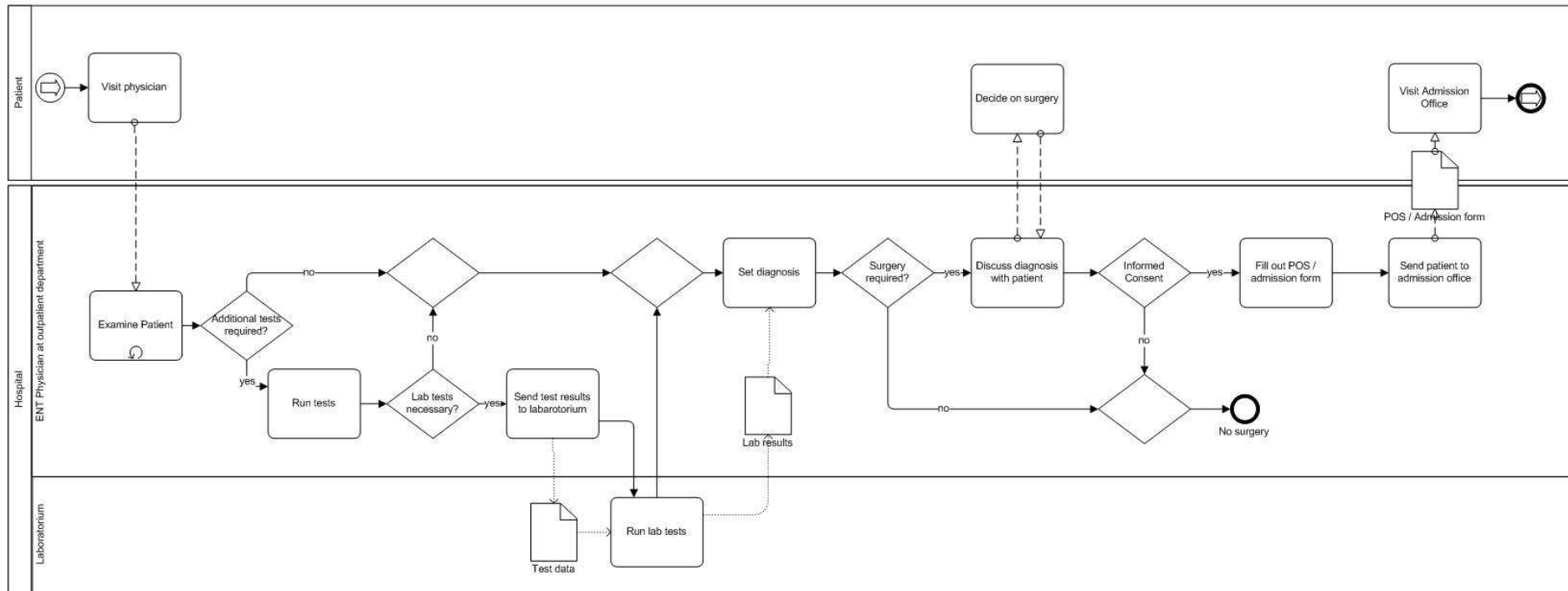


Figure A-3 Process description consult physician

Process-ENTsurgery_v1.0.vsd – Add patient to specialist's OR program - 03/06/2009

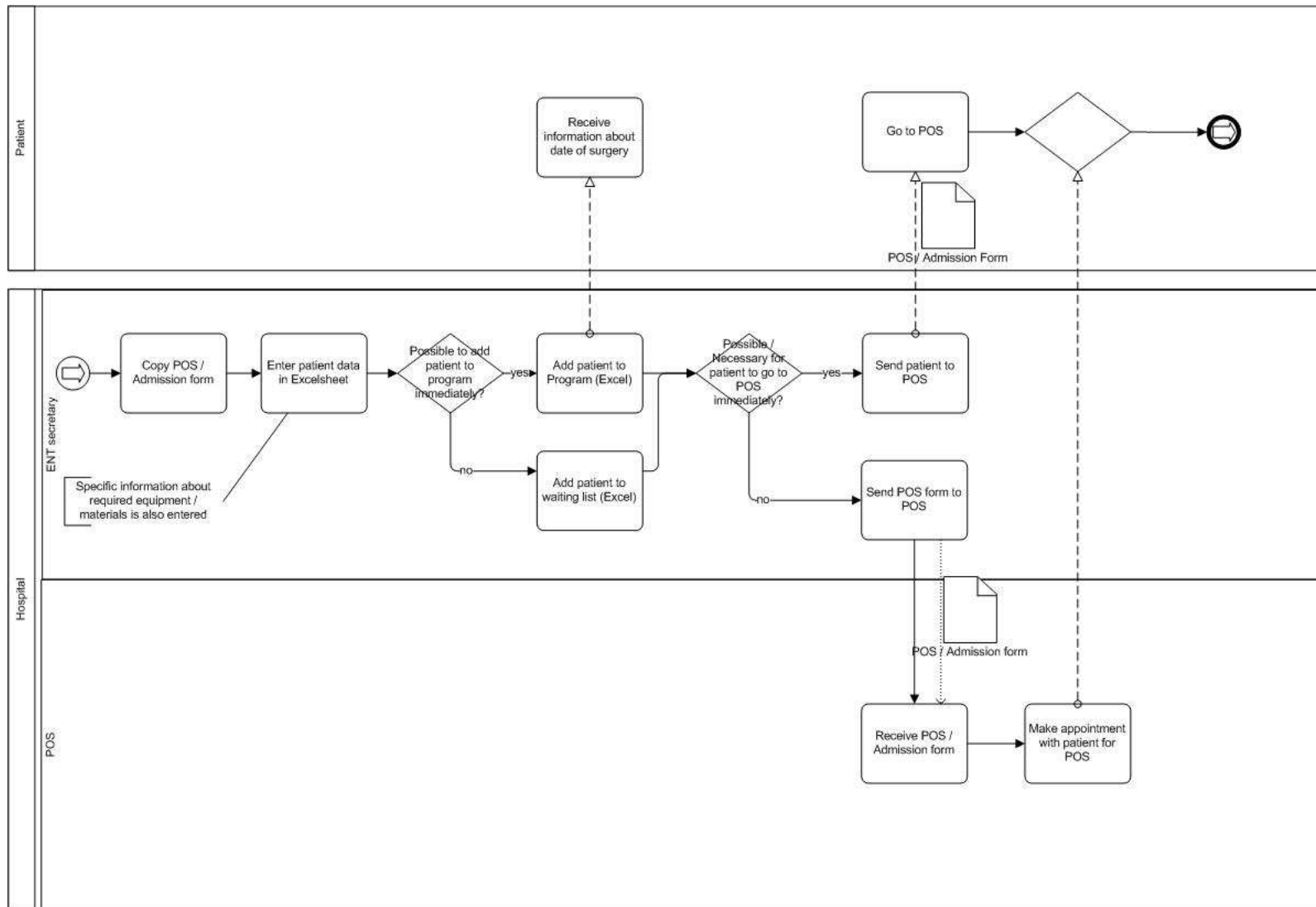


Figure A-4 Process description Apply for surgery

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Process-ENTsurgery_v1.0.vsd – Preoperative screening - 03/06/2009

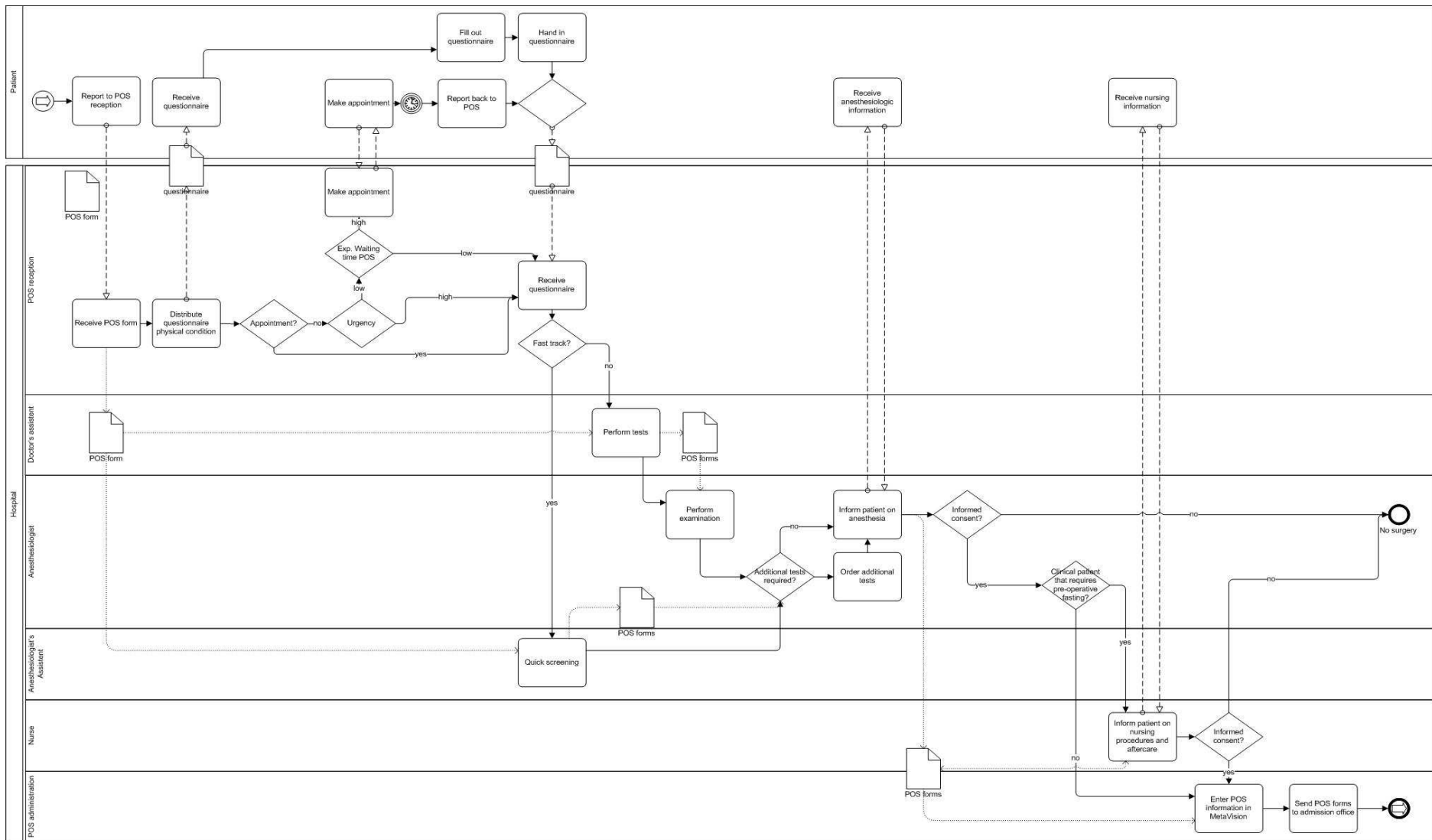


Figure A-5 Process description preoperative screening (POS)

Process-ENTSurgery_v1.0.vsd – Tactical Planning - 03/06/2009

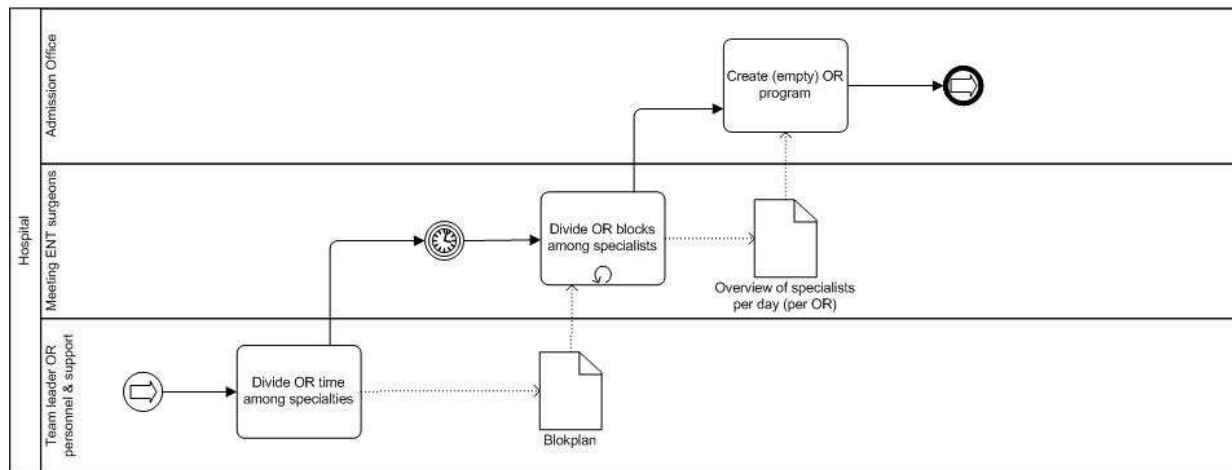


Figure A-6 Process description tactical planning

Process-ENTSurgery_v1.0.vsd – Enter patient info in WLRS (X-care) - 03/06/2009

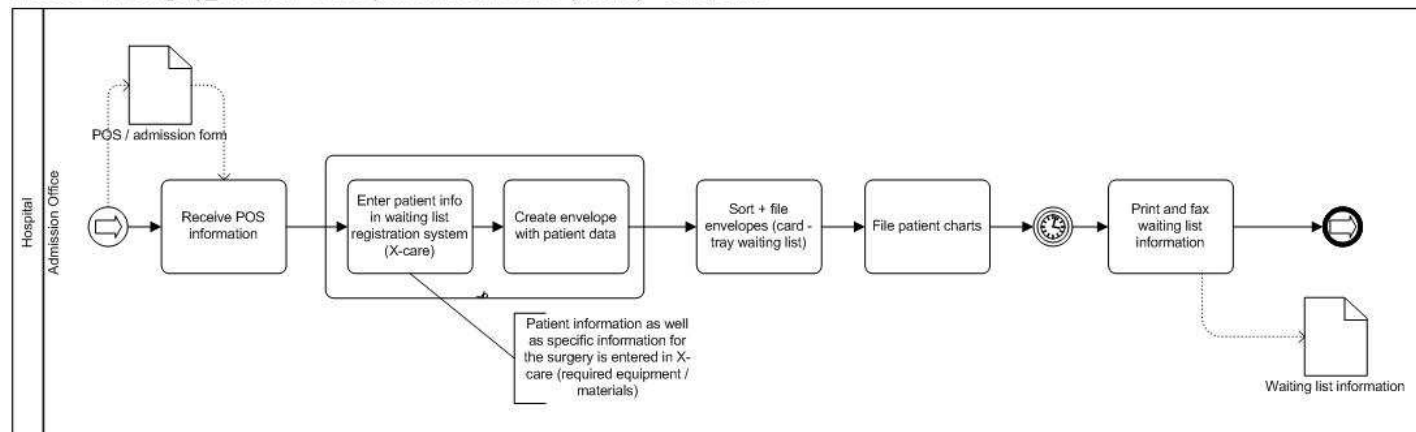


Figure A-7 Process description Waiting list registration

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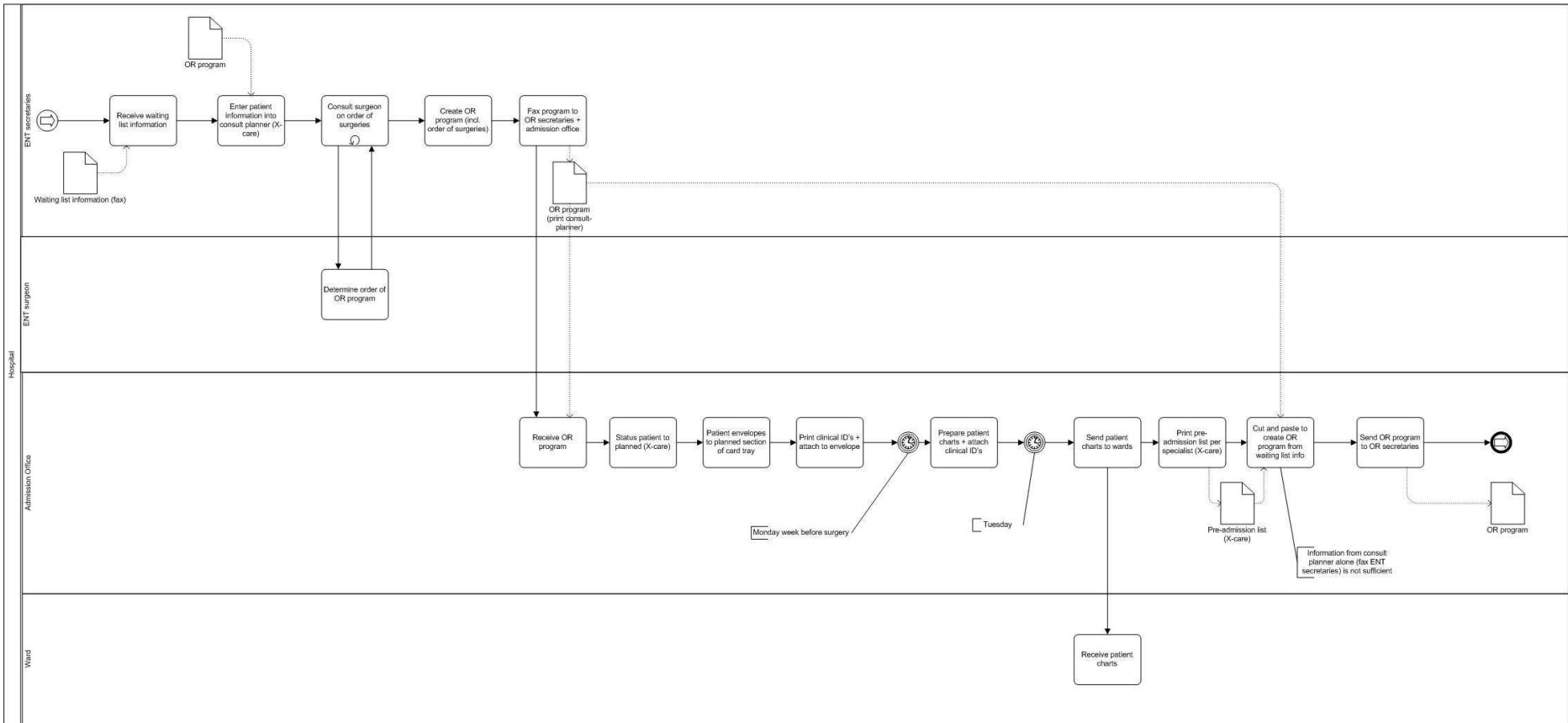
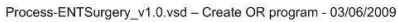


Figure A-8 Process description Creation of OR program (planning of elective patients)

Process-ENTsurgery_v1.0.vsd – Process OR program - 03/06/2009

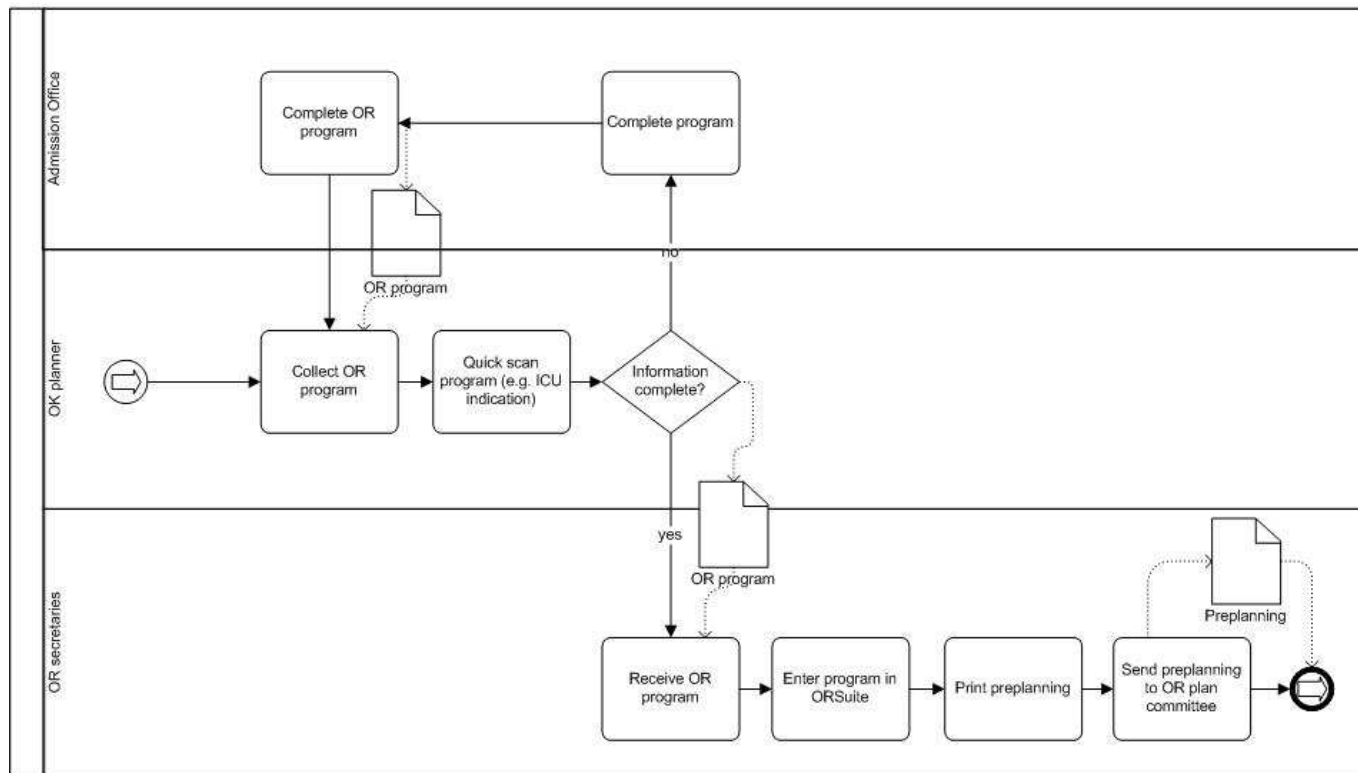


Figure A-9 Process concept planning (preplanning)

Process-ENTsurgery_v1.0.vsd – Evaluate OR program - 03/06/2009

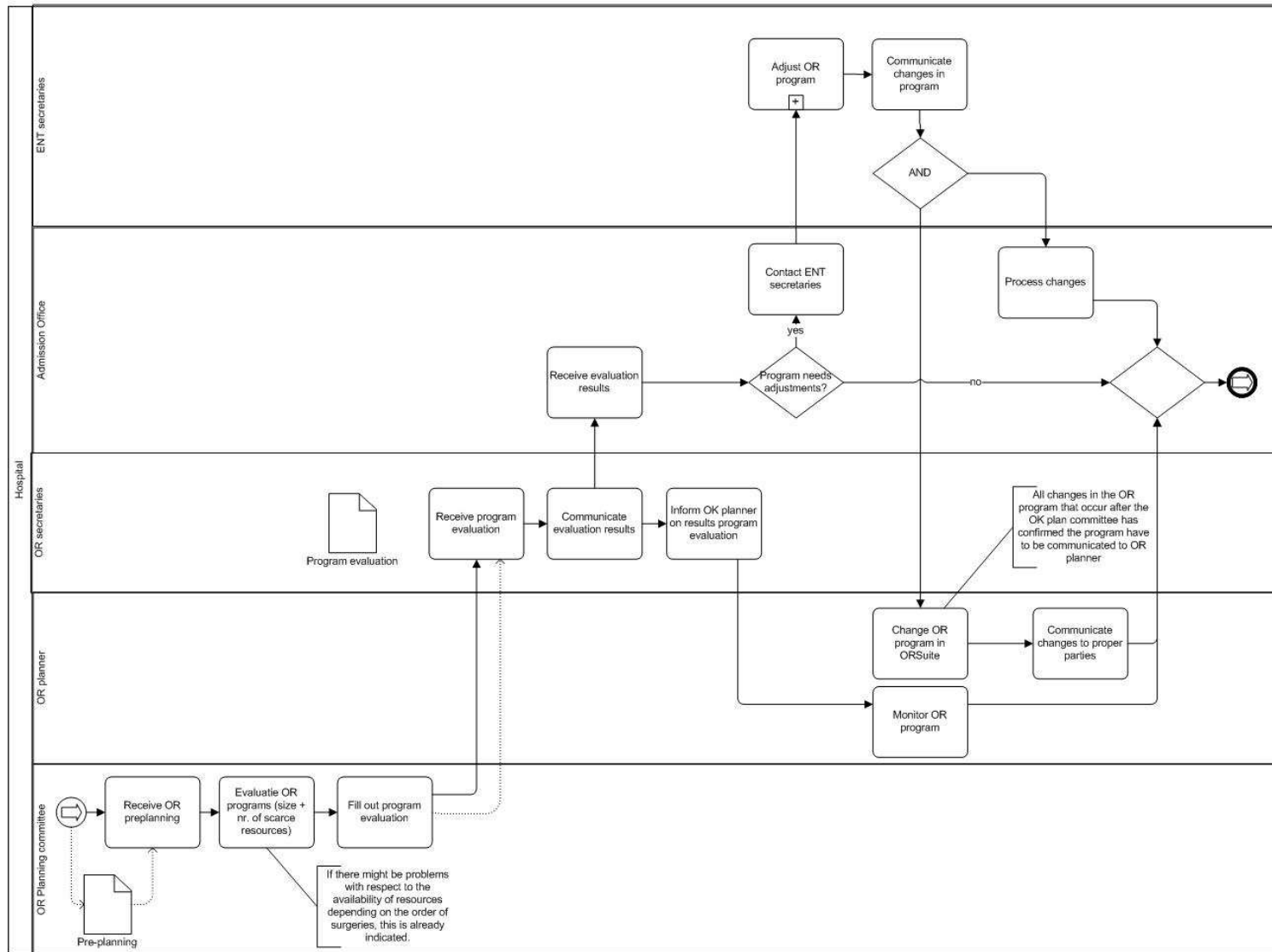


Figure A-10 Program evaluation

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Process-ENTsurgery_v1.0.vsd – finalize offline OR program - 03/06/2009

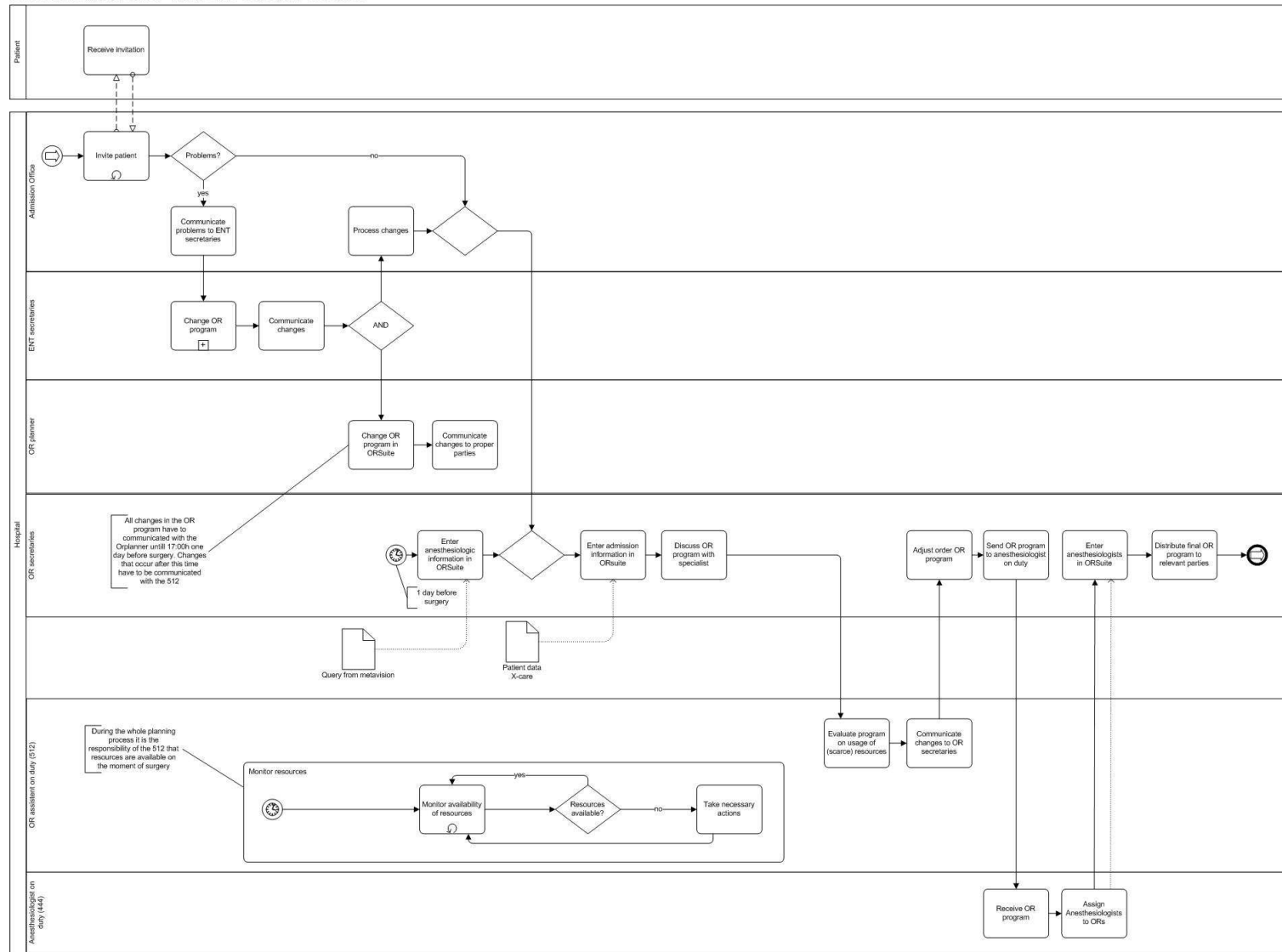


Figure A-11 Finalize operational offline planning

Process-ENTsurgery_v1.0.vsd – Prepare resources - 03/06/2009

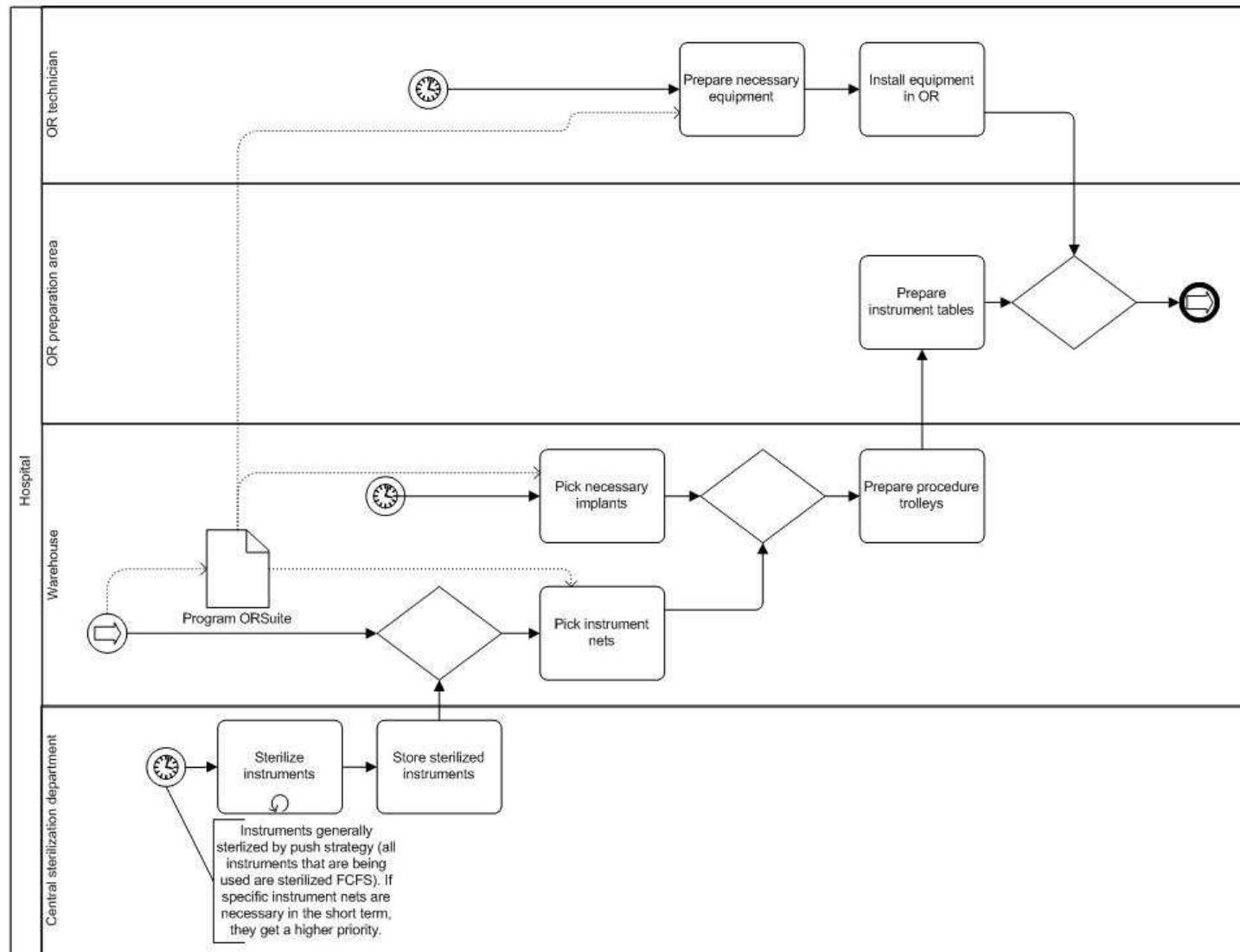


Figure A-12 Process description Prepare resources

Process-ENTsurgery_v1.0.vsd – Admit patient - 03/06/2009

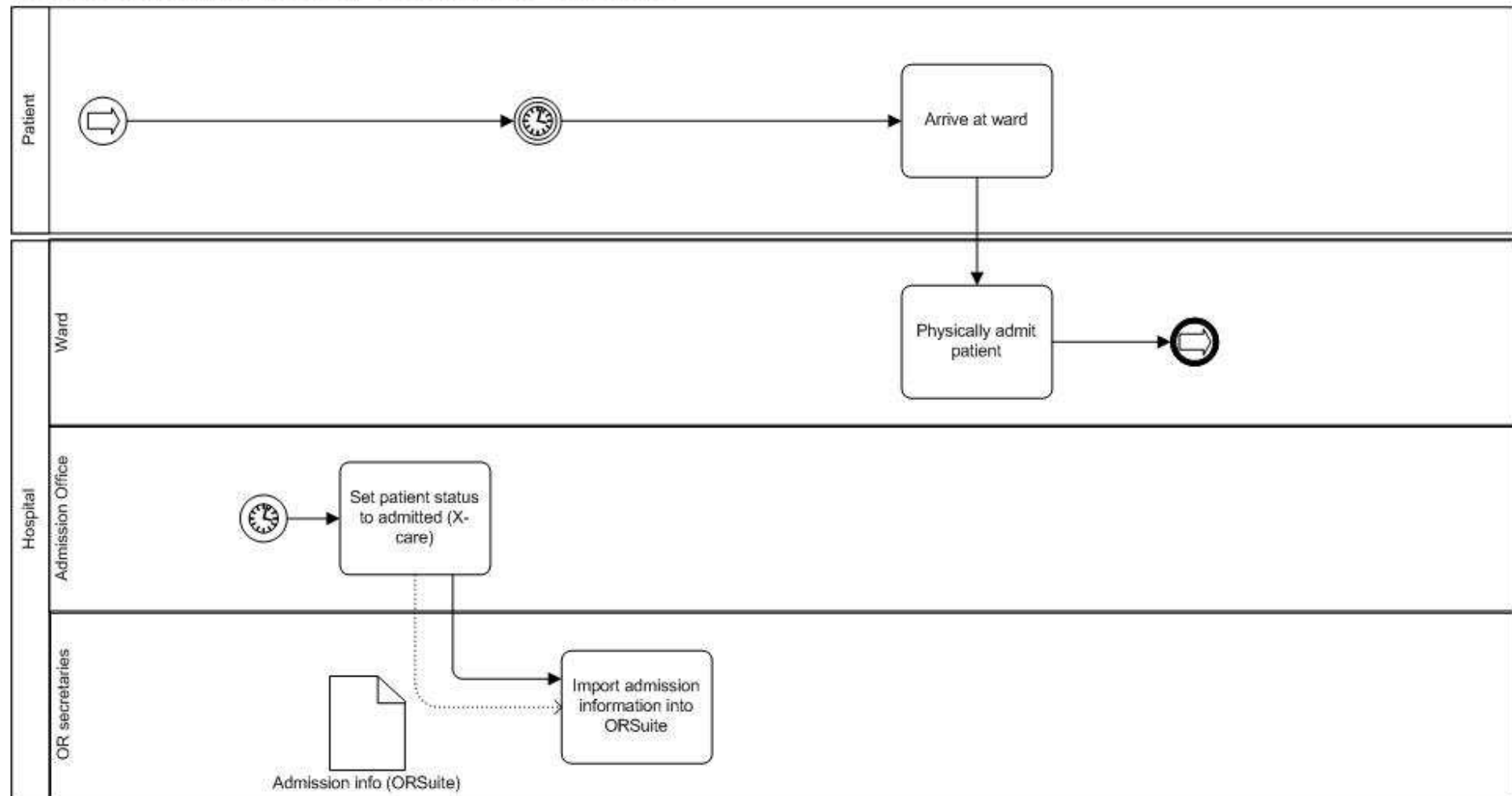


Figure A-13 Process description Admit patient

Process-ENTsurgery_v1.0.vsd – Prepare Patient - 03/06/2009

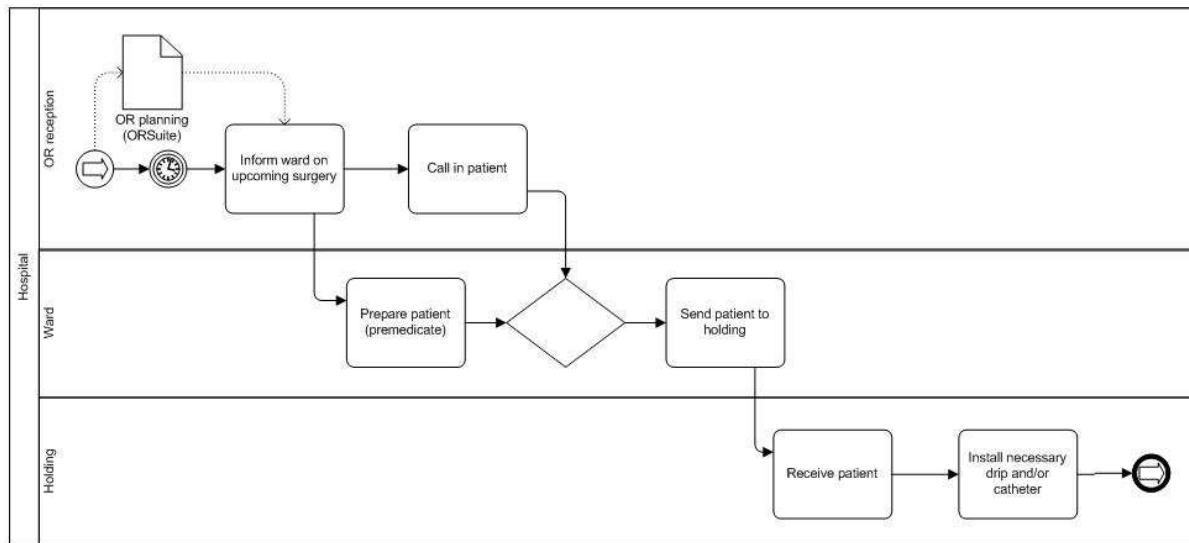


Figure A-14 Process description Prepare patient

Process-ENTsurgery_v1.0.vsd – Perform surgery - 04/06/2009

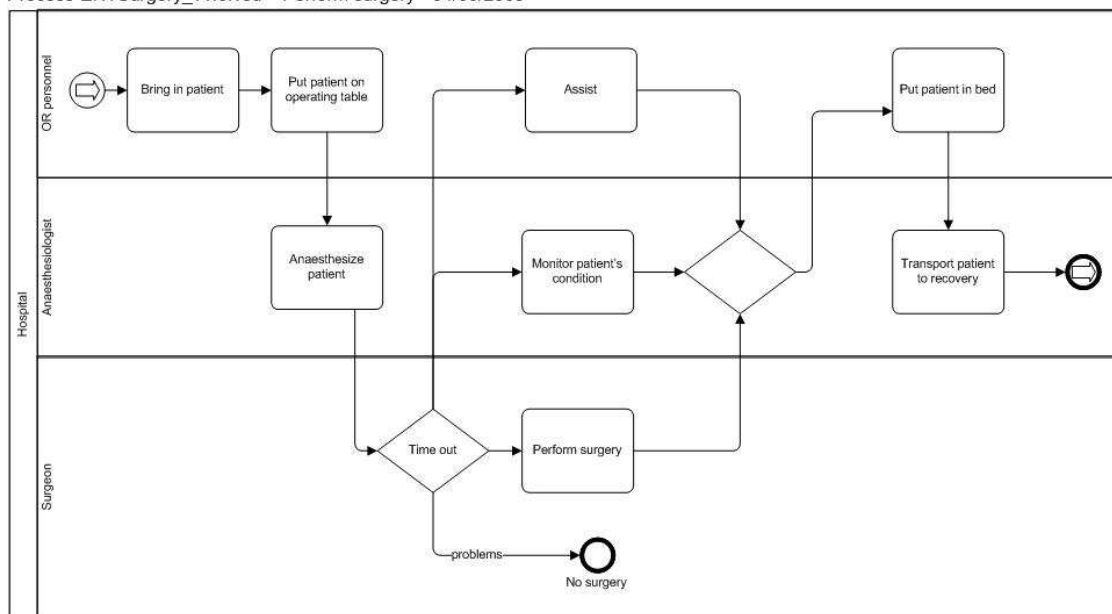


Figure A-15 Process description perform surgery

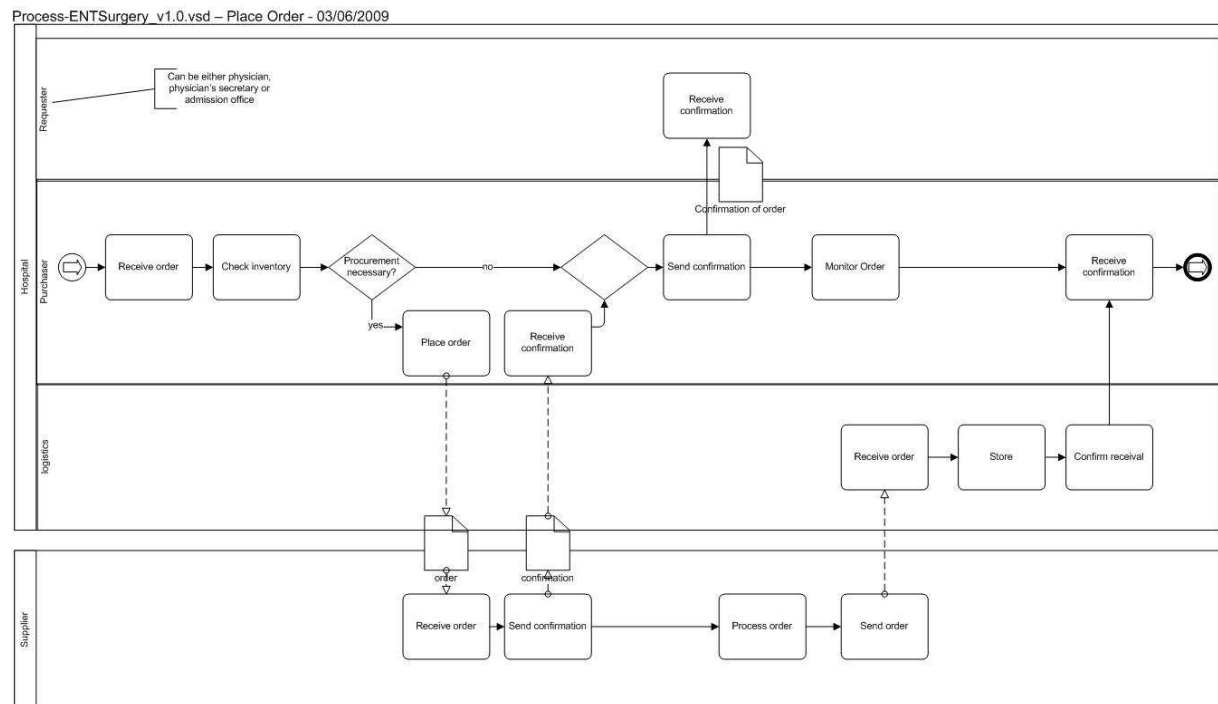


Figure A-16 Process description Order supplies

A.3 general surgery

Process-GeneralSurgery_v2.3.vsd – Index - 09/04/2009

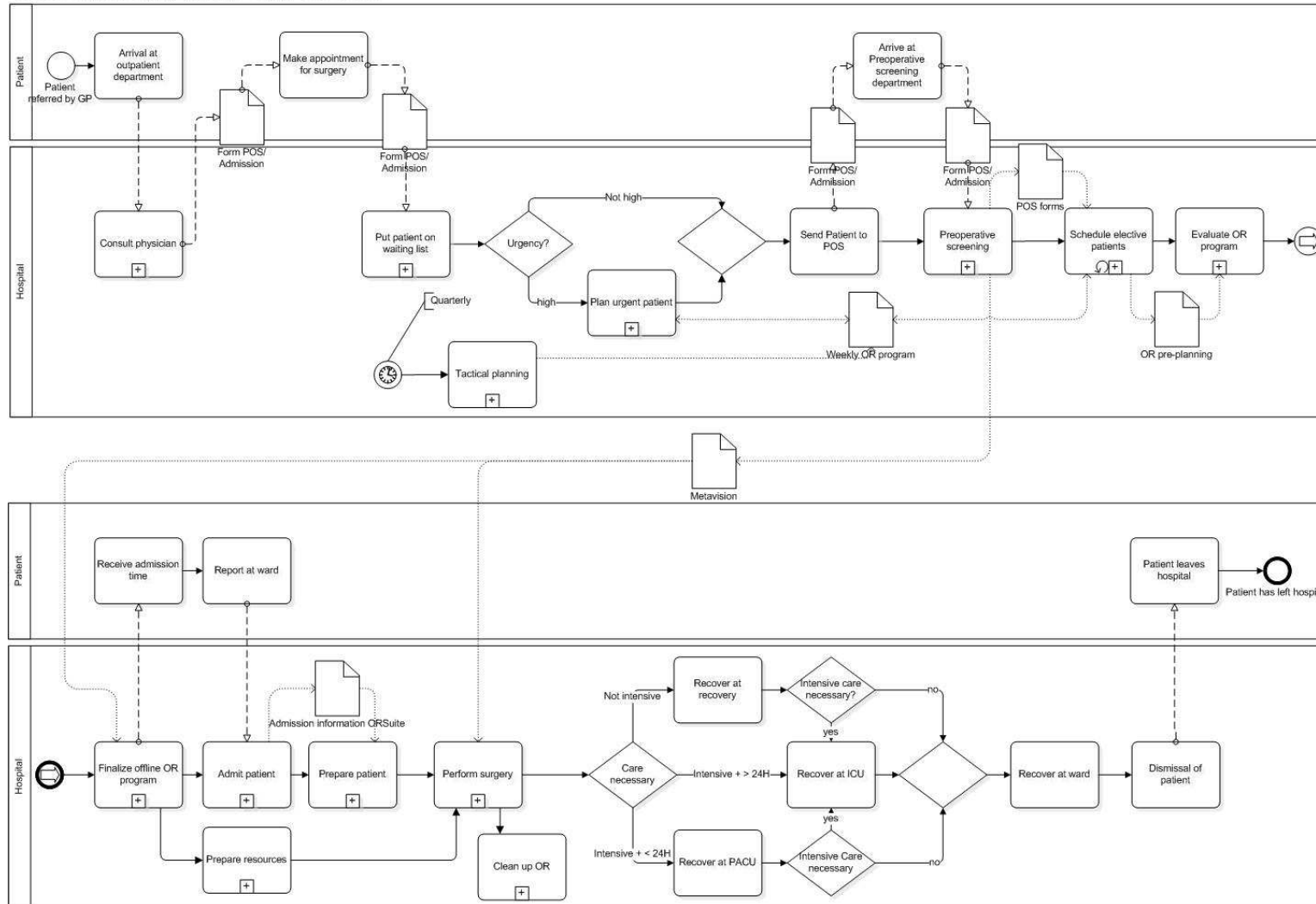


Figure A-17 Overview of planning process general surgery

Process-GeneralSurgery_v2.3.vsd – Put patient on waiting list - 09/04/2009

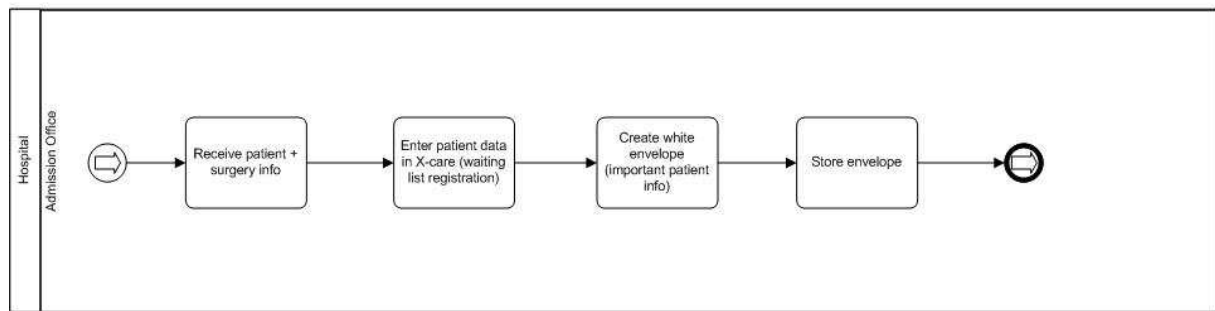


Figure A-18 Process description waiting list registration

Process-GeneralSurgery_v2.3.vsd – Plan urgent patient - 09/04/2009

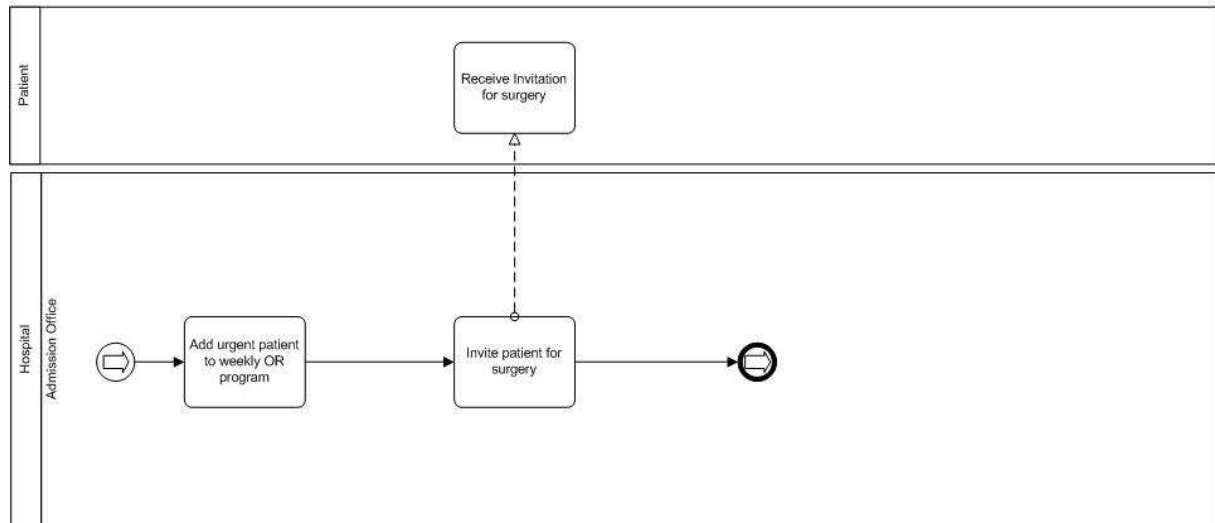


Figure A-19 Process description plan urgent patient

Process-GeneralSurgery_v2.3.vsd – Tactical Planning - 09/04/2009

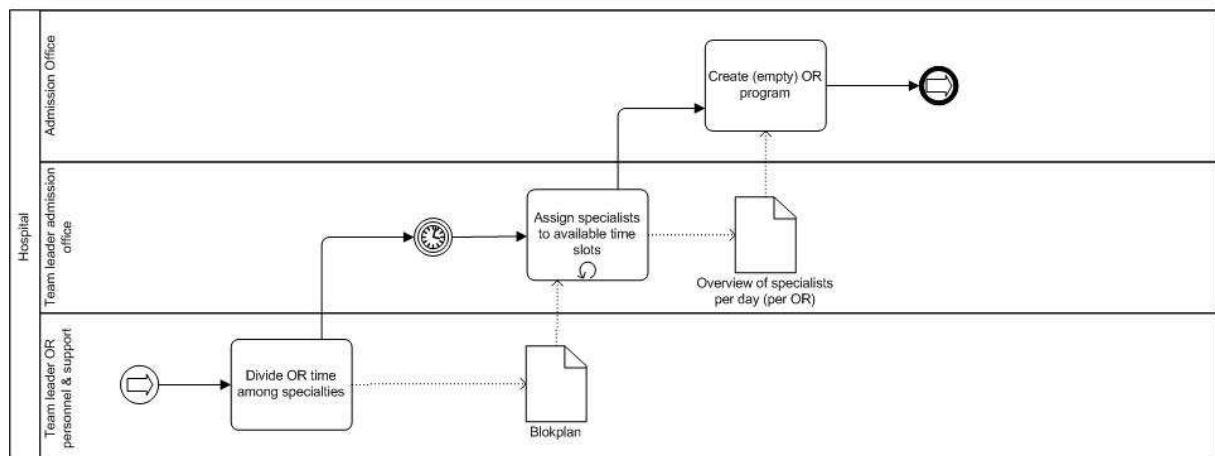


Figure A-20 Process description tactical planning

Process-GeneralSurgery_v2.3.vsd – Schedule elective patients - 09/04/2009

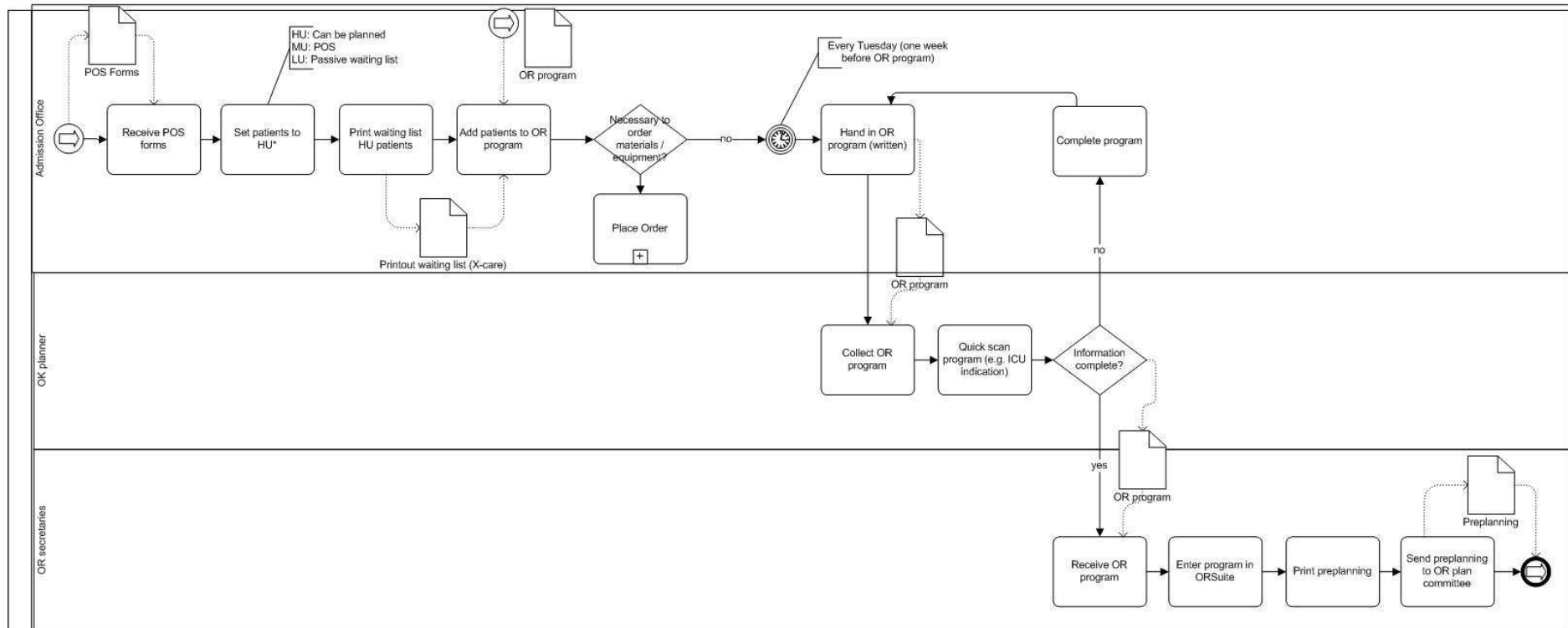


Figure A-21 Process description elective patient planning

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Process-GeneralSurgery_v2.3.vsd – finalize offline OR program - 09/04/2009

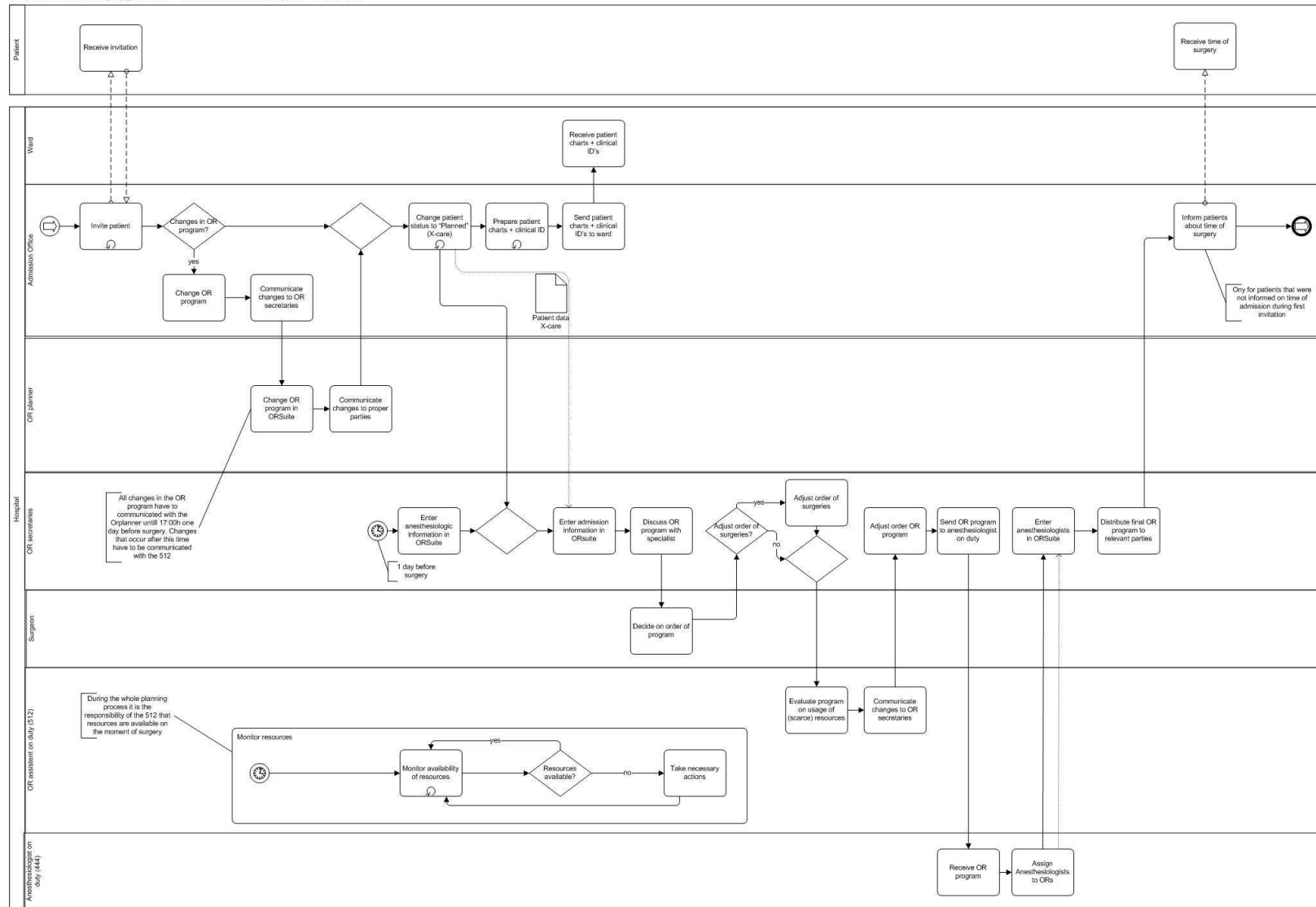


Figure A-22 Process description finalize offline planning

Process-PlasticSurgery_v1.0.vsd – Schedule elective patients - 20/04/2009

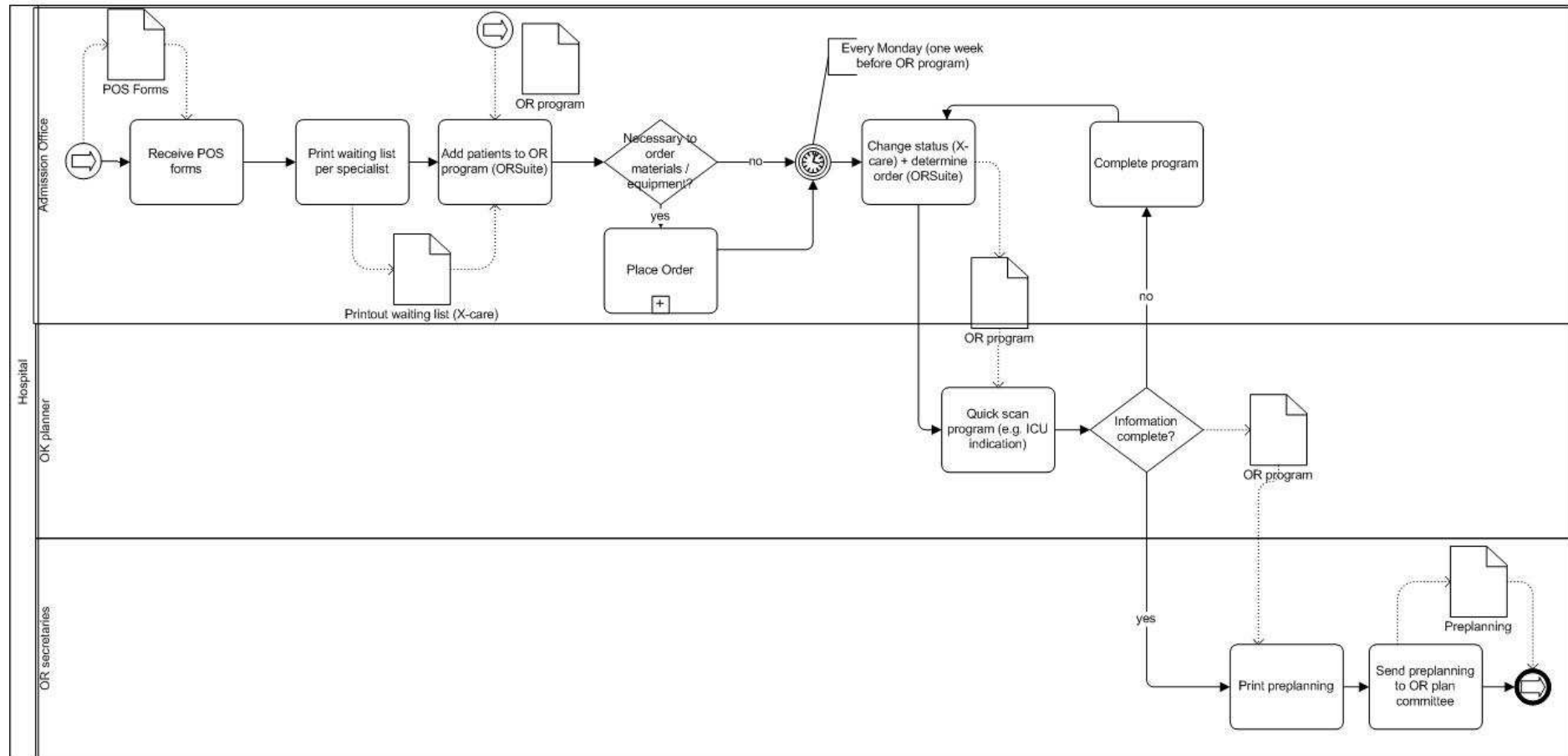


Figure A-24 Process description, scheduling of elective patients plastic surgery

A.5 Eye surgery

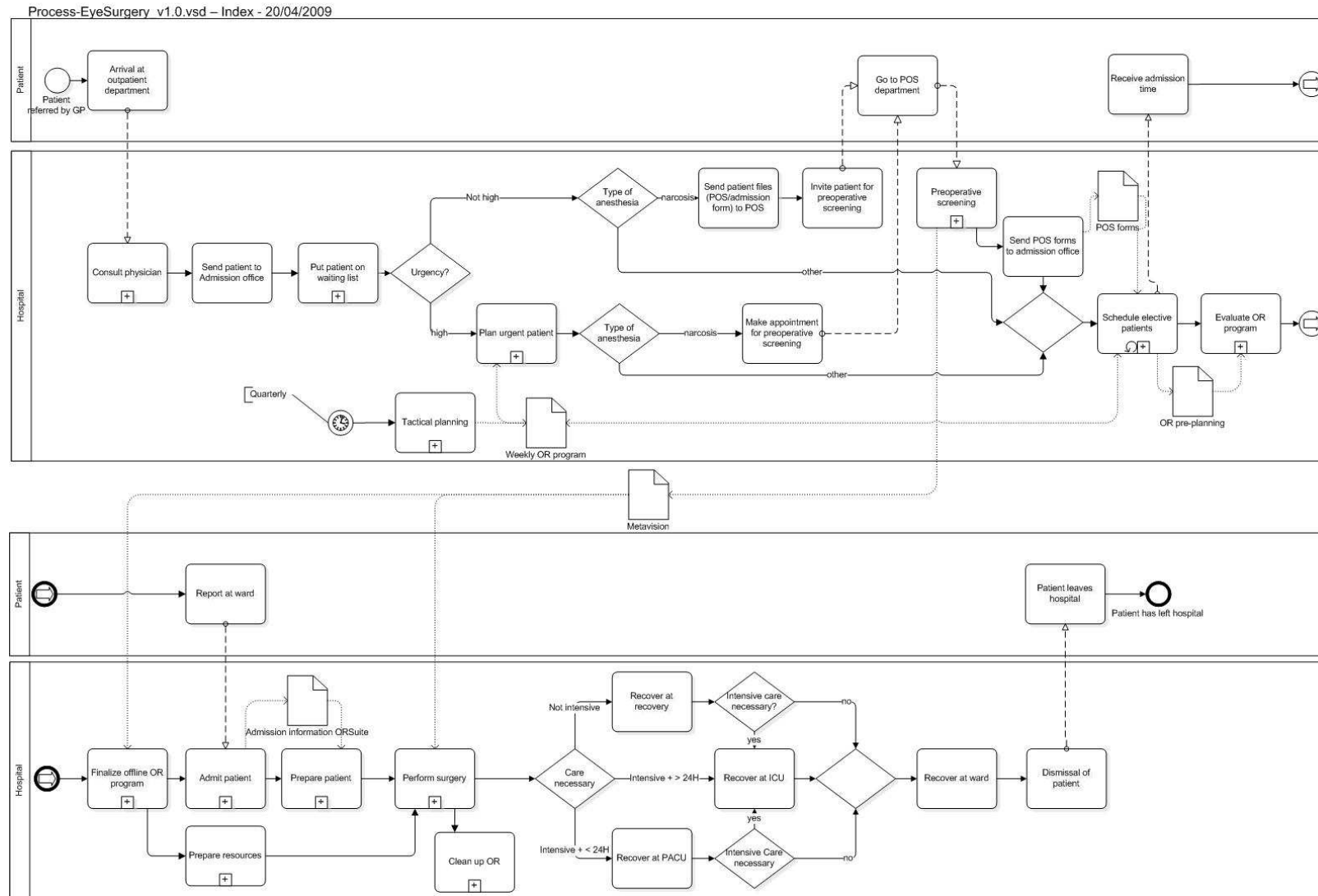


Figure A-25 Overview of planning process eye surgery

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Process-EyeSurgery_v1.0.vsd – Schedule elective patients - 20/04/2009

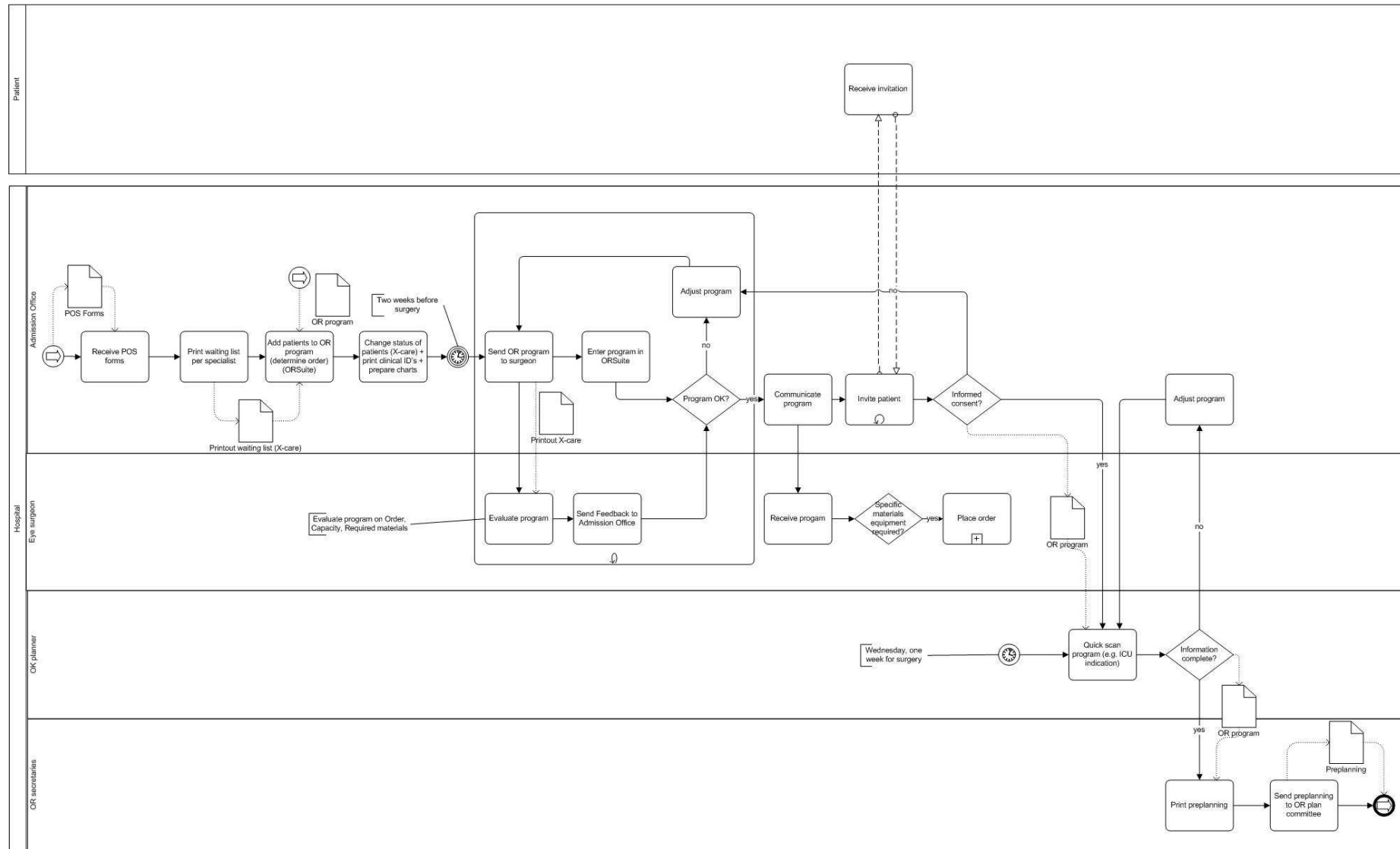


Figure A-26 Process description eye surgery: scheduling of elective patients

Appendix B. Performance indicators; notation and definitions

This appendix states the various notations and definition of the logistic performance indicators used to examine the performance of the general operating department at MST.

B.1 Notation

$T = \text{days } (t = 1, \dots, T)$

$K = \text{ORs } (k = 1, \dots, K)$

$C_{kt} = \text{capacity of OR } k \text{ on day } t$

$I_{kt} = \text{set of sessions on ORday } (k, t) \ (i = 1, \dots, I_{kt})$

$S_{ikt} = \text{start time of session } i \text{ on ORday } (k, t)$

$D_{ikt} = \text{duration of session } i \text{ on ORday } (k, t)$

$E_{ikt} = \text{ending time}^1 \text{ of session } i \text{ on ORday } (k, t) \ (= S_{ikt} + D_{ikt})$

$B_{kt} = \text{starting time of ORday } (k, t)$

$X_{kt} = \text{end of ORday } (k, t) \ (= B_{kt} + C_{kt})$

$H_{ikt} = \text{planned duration of session } i \text{ on ORday } (k, t)$

$N_{ikt} = \begin{cases} 1 & \text{if } S_{ikt} < B_{kt} \\ 0 & \text{otherwise} \end{cases} = \text{session starts before start ORday}$

$O_{ikt} = \begin{cases} 1 & \text{if } S_{ikt} \leq X_{kt} \cap E_{ikt} > X_{kt} \\ 0 & \text{otherwise} \end{cases} = (\text{part of}) \text{session in overtime}$

$W_{ikt} = \begin{cases} 1 & \text{if } i > 1 \cap X_{kt} \geq S_{ikt} \cap B_{kt} < E_{i-1,kt} \\ 0 & \text{otherwise} \end{cases}$

$= \text{changeover between sessions } i \text{ and } i - 1 \text{ on ORday } (k, t)$

$W^+_{ikt} = \begin{cases} 1 & \text{if } i > 1 \cap X_{kt} \geq S_{ikt} \cap B_{kt} < E_{i-1,kt} \cap S_{ikt} > E_{i-1,kt} \\ 0 & \text{otherwise} \end{cases}$

$= \text{positive changeover between sessions } i \text{ and } i - 1 \text{ on ORday } (k, t)$

$Y_{ikt} = \begin{cases} 1 & \text{if } B_{kt} - 30 \text{ minutes} \leq S_{ikt} \leq X_{kt} \\ 0 & \text{otherwise} \end{cases}$

$= \text{start within regular working time (or 30 minutes before)}$

$Z_{ikt} = \begin{cases} 1 & \text{if } (B_{kt} \leq S_{ikt} \leq X_{kt} \cup B_{kt} \leq E_{ikt} \leq X_{kt}) \cup (S_{ikt} < B_{kt} \cap E_{ikt} > X_{kt}) \\ 0 & \text{otherwise} \end{cases}$

$= (\text{part of}) \text{session takes place within regular working time}$

$I'_{kt} = \text{set of sessions for which } Z_{ikt} = 1 \ (i = 1, \dots, I'_{kt})$

¹ Ending time of session is measured as the time a patient leaves the OR

$$M_{ikt} = \begin{cases} 1 & \text{if } S_{ikt} > B_{kt} \cap S_{ikt} = \min_{i \in I'_{kt}} S_{ikt} \\ 0 & \text{otherwise} \end{cases}$$

= late start of first session within regular working hours

$$A_{ikt} = \begin{cases} 1 & \text{if } E_{ikt} = \max_{i \in I'_{kt}}(E_{ikt}) \cap E_{ikt} < X_{kt} \\ 0 & \text{otherwise} \end{cases}$$

= positive vacancy time at end of regular time

B.2 Definitions

These definitions correspond to the definitions used by Van Hoorn & Wendt (Van Hoorn & Wendt, 2008).

ORday

An ORday represents a combination of a date and an operating room at which at least a part of a session is performed. Holidays, weekends and night shifts are not taken into account.

$$OR_{kt} = \begin{cases} 1 & \text{if } I_{kt} > 0 \\ 0 & \text{otherwise} \end{cases} \quad [1]$$

Net utilization

Numerator: The cumulative duration of all sessions that either start within regular working hours or half an hour before. The duration is taken into account until the end of regular working hours.

Denominator: Difference between start and end of regular working hours summed up over all ORdays.

$$U_n = \frac{\sum_t \sum_k \sum_i Y_{ikt} \{\min(X_{kt}, E_{ikt}) - S_{ikt}\}}{\sum_t \sum_k C_{kt}} \quad [2]$$

Gross norm utilization

Numerator: The cumulative session times within regular working hours + ((number of sessions within regular working time – 1) * 10 minutes)

Denominator: Difference between start and end of regular working hours summed up over all ORdays.

$$U_{gn} = \frac{\sum_t \sum_k (\sum_i Z_{ikt} (\min(X_{kt}, E_{ikt}) - \max(S_{ikt}, B_{kt})) + ((\sum_i Z_{ikt}) - 1) * 10 \text{ minutes})}{\sum_t \sum_k C_{kt}} \quad [3]$$

Gross utilization

Numerator: The cumulative session times within regular working hours + cumulative positive changing times within regular working time

Denominator: Difference between start and end of regular working hours summed up over all ORdays.

$$U_g = \frac{\sum_k \sum_t \sum_i (Z_{ikt} (\min(X_{ikt}, E_{ikt}) - \max(S_{ikt}, B_{kt})) + W^+_{ikt} (S_{ikt} - E_{i-1,kt}))}{\sum_t \sum_k C_{kt}} \quad [4]$$

Overtime duration

Numerator: Difference between the end of the last sessions that is (partly) conducted within regular hours in case of overtime, summed up over all ORdays.

Denominator: The number of ORdays at which overtime occurs

$$O_d = \frac{\sum_t \sum_k \sum_i O_{ikt} (E_{ikt} - X_{kt})}{\sum_t \sum_k \sum_i O_{ikt}} \quad [5]$$

Overtime frequency

Numerator: number of ORdays at which overtime occurs

Denominator: number of ORdays that is used in calculating utilization.

$$O_f = \frac{\sum_t \sum_k \sum_i O_{ikt}}{\sum_t \sum_k \max_{i \in I_{kt}} Z_{ikt}} \quad [6]$$

End-of-day vacancy duration

Numerator: Sum of all positive vacancy times between the end of regular times and the last sessions within regular time.

Denominator: Number of ORdays with positive vacancy time at the end of the daily schedule.

$$V_d = \frac{\sum_t \sum_k \sum_i A_{ikt} (X_{kt} - E_{ikt})}{\sum_t \sum_k \sum_i A_{ikt}} \quad [7]$$

End-of-day vacancy frequency

Numerator: Number of ORdays with positive vacancy time at the end of the daily schedule.

Denominator: number of ORdays that is used in calculating utilization.

$$V_f = \frac{\sum_t \sum_k \sum_i A_{ikt}}{\sum_t \sum_k \max_{i \in I_{kt}} (Z_{ikt})} \quad [8]$$

Early start duration

Numerator: Time a session starts before regular hours, summed up over all sessions that are at least partly performed within regular hours.

Denominator: Number of sessions that start before start of regular time and end either in or after regular hours, summed up over all ORdays

$$ES_d = \frac{\sum_t \sum_k \sum_i Z_{ikt} N_{ikt} (B_{kt} - S_{ikt})}{\sum_t \sum_k \sum_i Z_{ikt} N_{ikt}} \quad [9]$$

Early start frequency

Numerator: Number of ORdays were the first session within regular time has started before the start of regular hours.

Denominator: number of ORdays that is used in calculating utilization.

$$ES_f = \frac{\sum_t \sum_k \sum_i (Z_{ikt} N_{ikt})}{\sum_t \sum_k \max_{i \in I_{kt}} (Z_{ikt})} \quad [10]$$

Late start duration

Numerator: Sum of all positive vacancy times between the start of regular times and the first sessions within regular time

Denominator: number of day late start has been determined

$$LS_d = \frac{\sum_t \sum_k \sum_i M_{ikt} (S_{ikt} - B_{kt})}{\sum_t \sum_k \sum_i M_{ikt}} \quad [11]$$

Late start frequency

Numerator: Number of ORdays with positive vacancy time at the start of the daily schedule

Denominator: number of ORdays that is used in calculating utilization.

$$LS_f = \frac{\sum_t \sum_k \sum_i M_{ikt}}{\sum_t \sum_k \max_{i \in I_{kt}} (Z_{ikt})} \quad [12]$$

Positive changeover times

Numerator: Sum of all positive periods between sessions i and i-1, within regular working time.

Denominator: Number of times positive changeovers occur.

$$W_p = \frac{\sum_t \sum_k \sum_i W_{ikt}^+ (S_{ikt} - E_{i-1,kt})}{\sum_t \sum_k \sum_i (W_{ikt}^+)} \quad [13]$$

Changeover times overall

Numerator: Sum of all periods between sessions i and i-1, within regular working time.

Denominator: Number of times changeovers occur

$$W_p = \frac{\sum_t \sum_k \sum_i W_{ikt} (S_{ikt} - E_{i-1,kt})}{\sum_t \sum_k \sum_i (W_{ikt})} \quad [14]$$

Changeover frequency

Numerator: Number of times changeovers occur

Denominator: number of ORdays that is used in calculating utilization.

$$W_f = \frac{\sum_k \sum_t \left\{ (\sum_i Z_{ikt}) - \max_{i \in I_{kt}} Z_{ikt} \right\}}{\sum_t \sum_k \max_{i \in I_{kt}} (Z_{ikt})} \quad [15]$$

Absolute deviation from planning

Numerator: |realized session times – expected session times|

Denominator: expected session times

$$P_a = \frac{\sum_k \sum_t \sum_i |D_{ikt} - H_{ikt}|}{\sum_k \sum_t \sum_i H_{ikt}} * 100\% \quad [16]$$

Average deviation from planning

Numerator: (realized session times – expected session times) for elective surgeries that take place in regular working hours

Denominator: expected session times for elective surgeries that take place in regular working hours.

$$P_m = \frac{\sum_k \sum_t \sum_i Z_{ikt} (D_{ikt} - H_{ikt})}{\sum_k \sum_t \sum_i H_{ikt} Z_{ikt}} * 100\% \quad [17]$$

Number of cancelled sessions

Numerator: Number of cancelled elective sessions

Denominator: Number of realized elective sessions + number of cancelled elective sessions

Appendix C. Performance indicators; Values

These results are based on OR data from 2008. Surgeries are included if they are at least partly conducted within regular working hours (e.g. monday-friday, 8AM-4PM). Holidays and other irregular days, like for example the anesthesiologist's days are excluded. The polyclinic OR (P-OK) is not part of the regular planning function and is therefore not taken into account.

Table C-1 Descriptive statistics

	Enschede	Oldenzaal	Totaal
Available ORs	11	4 ²	15
# ORdays	2524	502	3026
Outpatients	3474	3464	6938
Inpatients	7472	606	8078
Emergency patients	1268	31	1299
Total Nr. of Cases	12214	4101	16315

C.1 Values

Table C-2 Values of logistic performance indicators

	Enschede	Oldenzaal	Total
Utilization			
Net utilization	82,50%	80,57%	82,17%
Gross norm utilization	90,61%	95,54%	91,43%
Gross utilization	91,10%	90,77%	91,04%
Overtime			
Amount of overtime	41,9	19,2	39,0
Overtime frequency	35,22%	25,10%	33,53%
Early End			
Vacancy time	48,2	48,2	48,2
Early ending frequency	62,91%	73,31%	64,64%
Early start			
Early start time	10,8	3,0	10,7
frequency	4,42%	0,40%	3,75%
Late start			
Late start time	13,4	10,9	13,0
frequency	89,64%	89,44%	89,61%
Changeovers			
Changeover time positive	10,6	6,8	9,6
Changeover time overall	10,6	6,7	9,5
Changeover frequency per ORday	3,9	7,2	4,4
Deviation from planning			
Absolute	24,5%	25,4%	24,7%
Average	-7,5%	-13,8%	-8,6%
Cancellations			
	<i>nr. Of Cancellations</i>	<i>nr. of Cancellations / (nr realized cases +cancelled cases)</i>	
Overall	3453	18,7%	

² From September in Oldenzaal only 2 OR's were available.

cancellations > 1 wk	594	3.2%
1 wk > cancellations >= 24H	1973	10.7%
24H > cancellations >= 12H	221	1.2%
12H > cancellations >= 1H	391	2.1%
1H > cancellations >= 0H	101	0.5%
cancellations < 0H	173	0.9%

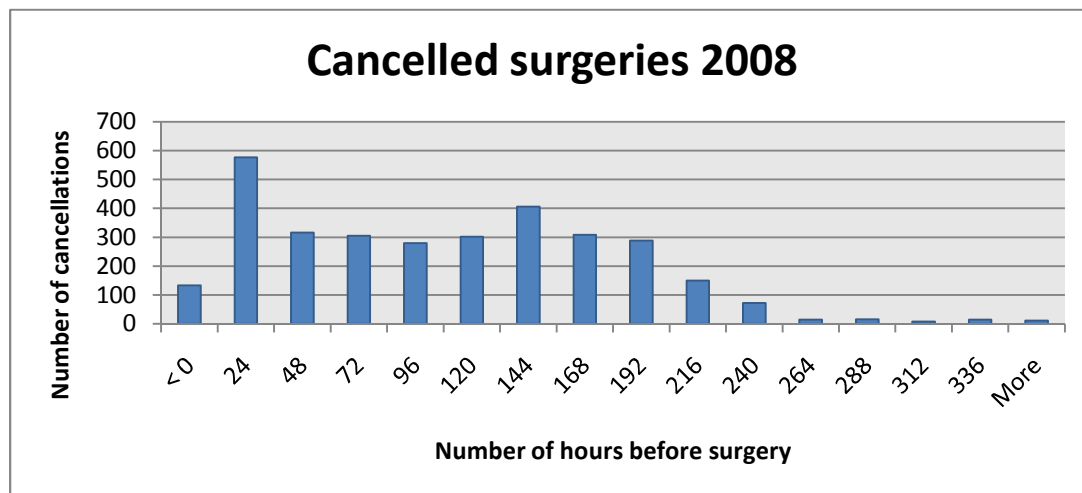
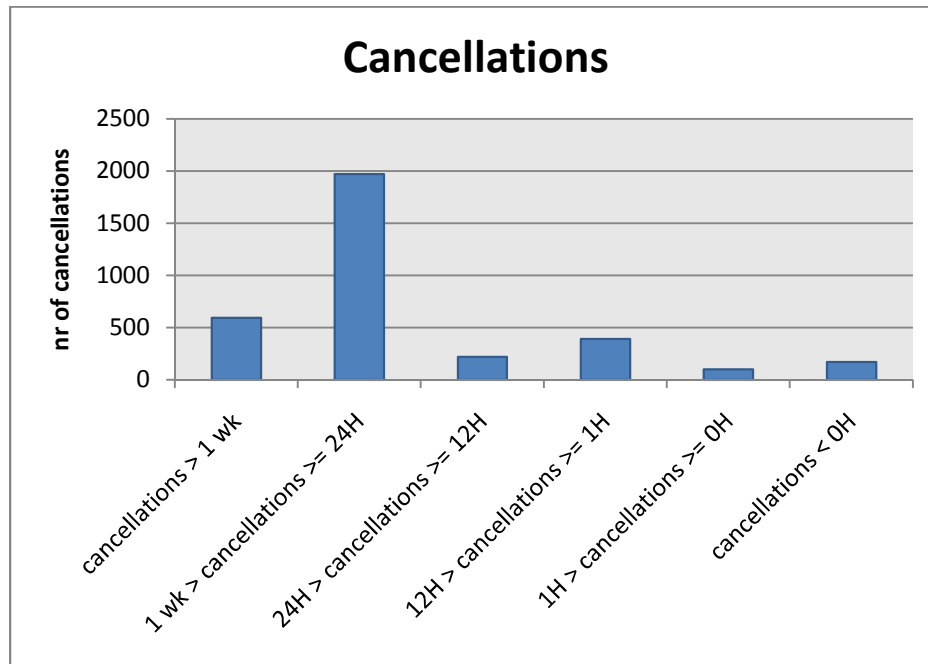


Figure C-1 and Figure C-2 Cancellations of surgeries in 2008³

³ Only sessions that were scheduled and cancelled during the year 2008, are taken into account

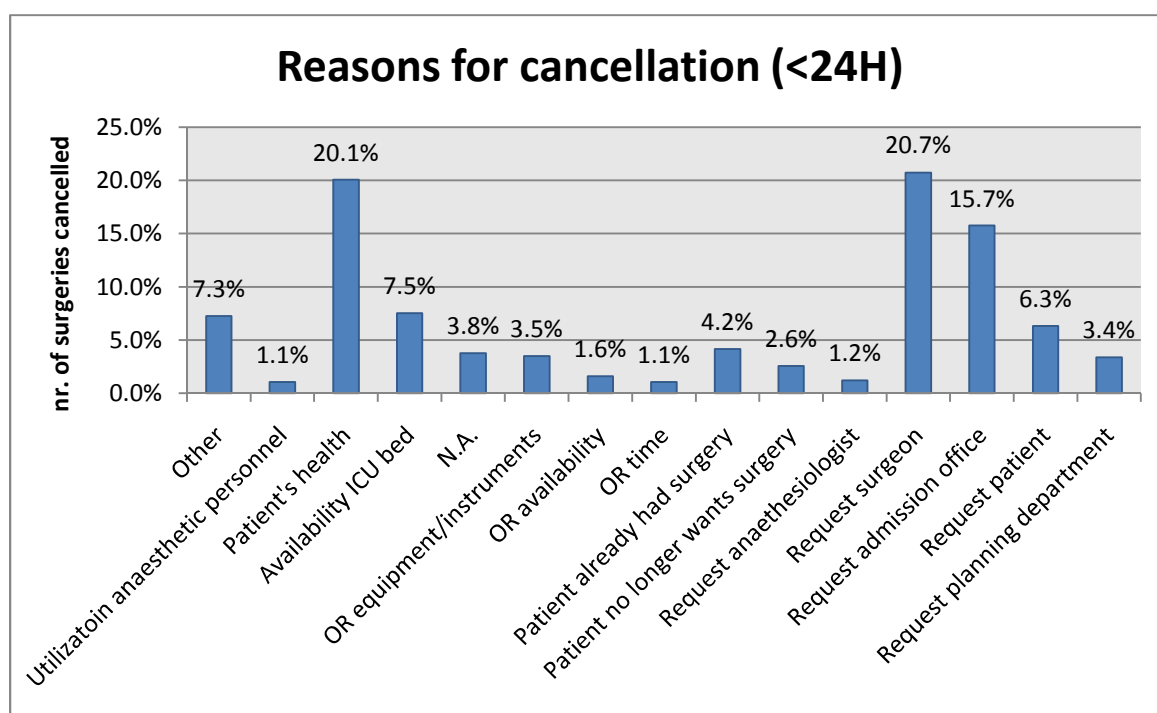


Figure C-3 Reasons for cancelling surgery within last 24H before surgery (data: MST, general ORs, 2008)

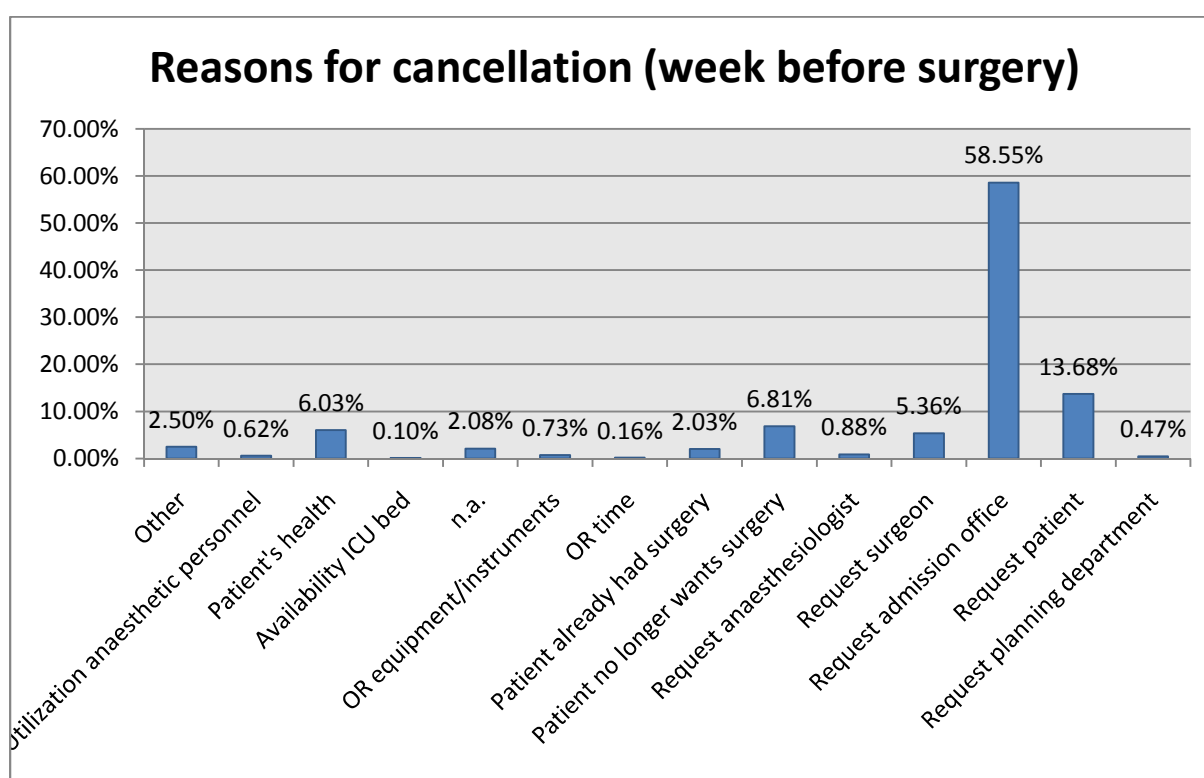


Figure C-4 Reasons for cancelling surgery within period between one week before surgery and 24H before surgery (data: MST, general ORs, 2008).

Appendix D. Surgeries and admissions per day

D.1 Number of surgeries per location

Number of surgeries in the general ORs per patient type. Patients that are operated upon in Enschede recover in Enschede and the same holds for Oldenzaal. Because of the different locations it is not possible to combine resources (like wards) between the two locations. The output from the ORs in Enschede therefore only have impact on the wards in Enschede and vice versa.

Enschede

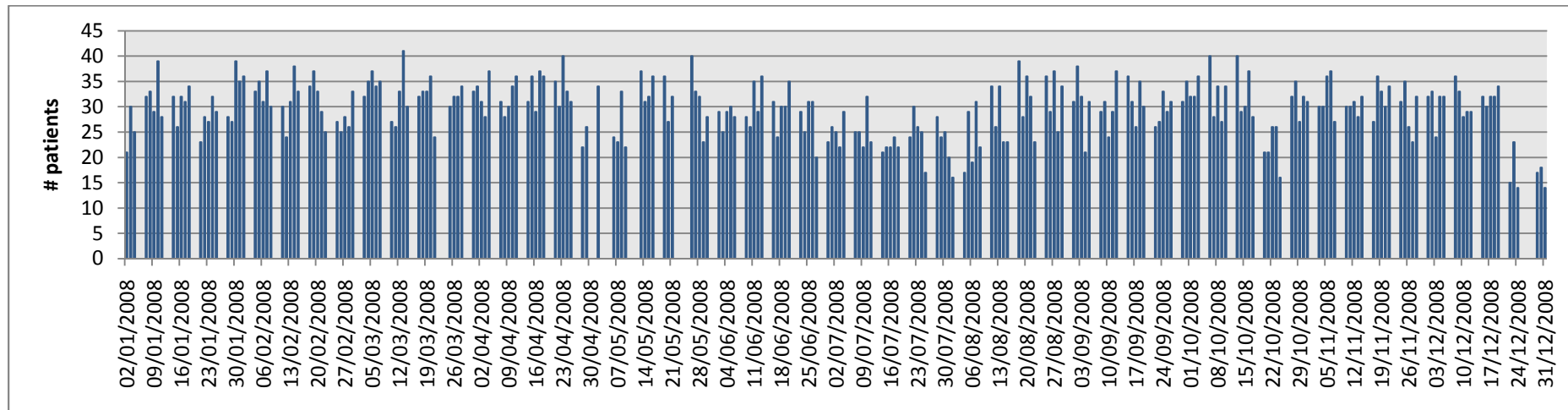


Figure D-1 Nr. Of inpatient surgeries at location Enschede (2008)

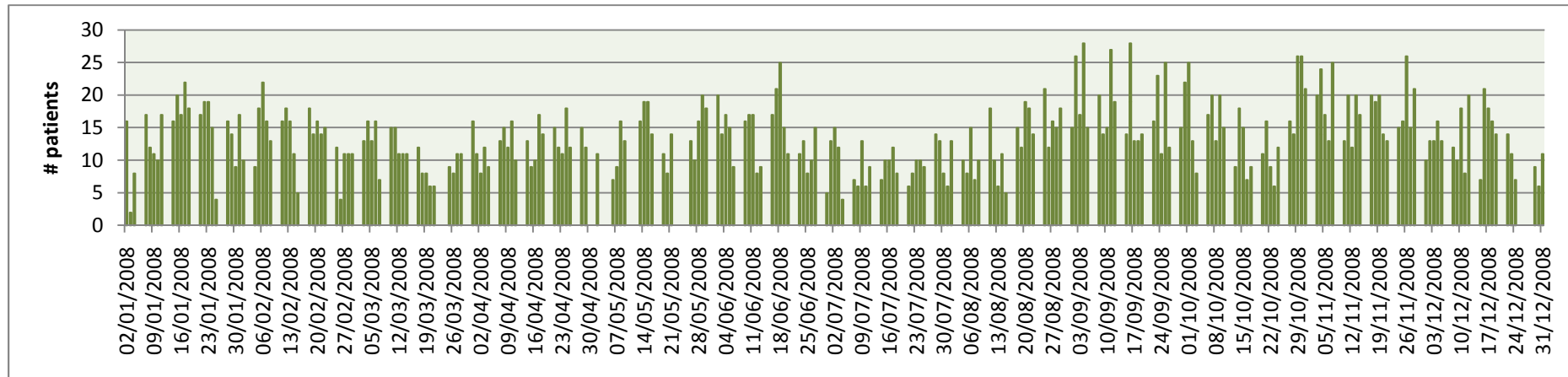


Figure D-2 Nr. of Outpatient surgeries at location Enschede (2008)

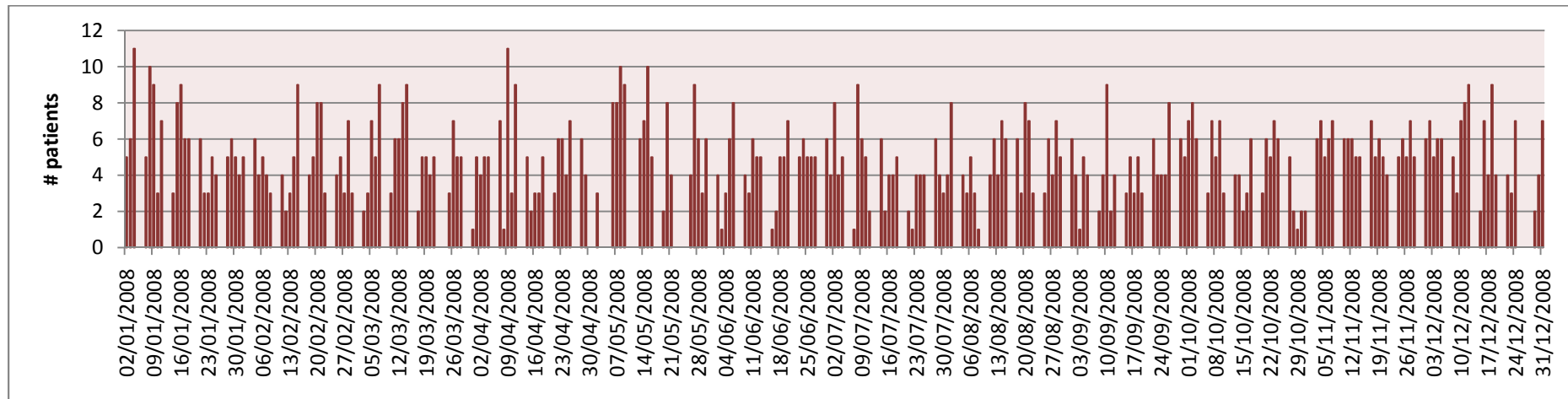


Figure D-3 Nr. of Emergency surgeries at location Enschede (2008)

Oldenzaal

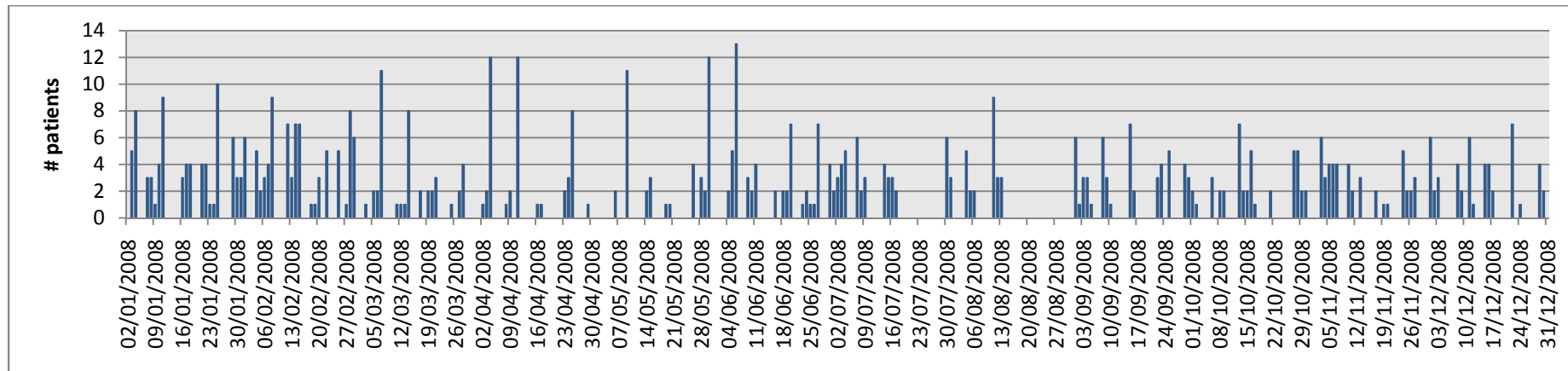


Figure D-4 Nr of inpatient surgeries in Oldenzaal (2008)

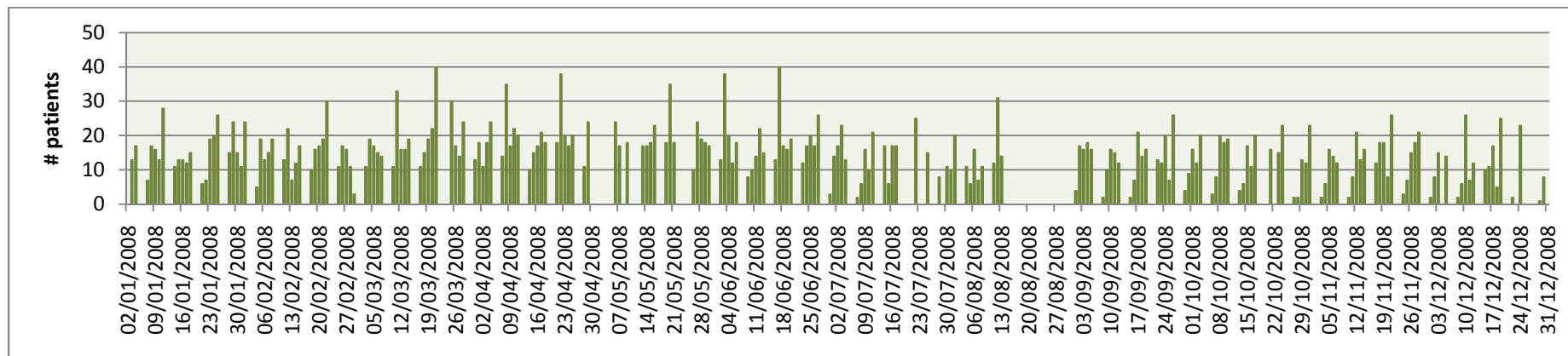


Figure D-5 Nr of outpatient surgeries in Oldenzaal (2008)

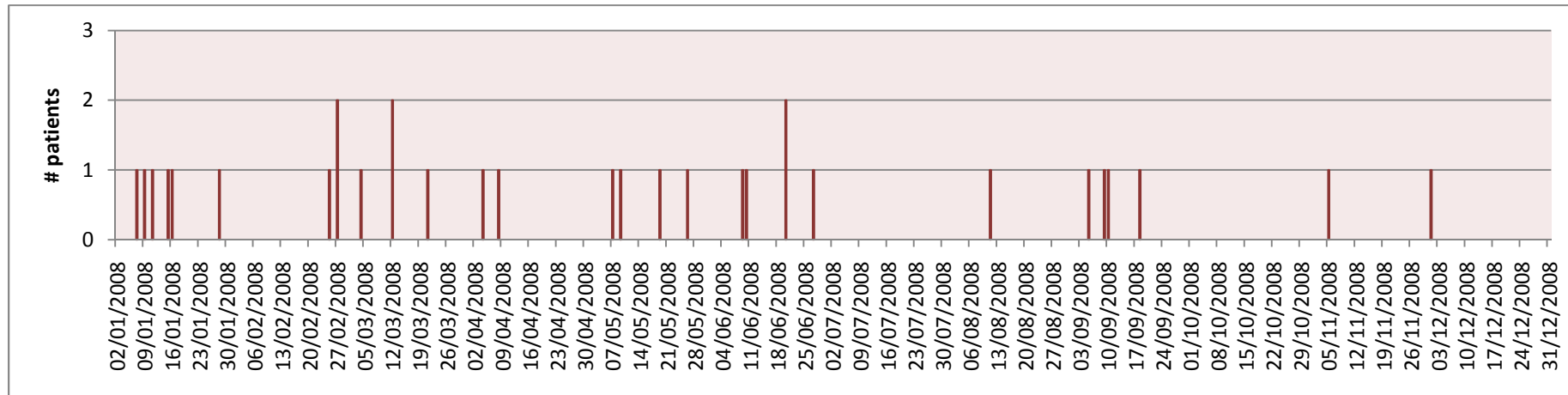


Figure D-6 Nr of emergency surgeries in Oldenzaal (2008)

D.2 Number of surgeries per weekday (clinical patients)

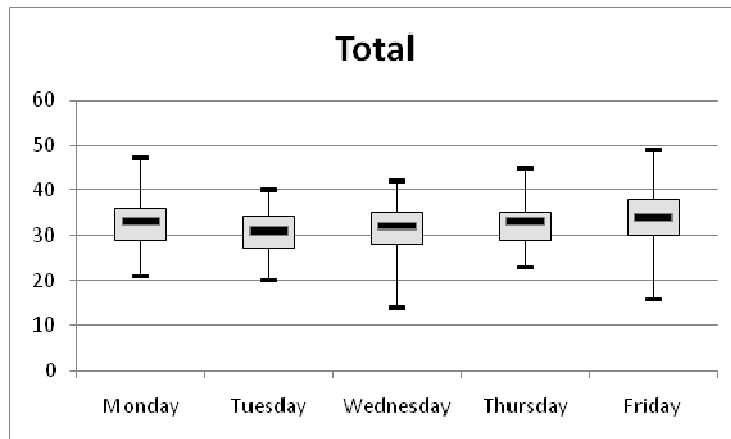


Figure D-7 Number of surgeries on clinical patients per weekday, all specialties (2008)

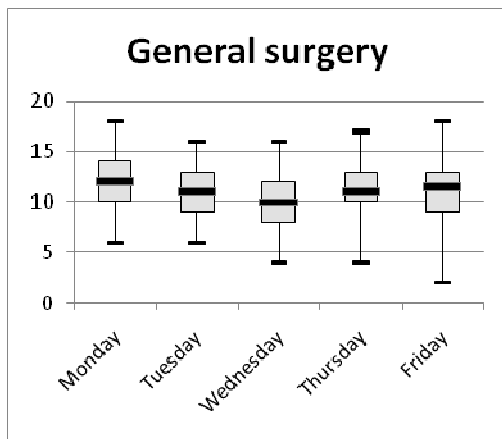


Figure D-8 Number of surgeries on clinical patients per weekday , general surgery (2008)

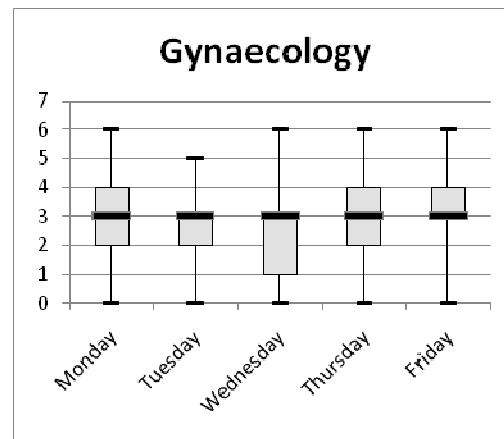


Figure D-9 Number of surgeries on clinical patients per weekday , Gynaecology (2008)

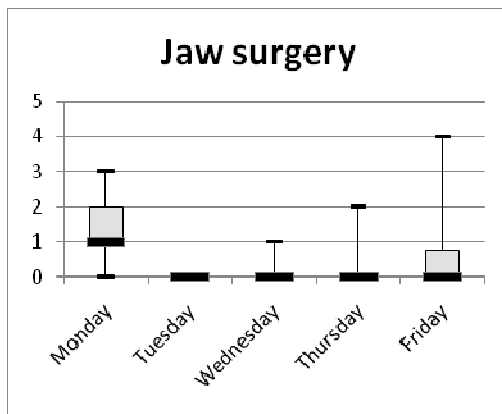


Figure D-10 Number of surgeries on clinical patients per weekday , Jaw surgery (2008)

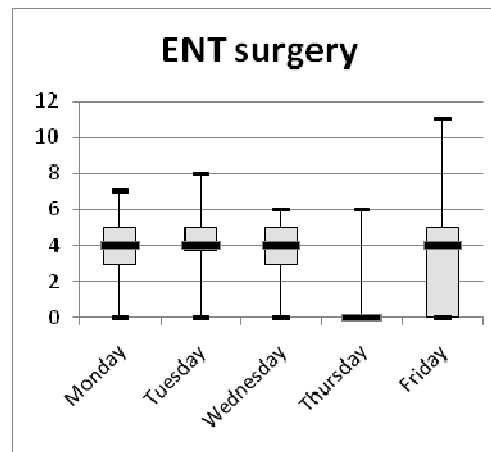


Figure D-11 Number of surgeries on clinical patients per weekday , ear-nose-throat surgery (2008)

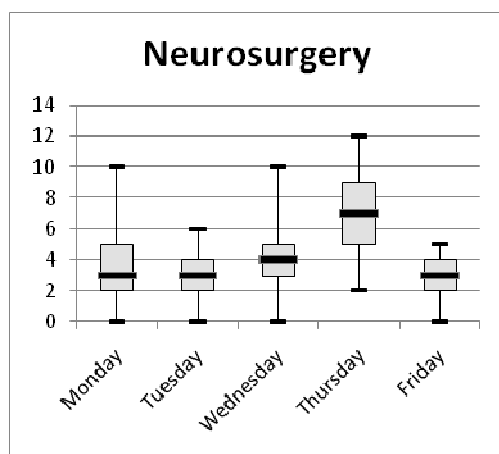


Figure D-12 Number of surgeries on clinical patients per weekday , neurosurgery (2008)

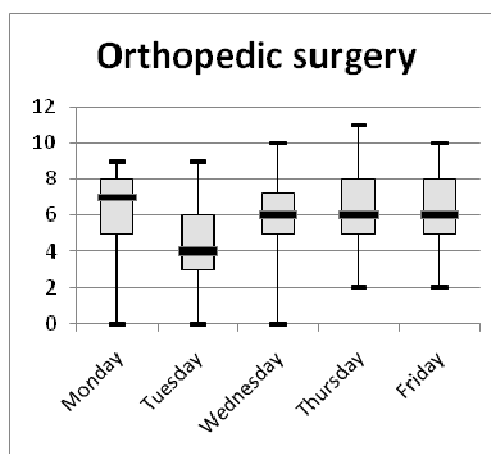


Figure D-13 Number of surgeries on clinical patients per weekday , orthopedic surgery (2008)

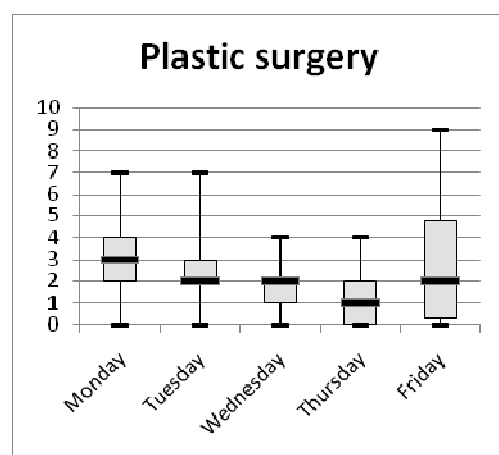


Figure D-14 Number of surgeries on clinical patients per weekday , plastic surgery (2008)

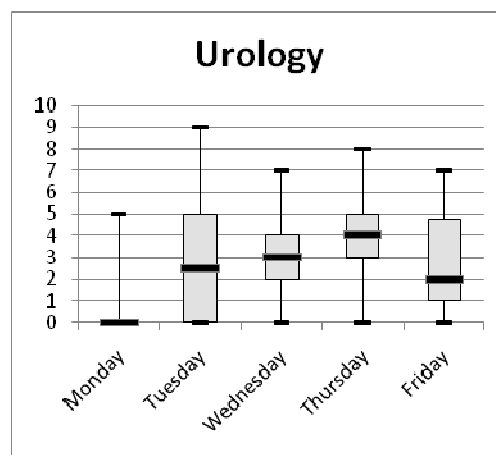


Figure D-15 Number of surgeries on clinical patients per weekday, orthopedic surgery (2008)

D.3 Admission per day

Figure D-16 shows the bed occupancy of the neurosurgical ward (B4). In 2009, the number of available (staffed) beds fluctuates between 16 and 20 beds. Although the number of available beds decreases, the number of occupied beds does not. This results in a large number of cases where the number of occupied beds exceeds the maximum number of available beds and even the number of beds present. In order to cope with these peaks in bed demand, temporary resources (beds, personnel) have to be applied. The number of beds occupied not only regularly exceeds the maximum capacity, it also regularly drops beneath 80% utilization. This large variation hinders an efficient use of available bedcapacity, and prevents an efficient deployment of human resources.

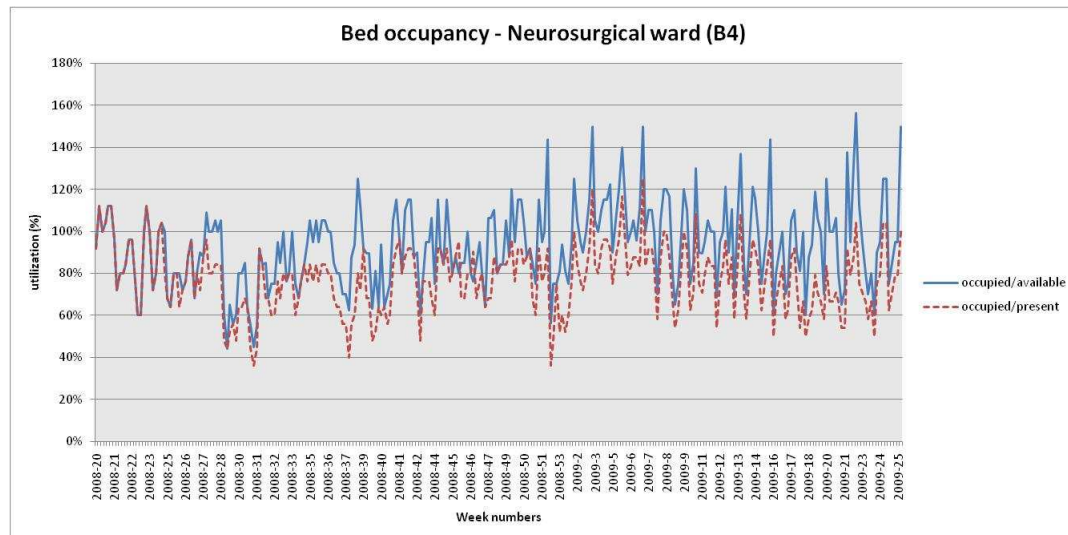


Figure D-16 Bed occupancy at neurosurgical ward.
Number of occupied beds / Number of available beds
Number of occupied beds / Number of beds physically present
Drops can be explained by
(Source: daily overview "Beddenoverzicht" May 2008 – June 2009)

Appendix E. Distributed sessions

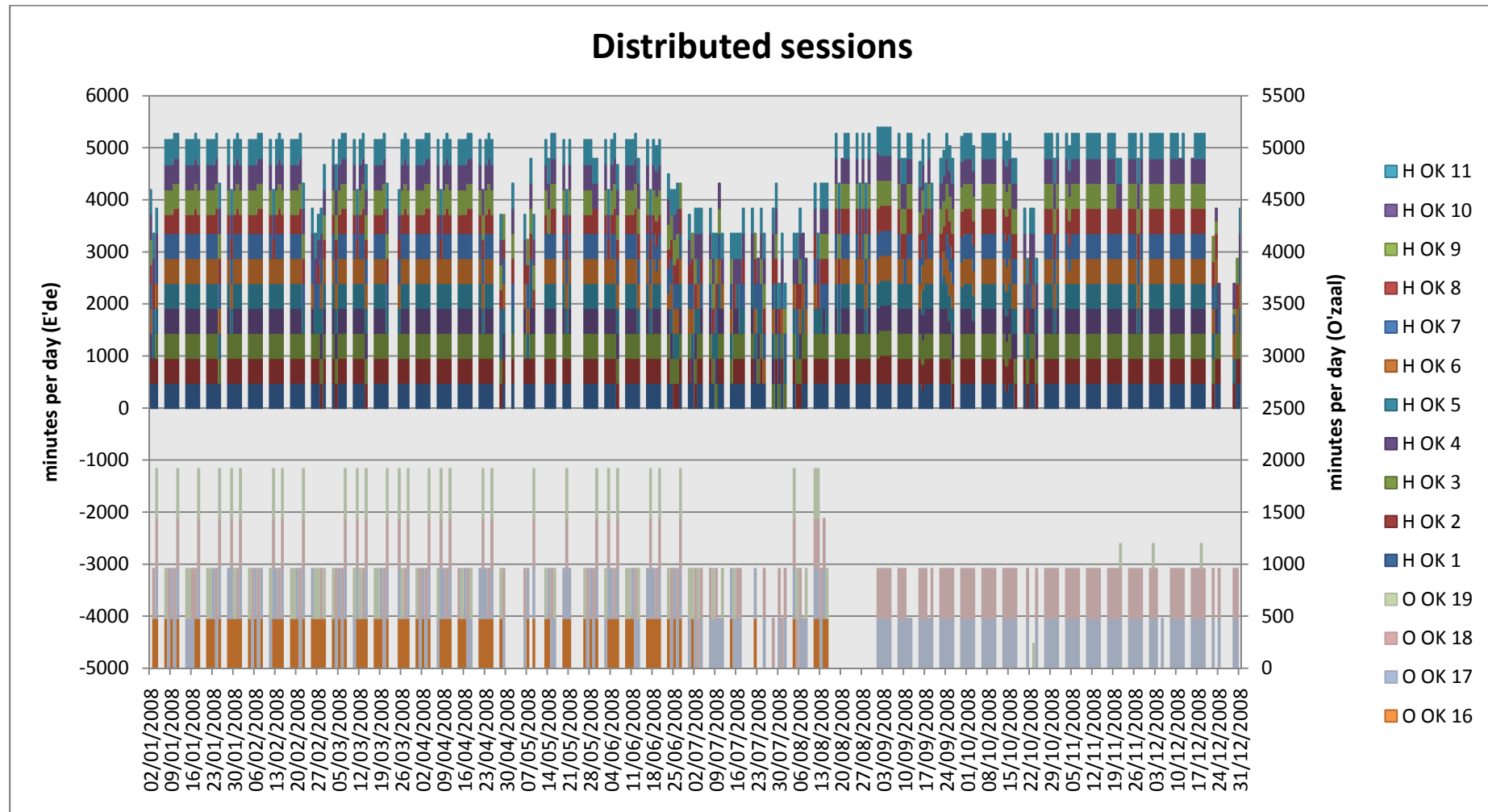


Figure E-1 Distributed sessions 2008 (source: data Blokplan)

Appendix F. Participating hospitals OR Benchmark Plexus

The following Hospital participated in Plexus OR benchmark ("Deelnemende ziekenhuizen OK-Benchmark," 2007):

Atrium Medisch Centrum	Zaans Medisch Centrum
Canisius-Wilhelmina Ziekenhuis	Ziekenhuis Bernhoven
Catharina Ziekenhuis Eindhoven	Ziekenhuis De Tjongerschans
Delfzicht Ziekenhuis	Ziekenhuis Gelderse Vallei
Elkerliek Ziekenhuis	Ziekenhuis Lievensberg
Haga Ziekenhuis	Ziekenhuis Rivierenland
IJsselmeerziekenhuizen	Ziekenhuis Walcheren
Ikazia Ziekenhuis	Ziekenhuisgroep Twente
Isala klinieken	
Jeroen Bosch Ziekenhuis	
Kennemer Gasthuis	
Laurentius Ziekenhuis	
Martini Ziekenhuis	
Máxima Medisch Centrum	
Meander Medisch Centrum	
Medisch Centrum Alkmaar	
Medisch Centrum Leeuwarden	
Medisch Centrum Rijnmond-Zuid	
Medisch Spectrum Twente	
Mesos Medisch Centrum	
Orbis Maaslandziekenhuis	
Reinier de Graaf Groep	
Rijnland Ziekenhuis	
Sint Anna Ziekenhuis	
Sint Elisabeth Ziekenhuis	
Sint Jans Gasthuis	
Sint Lucas Andreas Ziekenhuis	
Slingeland Ziekenhuis	
St. Antonius Ziekenhuis	
Stg. Oosterscheldeziekenhuizen	
Tweesteden Ziekenhuis	
Vlietland Ziekenhuis	

Appendix G. Emergency patients

Table G-1 and Figure G-1 show the time between a patient is registered in the planning software and the time the surgery took place. We use this value as an indicator for the urgency of the emergency patient's surgery. Fifteen of these 1371 surgeries are performed by two surgeons, both from another specialty. To prevent from taking these into account twice, both specialties count for 50%, hence the non integer values in Table G-1.

Table G-1 # emergency patients per specialty: time of surgery - time of registration in ORsuite (data of 2008)

Specialty	< 0	[0,2}	[2,6}	[6,12}	[12,24}	[24,48}	[48,168}	>=186	Sum
General surgery	14,5	175,5	272	29	170,5	126	47	7	841,5
Other	3	0	1,5	0	2	0	0	2	8,5
Special Dental surgery	0	0	1	0	0	0	2	0	3
Gynaecology	17	127	65	5	19	19,5	16	0	268,5
Jaw surgery	0	2	8	2	6	2	3,5	1	24,5
Jaw surgery (Old)	1	0	0	0	0	0	0	0	1
ENT	2	5	4,5	0	0,5	1	1	1	15
Neurosurgery	7	12	23	3	6	4	1	0	56
Eye surgery	2	0	3	0	2	1	2	4	14
Orthopedic surgery	2,5	12	37,5	10	6	5	0	0	73
Plastic surgery	4	7	14,5	5	1	3	0	2	36,5
Urology	2	9,5	8	0	3	2,5	2,5	2	29,5
Total	55	350	438	54	216	164	75	19	1371

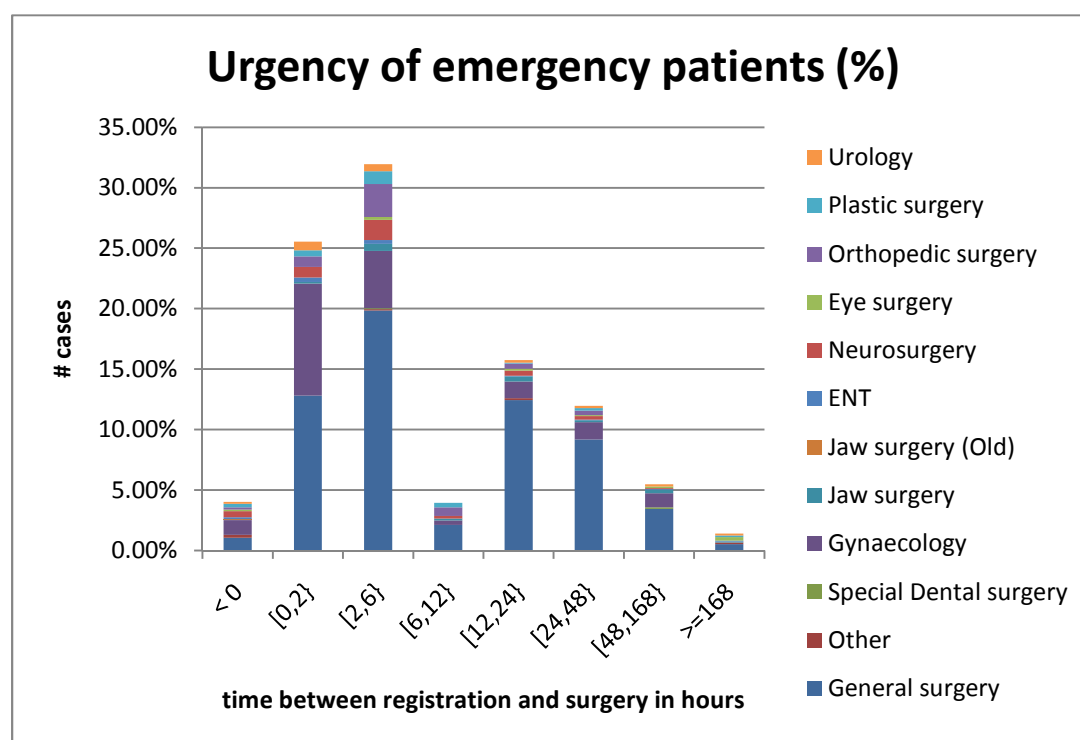


Figure G-1 Urgency of emergency patients (data 2008)

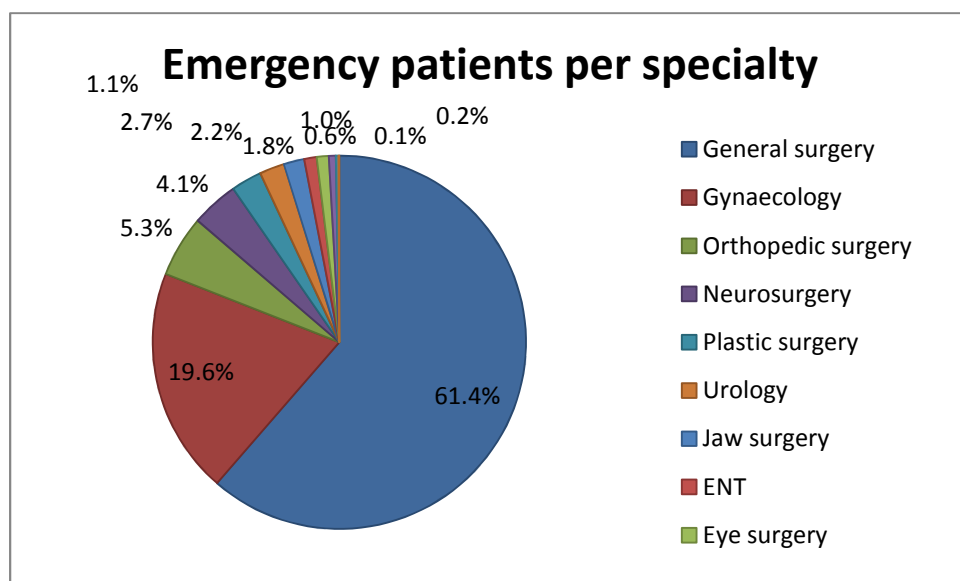


Figure G-2 Percentage of emergency patients per specialty (Data: MST general ORs, 2008)

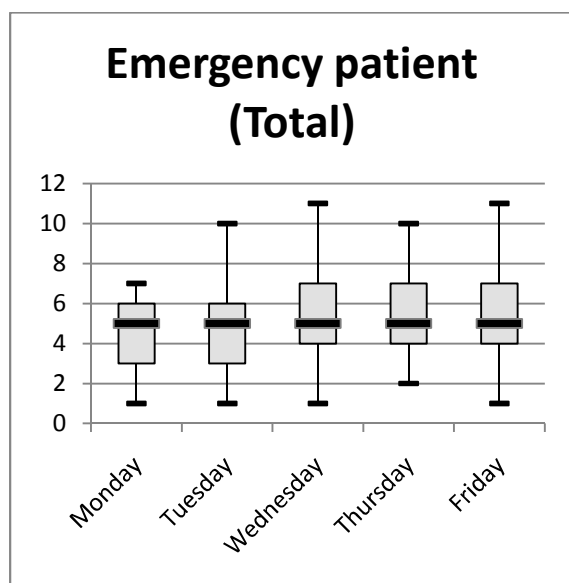


Figure G-3 Boxplot of number of emergency patients per weekday (Data: MST general ORs, 2008)

Appendix H. Surgery types

H.1 General surgery

Table H-1 Descriptive statistics general surgery (Data: MST general ORs, 2008)

Type	Description	N	Mean (minutes)	Median (minutes)	SDEV (minutes)	Min (minutes)	Max (minutes)	CV
CH-ALGE-015	Hernia inguinalis / lichtenstein plastiek / bzz / liesbreuk	305	69,37	66	20,96	30	166	0,30
CH-TRAU-067	Arthroscopie knie + menisectomie	213	50,92	49,00	13,11	29	101	0,26
CH-ENDO-17	Laparoscopische cholecystectomie	206	88,08	85,00	22,56	42	156	0,26
CH-ALGE-028	Lipoom / atheroom / zwelling exc	169	51,55	46	22,23	16	141	0,43
CH-MAMA-02	Excisie biopsie mamma + localisatie	124	54,38	49,00	23,77	27	193	0,44
CH-ABDO-07	Cholecystectomie	97	117,12	89	83,24	45	494	0,71
CH-ALGE-056	Carpaal tunnel syndroom / cts	80	36,95	36,50	6,39	20	52	0,17
CH-ALGE-052	Excisie fibro-adenoom	79	57,35	43,00	52,15	24	284	0,91
CH-VAAT-51	Cryostrip vsm	79	71,28	66,00	21,56	38	138	0,30
CH-ALGE-024	Haemorrhoidectomie	75	36,56	36	14,98	13	95	0,41
CH-MAMA-06	Mamma amputatie	69	111,99	109,00	22,99	68	182	0,21
CH-ALGE-070	Operatie recidief fistula ani	67	34,72	33,00	13,12	13	65	0,38
CH-ALGE-035	Verwijderen mergpen / cerclage / k-draad	66	48,91	40	24,00	18	148	0,49
CH-ALGE-053	Excisie middel / grote tumor	64	61,69	45,00	57,62	21	332	0,93
CH-ABDO-12	Hemicolectomie	62	133,55	132	34,21	68	227	0,26
CH-ALGE-021	Sinus pilonidalis	57	46,58	44	13,23	22	84	0,28
CH-MAMA-08	Ablatio mamma + sentinal node / sn	57	91,77	89,00	18,64	65	149	0,20
CH-VAAT-59	Cryostrip vsm + conv.	57	73,04	70,00	25,04	38	142	0,34
CH-ALGE-013	Hernia umbilicalis > 12jaar	56	57,98	51	23,35	31	132	0,40
CH-ALGE-033	Verwijderen plaat en schroeven	52	76,85	66	38,79	19	232	0,50
CH-TRAU-019	Arthroscopie knie	49	39,39	38,00	10,58	24	87	0,27
CH-MAMA-05	Ablatio mamma	45	137,60	132,00	53,45	58	338	0,39
CH-ABDO-18	Low anterior resectie	43	163,44	146	74,88	100	536	0,46
CH-ALGE-017	Recidief hernia inguinalis	41	80,15	76	25,79	34	183	0,32
CH-THOR-07	Mediastinoscopie	38	82,82	80,50	17,66	51	121	0,21
CH-ALGE-036	Port a cath inbrengen	37	76,16	72	23,48	44	165	0,31
CH-ALGE-106	Thd procedure	34	35,38	34,00	11,81	16	73	0,33
CH-VAAT-15	Infra genuale fem-pop	34	269,12	240,00	99,03	141	593	0,37
CH-ALGE-002	Diagnostische lymfeklierextractie supr / infra claviculair	33	73,94	63	42,54	28	219	0,58
CH-ALGE-022	Grote en/of gecompliceerde huidtransplantatie	33	70,06	62	28,61	28	180	0,41
CH-VAAT-07	Crossectomie	33	91,42	82,00	33,75	44	217	0,37
CH-ALGE-034	Verwijderen schroeven	32	53,56	44	31,67	26	163	0,59
CH-MAMA-03	Mso + lymfeklier extirpatie	32	83,22	81,50	18,55	53	127	0,22
CH-ALGE-012	Hernia cicatricialis / littekenbreuk	31	97,10	87	44,71	29	228	0,46
CH-ALGE-126	Versajet	31	46,97	47,00	13,40	22	81	0,29
CH-THOR-03	Lobectomie	31	217,55	210,00	46,25	137	318	0,21
CH-ALGE-025	Excisie skin-tags / marisken	30	26,20	24	10,56	11	48	0,40
CH-ALGE-042	Amputatie voorvoet	30	56,37	45,00	38,72	30	241	0,69
CH-VAAT-20	Aanleggen ciminoshunt	30	96,60	83,00	37,70	57	231	0,39
CH-VAAT-40	Carotis desobstructie	30	151,40	143,50	32,05	105	209	0,21
CH-ALGE-007	Lieskliertoilet	29	101,79	85	47,08	48	220	0,46
CH-ALGE-026	Botox injectie	29	19,21	16	11,70	7	58	0,61

Improving elective OR planning at general ORs of Medisch Spectrum Twente - Appendix

CH-HOHA-05	Hemi thyreoïdectomie	29	124,24	122,00	40,63	55	220	0,33
CH-TRAU-021	Semitendinosus	29	94,34	96,00	14,83	74	136	0,16
CH-VAAT-11	Varices strippen vsp	27	60,07	60,00	20,30	33	103	0,34
CH-ALGE-001	Verwijderen ganglion	26	54,08	47	26,69	23	129	0,49
CH-ABDO-08	Colonresectie	24	159,71	134	83,68	69	445	0,52
CH-VAAT-24	Aortabifurcatieprothese	24	266,58	266,50	73,19	129	450	0,27
CH-ABDO-28	Rectum amputatie	23	189,70	174	53,63	126	299	0,28
CH-ABDO-44	Dunne darm resectie	22	146,55	124	88,51	66	375	0,60
CH-ALGE-027	Peri-anaal abces	21	35,95	33	15,69	17	75	0,44
CH-ABDO-27	Rectosigmoid resectie	20	171,70	162	67,72	74	324	0,39
CH-ALGE-097	Fissura ani	20	20,45	19,50	9,89	8	45	0,48
CH-ABDO-02	Opheffen anus preternaturalis / ap	18	148,44	120	82,02	69	353	0,55
CH-ABDO-31	Sigmoidresectie	18	127,67	126	42,75	63	194	0,33
CH-VAAT-02	Anaconda	18	249,78	216,00	116,74	152	650	0,47
CH-ALGE-008	Excisie melanoom + sentinal node / sn	17	91,59	86	26,00	60	158	0,28
CH-VAAT-16	Supra genuale fem-pop	17	200,29	190,00	50,13	131	321	0,25
CH-VAAT-41	Aortografie	17	309,06	286,00	178,49	83	721	0,58
CH-ENDO-15	Laparoscopische coeliaca release	16	169,19	168,50	30,08	117	224	0,18
CH-ABDO-29	Kwabresectie lever	15	232,80	217	67,47	150	378	0,29
CH-ABDO-37	Proeflaparotomie	15	87,33	78	40,12	47	221	0,46
CH-ALGE-016	Hernia epigastrica	15	57,27	49	25,74	23	122	0,45
CH-ALGE-075	Operatie fistula ani	15	26,53	26,00	7,25	16	44	0,27
CH-ENDO-13	Laparoscopische hernia cicatricialis	15	104,67	105,00	22,20	81	167	0,21
CH-MAMA-04	Conus excisie van de mamma	15	46,53	46,00	10,58	30	70	0,23
CH-VAAT-28	Crawford	15	282,07	270,00	66,65	204	458	0,24
CH-ABDO-70	Aanleggen van een anus preternaturalis / open procedure	14	98,57	94	43,49	53	204	0,44
CH-MAMA-07	Excisie biopsie mamma + sentinal node / sn + rontgen localisatie	14	75,14	68,50	19,49	51	122	0,26
CH-TRAU-034	Excisie bursa olecrani	14	46,36	45,00	13,12	29	70	0,28
CH-ABDO-48	Subtotale colectomie	13	153,08	149	47,44	106	287	0,31
CH-MAMA-15	Okselklier dissectie	13	84,15	83,00	20,84	46	120	0,25
CH-TRAU-056	Clavicula fractuur ao	13	77,38	75,00	17,53	53	118	0,23
CH-VAAT-17	Femoro - crurale bypass	13	285,38	296,00	101,54	172	470	0,36
CH-ABDO-03	Appendectomie	12	83,17	68	37,87	48	174	0,46
CH-ABDO-19	Oesophagusresectie ca	12	264,50	240	81,29	153	418	0,31
CH-ALGE-005	Inbrengen capd	12	63,33	54	23,56	41	122	0,37
CH-ALGE-039	Amputatie onderbeen	12	101,17	95,50	34,52	72	204	0,34
CH-ALGE-066	Circumcisie	12	54,08	41,00	33,26	28	143	0,61
CH-ENDO-26	Geconverteerde galblaas	12	127,00	121,00	31,41	91	212	0,25
CH-HOHA-02	Totale parotidectomie	12	137,17	119,00	55,70	61	252	0,41
CH-HOHA-16	Subtotale parotidectomie	12	141,33	139,50	31,46	100	211	0,22
CH-TRAU-094	Metacarpaal fractuur	12	47,25	44,50	16,97	25	82	0,36
CH-VAAT-43	Reconstructie perifere slagader met transplantaat of patch	12	191,17	184,50	98,98	69	464	0,52
CH-ABDO-42	Platzbauch	11	107,00	117	29,00	62	146	0,27
CH-ALGE-047	Re-excisie melanoom	11	49,55	48,00	12,17	34	78	0,25
CH-ALGE-089	Matig / grote gecompliceerde transpositie	11	59,18	56,00	8,77	48	78	0,15
CH-ALGE-093	Amputatie in de voetwortel	11	64,09	67,00	17,97	30	91	0,28
CH-ALGE-125	Peri-anaal fistel	11	27,55	26,00	14,07	5	62	0,51
CH-ENDO-19	Laparoscopische appendectomie	11	75,73	73,00	12,78	60	98	0,17
CH-TRAU-016	Achillespeesruptuur	11	59,91	64,00	14,97	34	83	0,25
CH-ALGE-032	Abces incisie	10	99,30	47	135,01	15	463	1,36
CH-ALGE-067	Lymfeklier extirpatie regionaal	10	64,80	52,50	38,20	28	150	0,59

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CH-TRAU-008	Tibiaplateaufractuur	10	113,60	109,00	39,43	54	203	0,35
CH-TRAU-011	Enkelfractuur weber b lcp	10	89,50	89,00	27,71	50	137	0,31
CH-TRAU-030	Radiusfractuur	10	84,90	81,00	29,88	27	127	0,35
CH-TRAU-040	Externe fixateur hoffmann pols	10	77,10	81,50	18,98	54	108	0,25
CH-ABDO-06	Buik spoelen	9	124,00	96	70,13	58	298	0,57
CH-ABDO-10	Gastro-enterostomie	9	129,00	132	38,59	73	182	0,30
CH-ABDO-22	Partiele maagresectie	9	126,22	115	45,36	87	238	0,36
CH-ALGE-003	Eerste rib resectie	9	93,22	83	29,74	55	147	0,32
CH-ALGE-037	Port a cath verwijderen	9	49,22	45	22,42	25	104	0,46
CH-ALGE-045	Hall procedure	9	35,11	36,00	9,23	23	51	0,26
CH-ALGE-085	Operatieve behandeling tendovaginitis stenosans	9	40,00	39,00	8,89	25	52	0,22
CH-ENDO-03	Recidief laparoscopische hernia inguinalis	9	73,78	65,00	18,53	50	108	0,25
CH-VAAT-08	Crossectomie + korte strip	9	79,56	65,00	32,15	48	142	0,40
CH-VAAT-47	Korte strip vsm + convoluten	9	84,11	81,00	21,69	46	119	0,26
CH-ABDO-53	Debulking	8	268,63	285	65,72	168	336	0,24
CH-ABDO-61	Endoscopische hernia umbilicalis	8	84,13	77	20,26	63	120	0,24
CH-ALGE-062	Excisie tumor (bijv. sarcoom / melanoom / etc.)	8	90,13	75,50	51,71	45	201	0,57
CH-ALGE-064	Lies desobstructie	8	190,38	200,50	48,16	125	250	0,25
CH-ALGE-072	Ruptuur collaterale banden mcp gewricht / trigger vinger	8	51,75	50,50	8,75	41	63	0,17
CH-ALGE-122	Operatie voor aneurysma of arterioveneuze fistels	8	150,63	116,00	109,65	57	402	0,73
CH-ALGE-124	Verbeteren stomp van grote ledematen	8	91,00	79,00	39,22	42	166	0,43
CH-HOHA-11	Mediane halscyste / halsfistel	8	66,38	62,50	15,68	44	92	0,24
CH-THOR-13	Endoscopische bullectomie	8	123,00	127,50	32,56	83	186	0,26
CH-VAAT-01	Talent	8	204,75	192,00	60,76	141	276	0,30
CH-VAAT-23	Loopfistel arm / graez fistel	8	85,25	81,00	20,01	53	116	0,23
CH-VAAT-61	Endurant prothese	8	188,00	172,50	60,29	127	312	0,32
CH-ABDO-11	Hartmann procedure	7	219,29	187	98,83	118	407	0,45
CH-ABDO-13	Hemihepatectomie	7	216,00	215	39,54	152	275	0,18
CH-ABDO-15	Ileocoecalresectie	7	112,00	116	16,58	87	132	0,15
CH-ALGE-082	Sluiten wond	7	48,00	40,00	17,76	28	76	0,37
CH-ALGE-095	Gynaecomastie	7	71,00	53,00	41,88	40	160	0,59
CH-ENDO-18	Diagnostische laparoscopie	7	61,43	60,00	13,11	48	86	0,21
CH-TRAU-002	Heup fractuur - kophals prothese	7	106,57	103,00	14,39	89	133	0,13
CH-TRAU-026	Subcapitale humerus fractuur lcp lphp	7	124,43	112,00	48,73	58	208	0,39
CH-TRAU-037	Vingerfractuur k-draden	7	65,43	63,00	23,00	41	110	0,35
CH-TRAU-113	Verwijderen osm uit enkel	7	57,00	56,00	20,01	29	93	0,35
CH-TRAU-127	Pseudoarthrose schoudergordel	7	164,57	133,00	82,77	105	340	0,50
CH-VAAT-25	Aortabuisprothese	7	264,29	226,00	96,27	176	447	0,36
CH-VAAT-60	Fem pop	7	215,29	225,00	52,43	147	292	0,24
CH-ALGE-019	Fasciotomie	6	72,67	65	36,81	39	137	0,51
CH-HOHA-07	Parathyreoïdectomie	6	136,67	142,50	62,52	62	214	0,46
CH-TRAU-025	Humerusschacht fractuur t2 pen	6	138,50	119,00	43,47	104	210	0,31
CH-TRAU-033	Olecranon fractuur cerclage	6	77,83	73,00	21,40	55	113	0,28
CH-VAAT-10	Varices strippen vsm	6	74,00	70,50	21,03	46	111	0,28
CH-VAAT-14	Fem-fem crossover	6	130,17	134,50	54,54	34	195	0,42
CH-VAAT-19	Aanleggen shunt arm met bypass	6	108,50	109,00	35,97	50	158	0,33
CH-VAAT-21	Opheffen av shunt	6	48,17	46,00	7,19	42	62	0,15
CH-VAAT-52	Convolutectomie	6	75,50	74,50	20,31	45	105	0,27
CH-ABDO-38	Splenectomie / miltextirpatie	5	180,80	118	177,95	53	495	0,98
CH-ABDO-43	Pancreas extirpatie	5	169,20	175	22,33	142	198	0,13

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CH-ABDO-64	Gastrostomie (open procedure)	5	69,80	55	30,87	45	121	0,44
CH-ALGE-043	Amputatie teen	5	166,40	218,00	108,89	30	272	0,65
CH-ALGE-059	Hernia diafragmatica, abdominaal funduplicatie vlg's nissen	5	106,20	98,00	13,74	93	123	0,13
CH-ALGE-060	Vasectomie	5	42,20	42,00	7,29	34	50	0,17
CH-ALGE-081	Lumbale sympnectomie	5	68,20	64,00	9,31	61	84	0,14
CH-ALGE-114	Pseudoarthrose elleboog	5	127,00	133,00	26,80	97	159	0,21
CH-ENDO-10	Laparoscopische colonresectie	5	197,20	191,00	50,92	147	272	0,26
CH-TRAU-022	Epicondylitis	5	45,20	46,00	6,69	37	53	0,15
CH-TRAU-051	Polsfractuur ao	5	64,40	52,00	29,04	38	113	0,45
CH-TRAU-052	Polsfractuur lcp	5	73,40	74,00	21,22	46	101	0,29
CH-TRAU-061	Humerusfractuur lcp	5	144,40	127,00	33,53	112	191	0,23
CH-TRAU-078	Verwijderen schroeven malleolus	5	33,20	32,00	3,90	29	39	0,12
CH-TRAU-081	Verwijderen plaat / schroef uit enkel	5	52,00	46,00	14,42	41	77	0,28
CH-TRAU-103	Epicondylaire humerusfractuur	5	92,20	84,00	34,11	64	150	0,37
CH-VAAT-13	Varices vsp + convoluten	5	73,40	70,00	29,79	44	119	0,41
CH-VAAT-18	Desobstructie afc	5	192,80	155,00	96,91	97	340	0,50
CH-VAAT-55	Operatieve behandeling chronische veneuze insufficiëntie van een been	5	86,40	101,00	29,24	49	117	0,34
CH-ABDO-17	Ileus operatie zonder resectie of anastomose	4	122,00	120	24,10	98	151	0,20
CH-ABDO-23	Totale maagresectie	4	265,00	269	50,35	202	320	0,19
CH-ABDO-55	Entero-anastomose operatie	4	101,75	110	28,69	62	126	0,28
CH-ABDO-65	Sluiten ap anus praeternaturalis extraperitoneaal	4	81,50	74	23,07	64	115	0,28
CH-ALGE-009	Klieven frenulum tong	4	16,50	16	5,80	10	24	0,35
CH-ALGE-023	Behandeling haemorrhoiden dmv manuele dilatatie	4	32,00	30	17,32	15	53	0,54
CH-ALGE-030	Tracheostomie	4	70,25	71	12,84	55	84	0,18
CH-ALGE-046	Hernia femoralis	4	50,00	50,50	5,35	43	56	0,11
CH-ALGE-076	Verwijdering krammen	4	44,50	44,50	2,38	42	47	0,05
CH-ALGE-102	Spermatocele	4	47,75	52,00	9,88	33	54	0,21
CH-ALGE-109	Openbeïtelen bot voor diagnostische doeleinden	4	39,50	34,50	14,06	29	60	0,36
CH-ENDO-20	Laparoscopische hernia inguinalis	4	83,00	83,00	11,11	70	96	0,13
CH-HOHA-19	Halsklier dissectie	4	130,00	129,00	22,73	109	153	0,17
CH-MAMA-01	Okselklier toilet	4	100,75	82,50	38,89	79	159	0,39
CH-TRAU-003	Femurfractuur t2 pen	4	153,50	147,00	45,23	110	210	0,29
CH-TRAU-006	Acetabulum fractuur	4	224,50	218,00	35,09	190	272	0,16
CH-TRAU-012	Enkelfractuur weber b ao	4	67,00	66,50	18,49	51	84	0,28
CH-TRAU-020	Excisie bursa prepatellaris	4	53,00	50,50	13,29	40	71	0,25
CH-TRAU-031	Ulnafractuur	4	85,00	77,00	31,35	58	128	0,37
CH-TRAU-086	Verwijderen plaat / schroef uit femur	4	75,75	66,00	31,19	50	121	0,41
CH-TRAU-090	Verwijderen plaat / schroef uit pols	4	47,50	49,00	10,12	36	56	0,21
CH-TRAU-110	Behandeling bi of tri malleolaire enkelfractuur	4	77,50	79,00	22,75	52	100	0,29
CH-TRAU-123	Kleine of weinig gecompliceerde transpositie gesteed	4	47,25	47,50	14,36	30	64	0,30
CH-TRAU-132	Hechten patellapees	4	106,50	101,50	22,25	86	137	0,21
CH-VAAT-03	Aaaa / acuut aneurysma aorta abdominalis	4	183,75	200,50	50,51	112	222	0,27
CH-VAAT-06	Embolectomie been	4	223,25	227,50	57,48	149	289	0,26
CH-VAAT-12	Varices vsm + convoluten	4	69,25	56,50	31,03	49	115	0,45
CH-VAAT-32	Endoprothese	4	157,00	156,50	18,24	139	176	0,12
CH-VAAT-38	Desobstructie aie	4	198,25	185,50	41,35	164	258	0,21
CH-VAAT-45	Antegrade 2-taks reconstructie ac - ams supra coelicale klem	4	440,50	465,50	163,72	219	612	0,37
CH-ABDO-33	Totale colectomie	3	157,33	163	51,73	103	206	0,33

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CH-ABDO-35	Whipple	3	283,00	278	37,75	248	323	0,13
CH-ABDO-54	Enterotomie als onderdeel van een laparotomie	3	122,00	130	29,82	89	147	0,24
CH-ALGE-014	Hernia umbilicalis < 12jaar	3	59,00	60	4,58	54	63	0,08
CH-ALGE-020	Nagelextractie	3	33,67	27	17,01	21	53	0,51
CH-ALGE-029	Vrij huid transplantaat / ssg / split skin graft	3	68,67	61	14,15	60	85	0,21
CH-ALGE-077	Excochleatie en/of sequestrectomie van grote beenderen	3	72,00	58,00	25,12	57	101	0,35
CH-ALGE-087	Resectie rectumprolaps anaal	3	76,00	83,00	23,30	50	95	0,31
CH-ALGE-094	Partiele nagelbedexcisie	3	31,67	30,00	3,79	29	36	0,12
CH-ALGE-098	Release synostose	3	90,67	46,00	95,21	26	200	1,05
CH-ALGE-105	Operatieve behandeling van een fractuur van het caput radii + prothese	3	88,00	90,00	28,05	59	115	0,32
CH-ALGE-116	Para-aortale lymfeklieruitruiming	3	176,33	211,00	62,66	104	214	0,36
CH-ALGE-120	Verkrijgen van autotransplantaat van kleine beenderen	3	118,00	107,00	30,05	95	152	0,25
CH-ALGE-146	Hydradenitis	3	57,33	60,00	9,29	47	65	0,16
CH-ENDO-11	Laparoscopisch aanleggen anus preternaturalis / ap	3	96,67	72,00	42,72	72	146	0,44
CH-ENDO-22	Laparoscopische sigmoidresectie	3	212,67	192,00	42,91	184	262	0,20
CH-HOHA-03	Radicale halsklierauitruiming	3	246,00	257,00	31,95	210	271	0,13
CH-HOHA-10	Extirpatie laterale halscyste	3	50,33	49,00	9,07	42	60	0,18
CH-MAMA-09	Excisie biopsie mamma	3	42,67	41,00	4,73	39	48	0,11
CH-THOR-04	Pneumonectomie	3	220,33	232,00	32,13	184	245	0,15
CH-THOR-05	Vats	3	123,67	107,00	43,47	91	173	0,35
CH-THOR-08	Open longbiopsie	3	124,33	99,00	52,78	89	185	0,42
CH-THOR-11	Decorticatie long	3	178,67	187,00	14,43	162	187	0,08
CH-TRAU-005	Bekken fractuur ao	3	144,33	109,00	81,00	87	237	0,56
CH-TRAU-010	Cruisfractuur	3	113,33	131,00	43,29	64	145	0,38
CH-TRAU-045	Externe fixateur orthofix pols	3	72,67	88,00	28,31	40	90	0,39
CH-TRAU-065	Transfix voorste kruisbandreconstructie / vkb	3	100,67	100,00	4,04	97	105	0,04
CH-TRAU-105	Bennettfractuur	3	60,00	53,00	16,64	48	79	0,28
CH-TRAU-107	Reefplastiek enkel	3	51,33	52,00	3,06	48	54	0,06
CH-TRAU-118	Operatieve behandeling femur fractuur	3	112,00	106,00	13,08	103	127	0,12
CH-TRAU-126	Supra-of intracondylaire humerus fractuur	3	124,00	136,00	48,14	71	165	0,39
CH-TRAU-137	Quadriceps ruptuur	3	71,67	56,00	41,77	40	119	0,58
CH-TRAU-143	Pseudarthrose met beentransplantaat /verlengen onderbeen	3	124,33	139,00	63,29	55	179	0,51
CH-TRAU-146	Verwijderen exostosen van middelgrote beenderen	3	35,67	31,00	9,87	29	47	0,28
CH-VAAT-05	Embolectomie arm	3	176,67	193,00	32,72	139	198	0,19
CH-VAAT-09	Perforantectomie	3	46,67	51,00	7,51	38	51	0,16
CH-VAAT-22	Reconstructie av shunt	3	108,00	91,00	68,11	50	183	0,63
CH-VAAT-46	Inbrengen aortabifurcatieprothese inclusief nierarterie reconstructie	3	287,33	302,00	107,75	173	387	0,38
CH-ABDO-09	Leverruptuur / abces / cysten	2	121,00	121	82,02	63	179	0,68
CH-ABDO-14	Hepatico-jejunostomie	2	107,50	108	51,62	71	144	0,48
CH-ABDO-20	Reconstructie ap	2	60,50	61	24,75	43	78	0,41
CH-ABDO-30	Second look laparotomie	2	75,50	76	16,26	64	87	0,22
CH-ABDO-45	Enterotomie eventueel verwijderen poliepen / copora aliena	2	119,50	120	88,39	57	182	0,74
CH-ABDO-49	Therapeutische laparoscopie	2	51,50	52	10,61	44	59	0,21
CH-ABDO-50	Primair openen galwegen	2	213,50	214	96,87	145	282	0,45
CH-ABDO-60	Reconstructie anus praeternaturalis	2	49,50	50	10,61	42	57	0,21
CH-ABDO-66	Pancreas operatie	2	86,50	87	27,58	67	106	0,32
CH-ABDO-69	Cholecystectomie incl. choledochotomie	2	198,00	198	48,08	164	232	0,24

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CH-ALGE-055	Huidtransplantaat matig / groot	2	56,50	56,50	2,12	55	58	0,04
CH-ALGE-071	Miltexirpatie als onderdeel van een laparotomie om andere redenen	2	298,50	298,50	68,59	250	347	0,23
CH-ALGE-078	Recidief peri-anale fistel	2	27,00	27,00	5,66	23	31	0,21
CH-ALGE-090	Behandeling haemorrhoiden	2	27,00	27,00	9,90	20	34	0,37
CH-ALGE-107	Operatieve behandeling wervelfractuur	2	128,00	128,00	33,94	104	152	0,27
CH-ALGE-111	Amputatie vinger	2	39,50	39,50	10,61	32	47	0,27
CH-ALGE-112	Neurolyse van een zenuw zonder microscoop	2	68,00	68,00	38,18	41	95	0,56
CH-ALGE-117	Orchidopexie	2	53,00	53,00	7,07	48	58	0,13
CH-ALGE-119	Openbeitelen voor diagnostiek van middelgrote beenderen	2	42,00	42,00	4,24	39	45	0,10
CH-ALGE-123	Hydrocele/scrotaalbreuk	2	123,50	123,50	33,23	100	147	0,27
CH-ALGE-149	Seton drainage	2	60,00	60,00	43,84	29	91	0,73
CH-ALGE-150	Recidief seton drainage	2	36,50	36,50	10,61	29	44	0,29
CH-ENDO-01	Laparoscopisch opheffen hartmann	2	159,00	159,00	32,53	136	182	0,20
CH-ENDO-21	Laparoscopische bijnier verwijderen	2	183,00	183,00	63,64	138	228	0,35
CH-ENDO-27	Laparoscopische hemicolectomie	2	136,00	136,00	9,90	129	143	0,07
CH-HOHA-01	Para-thyreoidectomie + vriescoupe + re-implantatie in onderarm	2	183,50	183,50	72,83	132	235	0,40
CH-HOHA-04	Totale thyreoïdectomie	2	197,00	197,00	21,21	182	212	0,11
CH-HOHA-09	Extirpatie bij schildklier	2	78,50	78,50	13,44	69	88	0,17
CH-HOHA-14	Aandeel chirurg bij commando operatie	2	565,00	565,00	29,70	544	586	0,05
CH-MAMA-10	Lumpectomie mamma + localisatie + sentinel node	2	88,00	88,00	26,87	69	107	0,31
CH-THOR-02	Proefthoracotomie	2	302,50	302,50	140,71	203	402	0,47
CH-TRAU-014	Bandlaesie enkel	2	68,00	68,00	14,14	58	78	0,21
CH-TRAU-018	Jonesfractuur	2	60,50	60,50	10,61	53	68	0,18
CH-TRAU-024	Clavicula fractuur lcp	2	87,00	87,00	15,56	76	98	0,18
CH-TRAU-055	Enkelfractuur weber c ao	2	72,00	72,00	5,66	68	76	0,08
CH-TRAU-059	Femurfractuur lcp	2	172,00	172,00	12,73	163	181	0,07
CH-TRAU-060	Femurfractuur ao	2	143,50	143,50	68,59	95	192	0,48
CH-TRAU-068	Arthroskopische tibiaplateaufractuur	2	98,00	98,00	5,66	94	102	0,06
CH-TRAU-070	Uithalen t2 pen tibia	2	91,50	91,50	28,99	71	112	0,32
CH-TRAU-079	Verwijderen plaat / schroef uit onderarm	2	62,50	62,50	14,85	52	73	0,24
CH-TRAU-091	Scaphoidfractuur twinfix	2	67,50	67,50	19,09	54	81	0,28
CH-TRAU-101	K-draden uit schouder	2	63,50	63,50	13,44	54	73	0,21
CH-TRAU-111	Archillespees ruptuur	2	58,00	58,00	1,41	57	59	0,02
CH-TRAU-112	Osteotomie radius / ulnaschacht	2	77,00	77,00	12,73	68	86	0,17
CH-TRAU-117	Verwijderen exostosen van kleine beenderen	2	48,50	48,50	4,95	45	52	0,10
CH-TRAU-135	Pseudoarthrose femur	2	118,50	118,50	0,71	118	119	0,01
CH-TRAU-142	Verwijderen exostose grote beenderen	2	46,50	46,50	3,54	44	49	0,08
CH-TRAU-144	Eenvoudige arthrotomie of achterste capsulotomie	2	40,50	40,50	3,54	38	43	0,09
CH-VAAT-27	Av fistel	2	68,00	68,00	5,66	64	72	0,08
CH-VAAT-54	Opheffen inwendige arterioveneuze shunt	2	70,00	70,00	16,97	58	82	0,24
CH-VAAT-63	Verwijderen capd	2	40,50	40,50	3,54	38	43	0,09
CH-ABDO-05	Bijnier extirpatie	1	307,00	307	0,00	307	307	0,00
CH-ABDO-21	Overhechten maagperforatie	1	60,00	60	0,00	60	60	0,00
CH-ABDO-36	Re-laparotomie spoelen buik	1	52,00	52	0,00	52	52	0,00
CH-ABDO-39	Gastrotomie	1	84,00	84	0,00	84	84	0,00
CH-ABDO-41	Diafragmaticaruptuur	1	93,00	93	0,00	93	93	0,00
CH-ABDO-46	Enterostomie	1	89,00	89	0,00	89	89	0,00
CH-ABDO-56	Resectie meckel's divertikel inclusief eventuele appendectomie	1	113,00	113	0,00	113	113	0,00

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CH-ABDO-58	Endoscopische ileus operatie zonder resectie of anastomose	1	64,00	64	0,00	64	64	0,00
CH-ABDO-68	R2 maag resectie	1	103,00	103	0,00	103	103	0,00
CH-ABDO-71	Overhechten darmperforatie	1	211,00	211	0,00	211	211	0,00
CH-ABDO-73	Stagerings lymfadenectomie kleine bekken	1	74,00	74	0,00	74	74	0,00
CH-ABDO-75	Endoscopische totale colectomie + rectum amputatie	1	350,00	350	0,00	350	350	0,00
CH-ALGE-004	Thiersplastiek	1	55,00	55	0,00	55	55	0,00
CH-ALGE-010	Anodilatatie	1	39,00	39	0,00	39	39	0,00
CH-ALGE-011	Rectoscopie	1	30,00	30	0,00	30	30	0,00
CH-ALGE-038	Amputatie bovenbeen	1	72,00	72,00	0,00	72	72	0,00
CH-ALGE-048	Skoog procedure lies	1	61,00	61,00	0,00	61	61	0,00
CH-ALGE-049	Skoog procedure oksel	1	51,00	51,00	0,00	51	51	0,00
CH-ALGE-050	Explipatie fistel buikwand	1	71,00	71,00	0,00	71	71	0,00
CH-ALGE-058	Verwijderen neurinoom	1	36,00	36,00	0,00	36	36	0,00
CH-ALGE-063	Transanale resectie	1	101,00	101,00	0,00	101	101	0,00
CH-ALGE-065	Blootleggen en doorsnijden van pezen & spieren	1	46,00	46,00	0,00	46	46	0,00
CH-ALGE-068	Hechten een of twee strekpezen	1	45,00	45,00	0,00	45	45	0,00
CH-ALGE-074	Excochleatie en/of sequestro van middelgrote beenderen	1	78,00	78,00	0,00	78	78	0,00
CH-ALGE-086	Primaire behandeling bij ernstige verwondingen	1	53,00	53,00	0,00	53	53	0,00
CH-ALGE-091	Drainage thorax	1	69,00	69,00	0,00	69	69	0,00
CH-ALGE-096	Excochleatie en/of sequesterectomie van kleine beenderen	1	62,00	62,00	0,00	62	62	0,00
CH-ALGE-101	Verwijderen gentakralen heup	1	50,00	50,00	0,00	50	50	0,00
CH-ALGE-103	Nabloeding (039090)	1	135,00	135,00	0,00	135	135	0,00
CH-ALGE-128	Onderbinden of vernauwen van de vena cava als zelfstandige ingreep	1	267,00	267,00	0,00	267	267	0,00
CH-ALGE-129	Resectie zenuw voet	1	53,00	53,00	0,00	53	53	0,00
CH-ALGE-134	Excisie genitale wratten	1	35,00	35,00	0,00	35	35	0,00
CH-ALGE-135	Pseudoarthrose elleboog en/of onderarm zonder beentransplantaat	1	63,00	63,00	0,00	63	63	0,00
CH-ALGE-137	Winkelmann	1	47,00	47,00	0,00	47	47	0,00
CH-ALGE-139	Repositie capd	1	74,00	74,00	0,00	74	74	0,00
CH-ALGE-141	Reconstructie van een perifere slagader zonder transplantaat	1	163,00	163,00	0,00	163	163	0,00
CH-ALGE-143	Operatieve behandeling spierhernia	1	46,00	46,00	0,00	46	46	0,00
CH-ALGE-144	Frenulumplastiek	1	25,00	25,00	0,00	25	25	0,00
CH-ALGE-148	Continuiteitsresectie + arthrodese of arthroplast. bij grote beenderen	1	168,00	168,00	0,00	168	168	0,00
CH-ALGE-151	Trans anale rectum poliep	1	29,00	29,00	0,00	29	29	0,00
CH-ALGE-156	Beenplastiek radius en/of ulna	1	101,00	101,00	0,00	101	101	0,00
CH-ALGE-157	Geconverteerde sigmoidresectie	1	171,00	171,00	0,00	171	171	0,00
CH-ALGE-158	Exploratie littekenweefsel	1	60,00	60,00	0,00	60	60	0,00
CH-ALGE-163	Proctoscopie + biopsie	1	36,00	36,00	0,00	36	36	0,00
CH-ALGE-164	Bacaalcelcarcinoom / bcc	1	44,00	44,00	0,00	44	44	0,00
CH-ENDO-08	Laparoscopische enterotomie	1	80,00	80,00	0,00	80	80	0,00
CH-ENDO-16	Endoscopisch aneurysma	1	281,00	281,00	0,00	281	281	0,00
CH-ENDO-28	Laparoscopische rectosigmoid	1	181,00	181,00	0,00	181	181	0,00
CH-ENDO-29	Endoscopische entero anastomose	1	152,00	152,00	0,00	152	152	0,00
CH-HOHA-08	Schildklier adenoom	1	81,00	81,00	0,00	81	81	0,00
CH-HOHA-18	Benige halsribresectie	1	101,00	101,00	0,00	101	101	0,00
CH-HOHA-20	Hemi thyroïdectomie	1	111,00	111,00	0,00	111	111	0,00
CH-MAMA-11	Lumpectomie mamma	1	43,00	43,00	0,00	43	43	0,00
CH-MAMA-14	Excisie biopsie mamma + lokalisatie + vriescoupe	1	92,00	92,00	0,00	92	92	0,00

CH-MAMA-16	Lumpectomie + sn	1	92,00	92,00	0,00	92	92	0,00
CH-THOR-14	Endoscopische thoracale sympatectomie	1	90,00	90,00	0,00	90	90	0,00
CH-THOR-20	Grote borstwandresectie	1	253,00	253,00	0,00	253	253	0,00
CH-THOR-21	Endoscopische lobectomie of segmentresectie	1	125,00	125,00	0,00	125	125	0,00
CH-THOR-23	Endoscopische wigresectie	1	122,00	122,00	0,00	122	122	0,00
CH-THOR-24	Thoracale aaa + aorta aneurysma infrarenaal	1	280,00	280,00	0,00	280	280	0,00
CH-TRAU-001	Heup fractuur - omega	1	85,00	85,00	0,00	85	85	0,00
CH-TRAU-007	Onbloedige repositie malleolus fractuur	1	59,00	59,00	0,00	59	59	0,00
CH-TRAU-017	Calcaneus fractuur	1	48,00	48,00	0,00	48	48	0,00
CH-TRAU-023	Hohman release	1	41,00	41,00	0,00	41	41	0,00
CH-TRAU-032	Onbloedige repositie antebrachifractuur / monteggia	1	56,00	56,00	0,00	56	56	0,00
CH-TRAU-041	Externe fixateur hoffmann tibia	1	144,00	144,00	0,00	144	144	0,00
CH-TRAU-043	Externe fixateur hoffmann vinger	1	53,00	53,00	0,00	53	53	0,00
CH-TRAU-050	Vingerfractuur mini fragment ao	1	65,00	65,00	0,00	65	65	0,00
CH-TRAU-054	Enkelfractuur weber c lcp	1	74,00	74,00	0,00	74	74	0,00
CH-TRAU-057	Tibiafractuur lcp	1	118,00	118,00	0,00	118	118	0,00
CH-TRAU-062	Distale femurfractuur liss plaat	1	154,00	154,00	0,00	154	154	0,00
CH-TRAU-071	Uithalen humerus t2 pen	1	57,00	57,00	0,00	57	57	0,00
CH-TRAU-073	Verlengde gammanail gamma 3	1	140,00	140,00	0,00	140	140	0,00
CH-TRAU-077	Uithalen cerclage olecranon	1	39,00	39,00	0,00	39	39	0,00
CH-TRAU-093	Distale radiusfractuur	1	128,00	128,00	0,00	128	128	0,00
CH-TRAU-100	Excisie exostose kleine beenderen	1	42,00	42,00	0,00	42	42	0,00
CH-TRAU-106	Operatieve behandeling enkel fractuur / malleolus	1	62,00	62,00	0,00	62	62	0,00
CH-TRAU-108	Extirpatie bursa poplitea	1	49,00	49,00	0,00	49	49	0,00
CH-TRAU-109	Arthroscopie enkel	1	92,00	92,00	0,00	92	92	0,00
CH-TRAU-119	Operatieve behandeling antebrachius fractuur	1	65,00	65,00	0,00	65	65	0,00
CH-TRAU-122	Arthroscopische eminentia fractuur	1	97,00	97,00	0,00	97	97	0,00
CH-TRAU-125	Tibia plateau fractuur	1	113,00	113,00	0,00	113	113	0,00
CH-TRAU-128	Autotransplantaat van grote beenderen	1	225,00	225,00	0,00	225	225	0,00
CH-TRAU-129	Arthrotomie enkel	1	38,00	38,00	0,00	38	38	0,00
CH-TRAU-130	Resectie distale ulna uiteinden	1	74,00	74,00	0,00	74	74	0,00
CH-TRAU-133	Conservatieve behandeling tibia fractuur	1	42,00	42,00	0,00	42	42	0,00
CH-TRAU-138	Grote teen fractuur	1	57,00	57,00	0,00	57	57	0,00
CH-TRAU-147	Operatieve behandeling vinger- of duimluxatie	1	17,00	17,00	0,00	17	17	0,00
CH-TRAU-151	Een of meerdere fracturen van handwortelbeentjes	1	69,00	69,00	0,00	69	69	0,00
CH-TRAU-154	Beenplastiek tibia en/of fibula	1	108,00	108,00	0,00	108	108	0,00
CH-TRAU-160	Conservatieve behandeling clavicula fractuur	1	48,00	48,00	0,00	48	48	0,00
CH-TRAU-161	Achterste kruisbandplastiek	1	103,00	103,00	0,00	103	103	0,00
CH-VAAT-26	Carotis desobstructie + subluxatie kaak	1	108,00	108,00	0,00	108	108	0,00
CH-VAAT-34	Desobstructie aorta abdominalis	1	155,00	155,00	0,00	155	155	0,00
CH-VAAT-36	Geïnfecteerde bypass been	1	105,00	105,00	0,00	105	105	0,00
CH-VAAT-44	Opheffen naadaneurysma	1	129,00	129,00	0,00	129	129	0,00
CH-VAAT-58	Reconstructie van de aorta	1	232,00	232,00	0,00	232	232	0,00
CH-VAAT-62	Desobstructie aic	1	128,00	128,00	0,00	128	128	0,00

H.2 Orthopedic surgery

Table H-2 Descriptive statistics orthopedic surgery (Data: MST general ORs, 2008)

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Type	Description	N	Mean (minutes)	Median (minutes)	SDEV (minutes)	Min (minutes)	Max (minutes)	CV
OR-KNIE-18	Arthroscopie knie + menisectomie	330	40,52	39,00	9,45	23	84	0,23
OR-HEUP-12	Totale heup sp	236	110,25	106	21,52	73	202	0,20
OR-KNIE-19	Arthroscopie knie + shaven	223	41,10	39,00	11,63	16	85	0,28
OR-KNIE-04	Totale knie genesis	165	103,90	103,00	15,54	74	196	0,15
OR-KNIE-21	Arthroscopie knie	147	37,39	36,00	10,37	20	95	0,28
OR-KNIE-20	Arthroscopie knie + menisectomie + shaven	145	42,80	42,00	10,41	25	83	0,24
OR-KNIE-05	Totale knie nexgen = highflex	141	107,73	102,00	19,71	71	182	0,18
OR-SCHO-15	Open neer plastiek + bursa	86	54,38	52,00	13,00	23	98	0,24
OR-SCHO-13	Arthroscopische neerplastiek schouder	64	54,06	51,00	11,24	37	88	0,21
OR-HEUP-36	Totale heup cpt	60	106,57	105,00	10,25	89	133	0,10
OR-HEUP-14	Totale heup synergy	51	109,63	104	23,31	73	182	0,21
OR-KNIE-17	Arthroscopische voorste kruisband reconstructie / vkb	48	96,73	95,00	17,12	69	156	0,18
OR-SCHO-04	Open neerplastiek + hechten cuff	41	64,41	60,00	13,73	46	98	0,21
OR-ALGE-03	Verwijderen schroef	40	37,18	35	19,00	17	121	0,51
OR-VOET-24	Scarf osteotomie	31	67,00	63,00	10,92	52	94	0,16
OR-SCHO-22	Schouderprothese	25	118,00	112,00	31,46	79	185	0,27
OR-SCHO-39	Arthroscopische bankart repair pushlock	25	59,76	60,00	8,44	42	72	0,14
OR-ENKE-06	Arthroscopie enkel + shaven	23	43,61	41	10,80	28	78	0,25
OR-SCHO-09	Arthroscopische bankart + capsulaire shift	23	61,87	63,00	8,26	46	72	0,13
OR-VOET-09	Achillespees verlenging (splatt - sliding)	23	52,91	39,00	36,97	19	153	0,70
OR-CLAV-03	Laterale clavicula resectie	21	49,38	49	8,16	36	71	0,17
OR-ALGE-05	Verwijderen plaat	19	60,68	56	28,23	25	132	0,47
OR-ALGE-01	Klieven peesschede	18	46,28	32	30,35	18	124	0,66
OR-VOET-10	Brandes	17	52,65	50,00	13,43	34	77	0,26
OR-VOET-40	Strekken digitus voet	17	38,94	38,00	13,42	21	67	0,34
OR-ALGE-13	Verwijderen exostose kleine beenderen	16	34,81	32	9,02	23	62	0,26
OR-ELLE-01	Arthrotomie elleboog	16	44,81	43	12,01	32	74	0,27
OR-SCHO-14	Open mumford	16	47,06	44,50	14,48	29	93	0,31
OR-ALGE-07	Verwijderen mergpen / cerclage / k-draad	15	83,40	73	60,49	20	222	0,73
OR-HAND-13	Arthroplastiek cmc	15	64,87	67	11,91	46	89	0,18
OR-VOET-16	Dorsale release voet	15	96,13	93,00	33,26	41	172	0,35
OR-VOET-37	Hamerteen, digitus	14	35,14	36,00	7,48	14	46	0,21
OR-ALGE-24	Verwijderen ganglion	13	42,46	33	21,20	25	103	0,50
OR-VOET-32	Arthrodese voetwortel	13	87,46	78,00	22,94	60	139	0,26
OR-VOET-29	Achillespees ruptuur	11	59,64	58,00	7,27	48	73	0,12
OR-VOET-30	Verwijderen exostosen van middelgrote beenderen (voet)	11	41,18	39,00	7,63	32	60	0,19
OR-ARMA-04	Verwijderen plaat en schroeven	10	56,40	55	23,34	27	111	0,41
OR-SCHO-21	Open neer + bursa + mumford	10	58,70	54,50	15,17	41	89	0,26
OR-ALGE-04	Excochleatie en / of sequesterectomie van grote beenderen	9	49,00	43	17,35	26	85	0,35
OR-ARMA-02	Cts	9	41,33	42	16,86	20	68	0,41
OR-HEUP-13	Totale heup zmr	9	111,11	105	14,56	99	145	0,13
OR-HEUP-44	Totale heup cfp	9	102,11	104,00	8,78	90	115	0,09
OR-KNIE-24	Arthrotomie knie	9	54,89	51,00	15,12	40	84	0,28
OR-ENKE-02	Arthrotomie enkel	8	57,88	56	21,86	35	101	0,38
OR-SCHO-20	Arthroscopische bankart repair bioraptor	8	69,13	66,50	14,65	54	100	0,21

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OR-VOET-11	Hamerteen, operatie hallux valgus	8	65,50	65,50	26,65	38	124	0,41
OR-ALGE-10	Verwijderen van exostosen van grote beenderen	7	57,86	52	19,38	42	99	0,33
OR-ALGE-16	Decompressie lumbaal	7	82,86	81	8,40	70	97	0,10
OR-ALGE-20	Extensoren release	7	53,43	55	16,64	33	84	0,31
OR-HEUP-18	Revisie zmr	7	179,43	187	39,99	136	249	0,22
OR-POLS-04	Pols fractuur lcp / ao	7	83,29	78,00	32,57	46	133	0,39
OR-ARMA-07	Humerusfractuur	6	109,33	115	28,75	75	148	0,26
OR-KNIE-07	Revisie genesis	6	112,50	100,00	38,07	70	160	0,34
OR-KNIE-29	Arthroscopische onderpoolresectie knie	6	38,83	38,00	6,11	32	49	0,16
OR-VOET-08	Panarthrodese	6	163,17	150,00	32,69	129	221	0,20
OR-VOET-33	Verwijderen plaat en schroeven uit enkel	6	62,00	56,00	25,20	37	110	0,41
OR-BEEN-05	Pseudarthrose resp. verlengen onderbeen	5	163,80	137	92,15	88	309	0,56
OR-GIPS-02	Gipswissel	5	45,60	41	20,38	22	70	0,45
OR-KNIE-09	Extirpatie bursa praepatellaris	5	56,20	50,00	26,11	27	93	0,46
OR-KNIE-25	Patella prothese knie	5	93,60	95,00	11,84	75	108	0,13
OR-KNIE-35	Arthroskopie knie + arthrotomie + shaven	5	45,60	46,00	4,77	39	51	0,10
OR-SCHO-10	Arthroscopische bankart repair suretrac	5	73,60	68,00	14,57	62	99	0,20
OR-SCHO-11	Arthroskopie schouder	5	58,80	61,00	10,38	48	70	0,18
OR-SCHO-31	Arthroskopie schouder + shaven	5	57,60	56,00	9,86	49	74	0,17
OR-VOET-01	Verwijderen morton voet	5	41,20	44,00	6,14	31	46	0,15
OR-VOET-44	Verwijderen kalix	5	40,80	44,00	8,87	31	51	0,22
OR-VOET-52	Haglundse exostose	5	34,00	30,00	13,29	23	57	0,39
OR-ALGE-02	Openbeitelen bot voor diagnostische doeleinden (bijv. femur / humerus / bekken / etc.)	4	45,75	44	9,60	36	59	0,21
OR-ALGE-06	Verwijderen lipoom	4	31,75	29	7,68	26	43	0,24
OR-ALGE-18	Hohmann	4	59,00	59	6,27	52	67	0,11
OR-BEEN-04	Operatieve behandeling schacht van het femur	4	106,25	108	25,66	76	133	0,24
OR-ELLE-09	Transpositie nervus ulnaris	4	57,25	58	10,75	44	69	0,19
OR-HEUP-17	Revisie sp	4	139,75	134	23,60	121	170	0,17
OR-KNIE-14	Synovectomie knie	4	68,75	71,00	9,29	56	77	0,14
OR-KNIE-15	Doorbewegen knie	4	17,75	18,50	2,63	14	20	0,15
OR-KNIE-26	Totale knie lck	4	113,00	114,50	9,97	100	123	0,09
OR-SCHO-08	Habituële schouderluxatie / bankart	4	90,75	88,50	13,62	79	107	0,15
OR-TRAU-02	Verwijderen plaat / schroef uit femur	4	41,75	36,50	20,81	25	69	0,50
OR-VOET-06	Arthrodese triple voet	4	100,00	99,50	11,11	87	114	0,11
OR-VOET-14	Bunionectomie	4	34,50	32,00	6,45	30	44	0,19
OR-VOET-26	Mtp-dese + reconstructie voorvoet + strekken tenen	4	80,75	83,50	42,21	27	129	0,52
OR-VOET-38	Archillespees ruptuur	4	76,50	75,50	9,54	66	89	0,12
OR-ALGE-09	Excochleatie en / of sequesterectomie van kleine beenderen	3	39,00	40	7,55	31	46	0,19
OR-ALGE-22	Excisie neuroom	3	35,00	36	3,61	31	38	0,10
OR-ALGE-23	Verwijderen fixateur externe	3	48,33	49	29,01	19	77	0,60
OR-CLAV-02	Mediane clavicula resectie	3	69,33	68	6,11	64	76	0,09
OR-ELLE-03	Hohmann release elleboog	3	46,33	48	3,79	42	49	0,08
OR-ENKE-01	Arthroskopie enkel	3	95,67	98	19,60	75	114	0,20
OR-GIPS-01	Gipsbroek	3	43,33	43	3,51	40	47	0,08
OR-HAND-03	Arthrodese metacarpocarpaal of metacarpophalangeaal	3	71,00	57	26,00	55	101	0,37

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OR-HAND-05	Spongiosa plastiek os naviculare (matti russ)	3	88,67	89	3,51	85	92	0,04
OR-HEUP-31	Kop-hals prothese	3	115,33	125,00	19,40	93	128	0,17
OR-HEUP-35	Heup prothese specifiek	3	122,67	120,00	28,10	96	152	0,23
OR-HEUP-39	Transpositie spier bij heupdysplasie vlgs hr. sharrard	3	207,00	218,00	53,36	149	254	0,26
OR-HEUP-41	Revisie heup-cup	3	112,67	112,00	24,01	89	137	0,21
OR-KNIE-16	Patella fractuur	3	94,00	79,00	34,07	70	133	0,36
OR-POLS-03	Arthroscopie pols	3	55,67	61,00	11,93	42	64	0,21
OR-POLS-05	Arthrodese pols	3	59,67	64,00	14,98	43	72	0,25
OR-SCHO-16	Inbrengen schouderprothese	3	152,00	125,00	67,67	102	229	0,45
OR-SCHO-23	Open neer + cuff repair	3	54,33	53,00	7,09	48	62	0,13
OR-SCHO-25	Arthroscopische bankart + neerplastiek + bursa	3	63,67	64,00	13,50	50	77	0,21
OR-SCHO-26	Arthroscopische bankert repair	3	62,33	63,00	11,02	51	73	0,18
OR-SCHO-28	Open neer + mumford + cuff + bursa	3	68,00	71,00	12,77	54	79	0,19
OR-SCHO-29	Open neer + bankart + bursa	3	64,00	62,00	16,09	49	81	0,25
OR-TIBI-01	Tibiakop osteotomie (tomofix)	3	92,67	91,00	4,73	89	98	0,05
OR-TIBI-03	Valgiserende osteotomie tibia vlgs muller	3	88,33	87,00	6,11	83	95	0,07
OR-VOET-25	Mtp-dese	3	72,33	79,00	20,82	49	89	0,29
OR-VOET-45	Amputatie of exarticulatie teen	3	46,00	34,00	25,24	29	75	0,55
OR-WVKL-01	Decompressie rug	3	91,00	89,00	16,09	76	108	0,18
OR-ALGE-12	Uitgebreide spiertransplantatie van heup of bovenbeen	2	121,50	122	71,42	71	172	0,59
OR-ALGE-15	Wondtoilet	2	64,50	65	16,26	53	76	0,25
OR-ALGE-25	Verwijderen staples	2	28,00	28	7,07	23	33	0,25
OR-ALGE-26	Verwijderen zuggertung	2	40,00	40	11,31	32	48	0,28
OR-ARMA-05	Radius fractuur	2	57,50	58	10,61	50	65	0,18
OR-ARMA-09	Synovium biotpie	2	52,50	53	12,02	44	61	0,23
OR-BEEN-09	Verwijderen schroeven onderbeen	2	34,00	34	1,41	33	35	0,04
OR-BEEN-12	Operatieve behandeling femur fractuur	2	128,50	129	72,83	77	180	0,57
OR-BEEN-14	Osteotomie van de femurschacht of supracondylair	2	121,00	121	22,63	105	137	0,19
OR-CLAV-01	Clavicula fractuur	2	83,00	83	8,49	77	89	0,10
OR-CLAV-04	Acromioclaviculaire luxatie	2	78,00	78	16,97	66	90	0,22
OR-ELLE-04	Excisie bursa olecranon	2	38,00	38	7,07	33	43	0,19
OR-ELLE-05	Arthroscopie elleboog	2	84,00	84	15,56	73	95	0,19
OR-ELLE-06	Elleboog prothese	2	153,00	153	5,66	149	157	0,04
OR-ENKE-03	Enkelband plastiek lateraal (duquennoy)	2	44,50	45	14,85	34	55	0,33
OR-HAND-04	Arthrodese duim	2	63,00	63	15,56	52	74	0,25
OR-HAND-08	Verwijderen exostosen van middelgrote beenderen zoals handwortel	2	29,50	30	7,78	24	35	0,26
OR-HEUP-08	Arthrotomie heup	2	81,00	81	46,67	48	114	0,58
OR-HEUP-21	Verwisselen gentakralen heup	2	54,00	54	2,83	52	56	0,05
OR-HEUP-29	Epiphysiodese	2	96,00	96,00	18,38	83	109	0,19
OR-HEUP-30	Collumfractuur met gecannuleerde schroeven	2	79,50	79,50	17,68	67	92	0,22
OR-HEUP-43	Totale heup met gecombineerde protheses	2	103,00	103,00	16,97	91	115	0,16
OR-KNIE-03	Patella luxatie / hauser	2	63,00	63,00	7,07	58	68	0,11
OR-KNIE-12	Totale knie oxford	2	97,50	97,50	13,44	88	107	0,14
OR-KNIE-31	Uitgebreide arthrotomie knie	2	67,50	67,50	3,54	65	70	0,05
OR-KNIE-32	Totale knie rotating hinge knie	2	137,50	137,50	13,44	128	147	0,10

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OR-KNIE-34	Arthroscopie knie + arthrotomie	2	57,50	57,50	14,85	47	68	0,26
OR-POLS-01	Pols arthrodese triscape	2	73,00	73,00	16,97	61	85	0,23
OR-SCHO-12	Schouderprothese (humeruskop en schouderkom)	2	150,50	150,50	27,58	131	170	0,18
OR-SCHO-19	Open bankart + capsulaire shift	2	74,00	74,00	14,14	64	84	0,19
OR-SCHO-33	Bankart + cuff repair schouder	2	61,50	61,50	4,95	58	65	0,08
OR-SCHO-34	Open neer + kalk uit cuff	2	52,00	52,00	8,49	46	58	0,16
OR-SCHO-35	Doorbewegen schouder	2	22,00	22,00	14,14	12	32	0,64
OR-TRAU-03	Enkelfractuur, plaatsen schroeven	2	85,00	85,00	1,41	84	86	0,02
OR-TRAU-04	Verwijderen osm uit enkel	2	66,50	66,50	33,23	43	90	0,50
OR-TRAU-14	Transfix voorste kruisbandreconstructie	2	93,50	93,50	2,12	92	95	0,02
OR-VOET-02	Weber c enkelfractuur	2	75,00	75,00	14,14	65	85	0,19
OR-VOET-07	Arthrodese talo-cruraal gewricht	2	76,00	76,00	11,31	68	84	0,15
OR-VOET-20	Hohman hallux valgus	2	64,50	64,50	37,48	38	91	0,58
OR-VOET-23	Verwijderen scarfschroef phalanx hallux	2	39,00	39,00	4,24	36	42	0,11
OR-VOET-31	Arthrodese talo-cruraal gewricht	2	127,00	127,00	38,18	100	154	0,30
OR-VOET-43	Kelly plastiek enkel	2	50,50	50,50	6,36	46	55	0,13
OR-VOET-48	Jones procedure	2	139,50	139,50	109,60	62	217	0,79
OR-VOET-49	Arthrodese mtp	2	48,50	48,50	4,95	45	52	0,10
OR-WVKL-02	Spondylodese luque	2	165,50	165,50	31,82	143	188	0,19
OR-WVKL-03	Coflex	2	75,00	75,00	18,38	62	88	0,25
OR-ALGE-08	Excochleatie en / of sequesterectomie van middelgrote beenderen	1	84,00	84	0,00	84	84	0,00
OR-ALGE-14	Strekken en debaseren	1	108,00	108	0,00	108	108	0,00
OR-ALGE-27	Openbeitelen voor diagnostiek van middelgrote beenderen	1	60,00	60	0,00	60	60	0,00
OR-ALGE-28	Verwijderen bwm	1	97,00	97	0,00	97	97	0,00
OR-ALGE-29	Eenvoudige neurolyse	1	41,00	41	0,00	41	41	0,00
OR-ALGE-30	Continuïteitsresectie gevolgd door autotransplantaat	1	64,00	64	0,00	64	64	0,00
OR-ALGE-31	Openbeitelen voor diagnostische doeleinden van kleine beenderen	1	38,00	38	0,00	38	38	0,00
OR-ARMA-01	Osteotomie radius / ulnaschacht	1	78,00	78	0,00	78	78	0,00
OR-ARMA-10	Dupuytren	1	53,00	53	0,00	53	53	0,00
OR-ARMA-12	Totale synovectomie van het gehele polsgewricht	1	74,00	74	0,00	74	74	0,00
OR-ARMA-14	Operatieve behandeling radius kop fractuur	1	79,00	79	0,00	79	79	0,00
OR-ARMA-15	Bloedige repositie verouderde humerus luxatie	1	157,00	157	0,00	157	157	0,00
OR-BEEN-01	Adductoren tenotomie	1	44,00	44	0,00	44	44	0,00
OR-BEEN-07	Epifysiodese femur	1	62,00	62	0,00	62	62	0,00
OR-BEEN-10	Epifysiodese femur	1	82,00	82	0,00	82	82	0,00
OR-BEEN-11	Quadricepsplastiek	1	65,00	65	0,00	65	65	0,00
OR-ENKE-04	Enkel prothese (hintegra)	1	178,00	178	0,00	178	178	0,00
OR-ENKE-05	Arthrodese talo-cruraal gewricht	1	91,00	91	0,00	91	91	0,00
OR-ENKE-07	Reefplastiek enkel	1	37,00	37	0,00	37	37	0,00
OR-ENKE-09	Verwijderen gentakralen uit enkel	1	38,00	38	0,00	38	38	0,00
OR-HAND-01	Vinger prothese	1	94,00	94	0,00	94	94	0,00
OR-HAND-06	Pip-dese jones procedure	1	38,00	38	0,00	38	38	0,00
OR-HAND-07	Release trigger vinger	1	27,00	27	0,00	27	27	0,00
OR-HAND-10	Repositie luxatie handwortel	1	9,00	9	0,00	9	9	0,00
OR-HAND-11	Vinger fractuur	1	35,00	35	0,00	35	35	0,00
OR-HAND-15	Verwijderen os pisiformis	1	43,00	43	0,00	43	43	0,00

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OR-HAND-16	Four corner arthrodese pols	1	65,00	65	0,00	65	65	0,00
OR-HAND-17	Rerouting ext. pezen (038375)	1	71,00	71	0,00	71	71	0,00
OR-HAND-18	Bennett fractuur	1	60,00	60	0,00	60	60	0,00
OR-HEUP-06	Osteotomie heup	1	172,00	172	0,00	172	172	0,00
OR-HEUP-15	Revisie synergy	1	150,00	150	0,00	150	150	0,00
OR-HEUP-20	Revisie exeter	1	201,00	201	0,00	201	201	0,00
OR-HEUP-32	Verwijderen totale heup	1	226,00	226,00	0,00	226	226	0,00
OR-HEUP-34	Revisie profile	1	142,00	142,00	0,00	142	142	0,00
OR-HEUP-38	Uitgebreide revisie sp	1	117,00	117,00	0,00	117	117	0,00
OR-HEUP-40	Revisie landos	1	198,00	198,00	0,00	198	198	0,00
OR-HEUP-42	Vervanging femurkop en het acetabulum	1	102,00	102,00	0,00	102	102	0,00
OR-HEUP-45	Revisie heup kop	1	93,00	93,00	0,00	93	93	0,00
OR-HEUP-46	Revisie steel wissel	1	236,00	236,00	0,00	236	236	0,00
OR-KNIE-08	Revisie nexgen	1	199,00	199,00	0,00	199	199	0,00
OR-KNIE-22	Voorste kruisbandplastiek/vkb	1	111,00	111,00	0,00	111	111	0,00
OR-KNIE-27	Tibia plateau fractuur	1	169,00	169,00	0,00	169	169	0,00
OR-KNIE-30	Revisie mg	1	141,00	141,00	0,00	141	141	0,00
OR-KNIE-33	Knie revisie lck	1	223,00	223,00	0,00	223	223	0,00
OR-KNIE-36	Wisselen inlay tibia knie	1	83,00	83,00	0,00	83	83	0,00
OR-SCHO-03	Open neerplastiek	1	59,00	59,00	0,00	59	59	0,00
OR-SCHO-05	Arthrotomie van het schoudergewricht	1	63,00	63,00	0,00	63	63	0,00
OR-SCHO-17	Herstel cuff ruptuur	1	71,00	71,00	0,00	71	71	0,00
OR-SCHO-24	Arthroscopische bankart + cuff repair	1	60,00	60,00	0,00	60	60	0,00
OR-SCHO-27	Arthroscopische neer + bursa + mumford	1	65,00	65,00	0,00	65	65	0,00
OR-SCHO-36	Cheilectomie supra claviculair	1	52,00	52,00	0,00	52	52	0,00
OR-SCHO-37	Verwijderen prothese humeruskop	1	122,00	122,00	0,00	122	122	0,00
OR-SCHO-38	Arthroscopische schouder + nettoyage bankart repair	1	56,00	56,00	0,00	56	56	0,00
OR-SCHO-40	Scopie schouder met evt. bankart	1	60,00	60,00	0,00	60	60	0,00
OR-SCHO-41	Arthroscopie schouder + nettoyage	1	64,00	64,00	0,00	64	64	0,00
OR-SCHO-43	Open neer + bankart + cuff repair + bursa	1	71,00	71,00	0,00	71	71	0,00
OR-TIBI-04	Verwijderen tibiapen	1	75,00	75,00	0,00	75	75	0,00
OR-TRAU-05	Operatieve behandeling luxatiefractuur caput humeri	1	65,00	65,00	0,00	65	65	0,00
OR-TRAU-06	Conservatieve behandeling femur fractuur	1	31,00	31,00	0,00	31	31	0,00
OR-TRAU-08	Hechten achillespees na traumatische doorsnijding	1	58,00	58,00	0,00	58	58	0,00
OR-TRAU-09	Hechten van een of twee buigpezen, per pees	1	60,00	60,00	0,00	60	60	0,00
OR-TRAU-10	Behandeling bi of tri malleolaire enkelfractuur	1	93,00	93,00	0,00	93	93	0,00
OR-TRAU-13	Wervelfractuur	1	126,00	126,00	0,00	126	126	0,00
OR-VOET-05	Arthrodese interphalangeaal gewricht voet	1	44,00	44,00	0,00	44	44	0,00
OR-VOET-12	Grote teen fractuur	1	77,00	77,00	0,00	77	77	0,00
OR-VOET-15	Chevron osteotomie	1	81,00	81,00	0,00	81	81	0,00
OR-VOET-18	Kate kessel	1	40,00	40,00	0,00	40	40	0,00
OR-VOET-21	Jones plastiek	1	123,00	123,00	0,00	123	123	0,00
OR-VOET-27	Mtp-dese + hallux fix	1	69,00	69,00	0,00	69	69	0,00
OR-VOET-34	Hohmann relaese voet + afvlakken kopje	1	65,00	65,00	0,00	65	65	0,00
OR-VOET-35	Decompressie achillespees	1	28,00	28,00	0,00	28	28	0,00

OR-VOET-36	Flexor transfer voet	1	61,00	61,00	0,00	61	61	0,00
OR-VOET-39	Kate kessel plus arthrodesse	1	140,00	140,00	0,00	140	140	0,00
OR-VOET-41	Pip-dese teen	1	46,00	46,00	0,00	46	46	0,00
OR-VOET-46	Transplantatie van bot of kraakbeen	1	97,00	97,00	0,00	97	97	0,00
OR-VOET-47	Pees repair en peesplastiek	1	98,00	98,00	0,00	98	98	0,00
OR-VOET-51	Release fascia plantaris	1	32,00	32,00	0,00	32	32	0,00
OR-VOET-53	Reven kapsel talonaviculair gewricht + plaatsen kalix	1	113,00	113,00	0,00	113	113	0,00
OR-VOET-54	Vervijderen voetwortelbeentje	1	61,00	61,00	0,00	61	61	0,00
OR-WVKL-04	Extirpatie os coccygis	1	66,00	66,00	0,00	66	66	0,00

H.3 Neurosurgery

Table H-3 Descriptive statistics neurosurgery (Data: MST general ORs, 2008)

Type	Description	N	Mean (minutes)	Median (minutes)	SDEV (minutes)	Min (minutes)	Max (minutes)	CV
NE-WVKL-06	Hnp lumbaal	366	76,57	73	24,33	38	274	0,32
NE-WVKL-04	Laminectomie lumbaal (bv + microscoop + snelle boor)	117	84,93	82	23,01	37	191	0,27
NE-ALGE-09	Carpaaltunnelsyndroom / cts	116	22,18	21	7,02	13	61	0,32
NE-CRAN-10	Craniotomie	51	209,90	214	63,61	68	386	0,30
NE-ALGE-10	Ulnaropathie / transpositie nervus ulnaris	50	38,80	38	8,10	24	68	0,21
NE-NVST-01	Nervus vagus stimulatie / implantatie nvs	38	91,37	88	20,21	58	189	0,22
NE-WVKL-14	Cervicale hnp (bv + microscoop + snelle boor)	36	124,56	120	38,73	58	220	0,31
NE-WVKL-15	Cervicale laminectomie + bv	26	115,85	117	32,50	60	180	0,28
NE-PIJN-02	Epidurale ruggemerg stimulatie voor pijn fase 2 (plaatsen syst.) +bv	23	81,17	66	41,01	47	209	0,51
NE-WVKL-21	Recidief hnp lumbaal (microscoop + snelle boor)	23	87,70	84	20,03	59	135	0,23
NE-WVKL-26	Anterieure discectomie cervicaal	21	140,57	134	39,02	101	270	0,28
NE-CRAN-07	Stereotactische biopsie	20	89,70	88	14,20	66	125	0,16
NE-WVKL-05	Laminectomie + coflex + bv	19	105,42	89	40,46	55	199	0,38
NE-CRAN-22	Ventriculo peritoneale drain / vpd	16	93,50	99	16,72	48	110	0,18
NE-WVKL-13	Cervicale hnp + spondylodese (bv + microscoop + snelle boor)	16	158,38	147	64,66	81	348	0,41
NE-WVKL-29	Foraminotomie	15	81,60	75	24,04	54	138	0,29
NE-WVKL-03	Cervicale spondylodese anterieur (bv + microscoop + snelle boor)	14	131,14	124	31,83	95	208	0,24
NE-CRAN-05	Subduraal haematoom chronisch	12	73,08	75	15,74	51	101	0,22
NE-NVST-02	Vervanging nervus vagus stimulator	11	60,45	55	15,21	43	89	0,25
NE-SPAS-01	Implantatie baclofenpomp / synchroed + bv	11	118,64	127	34,73	53	180	0,29
NE-CRAN-28	Tumor schedelbasis	10	420,40	403	187,19	213	770	0,45
NE-PIJN-01	Epidurale ruggemerg stimulatie fase 1 (proefstimulatie) + bv	10	165,50	152	60,55	111	320	0,37
NE-ALGE-21	Neurolyse van een zenuw zonder microscoop	9	23,67	16	14,18	12	47	0,60
NE-CRAN-35	Convexiteits meningeoom	9	302,00	300	76,48	185	417	0,25
NE-DBST-05	Vervangen tweezijdige stn-stimulator	9	47,44	50	6,69	34	54	0,14
NE-CRAN-02	Hypofysetumor transnasaal	7	129,29	121	21,62	97	158	0,17
NE-DBST-04	Stn-stimulatie tweezijdige + plaatsen tweezijdige stimulator	7	247,14	335	149,80	37	396	0,61
NE-PIJN-03	Vervanging epidurale ruggemerg stimulator	7	51,43	48	17,29	36	85	0,34
NE-SPAS-02	Vervangen baclofenpomp / synchroed	7	72,86	68	16,14	52	99	0,22

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NE-CRAN-01	Pallidotomie / thalamotomie	6	112,83	75	97,00	65	310	0,86
NE-PIJN-04	Revisie epidurale ruggenmerg stimulator (zonder stimulatorvernieuwing) +bv	6	60,17	52	25,58	44	112	0,43
NE-WVKL-02	Thoracale laminectomie + intraduraal (bv + microscoop + snelle boor)	6	158,17	164	44,86	91	217	0,28
NE-WVKL-24	Spondylodese axialif	6	172,50	188	54,70	103	239	0,32
NE-ALGE-31	Ulnarolyse	5	35,80	36	5,93	26	41	0,17
NE-CRAN-08	Hersen punctie + bioptie	5	92,20	90	16,87	73	117	0,18
NE-WVKL-11	Osm uithalen ttl / xia / bwm	5	63,80	59	11,65	52	81	0,18
NE-WVKL-25	Spondylodese ventraal	5	177,00	165	49,07	126	237	0,28
NE-ALGE-19	Revisie ventriculo peritoneale drain	4	67,00	68	22,64	45	88	0,34
NE-CRAN-18	Plaatsen rickham reservoir	4	74,50	80	16,78	51	88	0,23
NE-WVKL-07	Thoracale laminectomie	4	126,75	109	70,74	67	223	0,56
NE-WVKL-09	Pliff (bv + microscoop + snelle boor)	4	142,50	120	93,99	57	274	0,66
NE-ALGE-22	Excisie neuroom (klein)	3	48,33	34	36,67	21	90	0,76
NE-ALGE-26	Tumor perifere zenuw	3	108,67	112	21,20	86	128	0,20
NE-ALGE-33	Wondrevisie	3	48,33	50	3,79	44	51	0,08
NE-WVKL-08	Spondylodese ttl + bv	3	175,33	205	55,77	111	210	0,32
NE-WVKL-23	Spondylodese thoracaal	3	162,33	172	24,01	135	180	0,15
NE-WVKL-37	Decompressie lumbaal	3	69,33	68	12,06	58	82	0,17
NE-CRAN-14	Externe ventrikeldrain	2	301,00	301	281,43	102	500	0,93
NE-CRAN-17	Schedelplastiek zonder duratransplantaat	2	150,00	150	91,92	85	215	0,61
NE-CRAN-32	Brughoek tumor	2	218,00	218	97,58	149	287	0,45
NE-CRAN-34	Open biopt schedeldak	2	308,50	309	351,43	60	557	1,14
NE-DBST-02	Vervangen eenzijdige strn - stimulator	2	40,50	41	4,95	37	44	0,12
NE-DBST-03	Revisie eenzijdige strn-stimulatie zonder stimulatorvervanging	2	154,00	154	155,56	44	264	1,01
NE-WVKL-01	Lumbale laminectomie + intraduraal (bv + microscoop + snelle boor)	2	175,00	175	38,18	148	202	0,22
NE-WVKL-16	Cervicale laminectomie + intraduraal + bv	2	144,00	144	11,31	136	152	0,08
NE-WVKL-27	Sluiten liquorlek lumbaal	2	71,50	72	7,78	66	77	0,11
NE-ALGE-25	Incisie van de huid ter ontlasting van abces / ontsteking	1	55,00	55	0,00	55	55	0,00
NE-ALGE-30	Incisie van de huid ter ontlasting van abces / onsteking	1	60,00	60	0,00	60	60	0,00
NE-ALGE-32	Zenuwletsel zonder transplantatie + microscoop	1	59,00	59	0,00	59	59	0,00
NE-ALGE-36	Neurolyse gecompliceerd	1	139,00	139	0,00	139	139	0,00
NE-CRAN-16	Schedelplastiek met duratransplantaat	1	136,00	136	0,00	136	136	0,00
NE-CRAN-19	Plaatsen omaya reservoir	1	72,00	72	0,00	72	72	0,00
NE-CRAN-21	Impressiefractuur gecompliceerd	1	172,00	172	0,00	172	172	0,00
NE-CRAN-29	Vervangen baclofenpomp	1	63,00	63	0,00	63	63	0,00
NE-CRAN-31	Hersenabces supra / intratentorieel of empyeem	1	96,00	96	0,00	96	96	0,00
NE-CRAN-36	Boorgaten	1	74,00	74	0,00	74	74	0,00
NE-ENDO-02	Endoscopische hypofysectomie	1	152,00	152	0,00	152	152	0,00
NE-ENDO-03	Ventriculoscopie	1	69,00	69	0,00	69	69	0,00
NE-PIJN-06	Vervangen isomed pijn-pomp	1	91,00	91	0,00	91	91	0,00
NE-SPAS-03	Revisie baclofenpomp / synchroed zonder pompvernieuwing + bv	1	105,00	105	0,00	105	105	0,00
NE-WVKL-10	Wervelfractuur (bv + snelle boor)	1	169,00	169	0,00	169	169	0,00
NE-WVKL-20	Lumbo-peritoneale drain / lpd	1	63,00	63	0,00	63	63	0,00
NE-WVKL-28	Vasculaire malformatie ruggenmerg	1	207,00	207	0,00	207	207	0,00

NE-WVKL-30	Sluiten liquorlek thoracaal	1	74,00	74	0,00	74	74	0,00
NE-WVKL-32	Dissectomie lumbaal	1	115,00	115	0,00	115	115	0,00
NE-WVKL-34	Sequester lumbaal	1	62,00	62	0,00	62	62	0,00
NE-WVKL-35	Cervicale hnp + prothese + bv	1	96,00	96	0,00	96	96	0,00
NE-WVKL-36	Cervicale spondylodese anterieur + prothese	1	152,00	152	0,00	152	152	0,00

H.4 Plastic surgery

Table H-4 Descriptive statistics plastic surgery (Data: MST general ORs, 2008)

Type	Description	N	Mean (minutes)	Median (minutes)	SDEV (minutes)	Min (minutes)	Max (minutes)	CV
PL-LICH-01	Mamma reductie	87	150,68	145	41,22	70	305	0,27
PL-ALGE-05	Excisie tumor / cyste	77	71,86	64	35,80	18	178	0,50
PL-ARMA-07	Dupuytren met huidtranspositie	65	67,05	65	24,78	27	133	0,37
PL-ARMA-26	Carpaal tunnel syndroom / cts	62	39,73	30	26,58	14	144	0,67
PL-LICH-08	Capsulotomie + prothese wissel	48	89,48	81	35,54	40	196	0,40
PL-LICH-03	Mamma augmentatie	47	87,17	81	34,53	34	207	0,40
PL-ALGE-04	Wondtoilet	41	121,00	81	116,63	32	641	0,96
PL-ZENU-04	Neurolyse gecompliceerd	37	58,38	50,00	21,77	35	116	0,37
PL-ALGE-06	Verlengen, verkorten of uitsnijden van pezen fascien of spieren	34	98,47	89	56,68	27	305	0,58
PL-ARMA-08	Dupuytren straalsgewijs	32	45,56	44	13,91	27	76	0,31
PL-LICH-09	Abdominoplastiek	28	139,68	132	45,82	59	263	0,33
PL-GELA-16	Voorhoofdsliift / wenkbrauwlift / rhytidectomie	23	147,74	144	37,33	90	233	0,25
PL-GELA-06	Correctie afstaande oren	17	85,53	93	23,96	46	124	0,28
PL-GELA-01	Uitgebreide blepharoplastiek	14	105,00	105	43,56	42	189	0,41
PL-TRAN-07	Grote gecompliceerde transpositie gesteeld	14	85,07	78,00	43,10	34	209	0,51
PL-ALGE-15	Verwijderen tumor middelgroot	12	41,08	31	23,79	15	87	0,58
PL-TRAN-03	Grote gecompliceerde transplatatie	12	74,00	74,50	31,10	36	130	0,42
PL-LICH-02	Tissue expander inbrengen	11	72,00	66	19,19	42	109	0,27
PL-LICH-07	Correctie buikwand	10	138,50	132	32,56	107	215	0,24
PL-TRAN-05	Kleine transpositie gesteeld	10	48,90	46,00	24,24	12	101	0,50
PL-ALGE-28	Transplantatie van derma en/of vet	9	100,00	93	27,82	55	145	0,28
PL-ALGE-36	Litteken correctie	9	82,33	62	45,09	33	175	0,55
PL-GELA-11	Schizis lipsluiting primair	9	95,89	93	24,83	67	134	0,26
PL-GELA-19	Basaal cel carcinoom / bcc	9	66,22	63	28,11	24	104	0,42
PL-LICH-19	Correctie deformiteit mamma	9	85,33	59,00	66,95	33	217	0,78
PL-ALGE-03	Verwijderen schroef	8	69,63	61	24,12	45	105	0,35
PL-ARMA-27	Arthrode van een interphalangeaal gewricht	8	63,25	54	23,57	45	114	0,37
PL-GELA-07	Uitwendige neuscorrectie	8	104,50	108	29,40	54	151	0,28
PL-TRAN-08	Zeer grote transposities gesteeld	8	89,50	82,00	28,42	61	134	0,32
PL-ALGE-07	Continuïteits resectie + arthodese of arthoplastiek	7	120,14	124	21,71	83	152	0,18
PL-ALGE-13	Operatieve verwijdering gezwellen	7	77,00	43	56,68	36	189	0,74
PL-ARMA-02	Arthrodese metacarpocarpaal	7	106,86	112	48,66	41	196	0,46
PL-LICH-06	Plastische correctie van een deformiteit van de mamma	7	177,57	160	98,17	60	325	0,55
PL-LICH-20	Inwendige bh	7	197,86	203,00	22,53	166	230	0,11
PL-LICH-23	Plaveiselcel carcinoom / pcc	7	63,00	67,00	9,54	49	72	0,15

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PL-ALGE-17	Locale intraveneuze anesthesie	6	60,50	60	29,39	25	99	0,49
PL-GELA-13	Schizis achterste deel gehemelte	6	98,17	100	12,84	84	115	0,13
PL-GELA-21	Plaveiselcel carcinoom / pcc	6	94,50	63	88,35	33	271	0,93
PL-GELA-23	Macs facelift	6	192,00	143	88,55	134	351	0,46
PL-LICH-11	Liposuctie buik	6	136,00	150,50	62,94	52	213	0,46
PL-TRAN-13	Tramflap	6	258,33	265,50	27,08	222	290	0,10
PL-ALGE-09	Naevus verwijderen	5	72,40	66	48,03	26	148	0,66
PL-ARMA-09	Primair peesherstel in de flexorloge.	5	57,80	67	17,77	34	75	0,31
PL-ARMA-12	Hechten een of twee strekpezen	5	68,80	56	24,68	48	108	0,36
PL-ARMA-24	Verwijderen ganglion	5	42,00	43	5,39	33	47	0,13
PL-GELA-22	Blepharoplastiek / correctie ptosis	5	129,60	114	68,49	62	211	0,53
PL-LICH-04	Mamma reconstructie + tissue expander	5	230,20	258	152,85	45	380	0,66
PL-LICH-12	Liposuctie trochanter gebied	5	78,00	59,00	42,53	34	142	0,55
PL-TRAN-24	Transpositie van een fascie	5	45,20	40,00	13,33	33	64	0,29
PL-ALGE-26	Verwijderen bcc + huidtransplantaat	4	57,00	48	21,53	43	89	0,38
PL-ALGE-27	Continuïteitsresectie bij kleine beenderen	4	70,25	71	17,65	48	91	0,25
PL-ARMA-05	Trigger vinger / tendovaginitis	4	37,25	37	6,13	31	45	0,16
PL-ARMA-15	Transpositie van een pees	4	85,25	75	28,42	64	127	0,33
PL-ARMA-16	Transpositie van meer dan een pees	4	103,00	112	45,48	47	142	0,44
PL-ARMA-17	Peesplastiek met transplaat	4	84,25	85	35,35	42	126	0,42
PL-ARMA-50	Tumor perifere zenuw	4	61,00	62	26,57	28	93	0,44
PL-GELA-15	Facelift	4	141,00	139	39,71	95	192	0,28
PL-TRAN-02	Matig / grote gecompliceerde transplatie	4	69,00	58,50	35,34	39	120	0,51
PL-ZENU-06	Uitgebreide perifere zenuw transplaat + microscoop	4	74,50	69,50	34,84	40	119	0,47
PL-ALGE-30	Excisie neuroom	3	168,00	116	113,33	90	298	0,67
PL-ALGE-33	Autotransplaat middelgrote beenderen	3	70,33	76	34,85	33	102	0,50
PL-ALGE-38	Necrotomie	3	43,00	44	16,52	26	59	0,38
PL-AMPU-04	Amputatie straal (smalle hand)	3	88,33	96	22,50	63	106	0,25
PL-ARMA-13	Hechten een of twee buigpezen	3	63,67	59	22,37	44	88	0,35
PL-ARMA-41	Bovenarm reductie	3	161,33	159	42,55	120	205	0,26
PL-GELA-02	Ptosis correctie	3	61,67	61	9,02	53	71	0,15
PL-GELA-03	Ectropion	3	88,00	90	8,19	79	95	0,09
PL-GELA-12	Pharyngo plastiek	3	76,00	66	20,88	62	100	0,27
PL-GELA-14	Schizis voorste deel gehemelte	3	88,33	80	15,31	79	106	0,17
PL-LICH-05	Gynaecomastie	3	129,33	141	61,34	63	184	0,47
PL-LICH-25	Mamma prothese verwijderen	3	47,67	47,00	14,01	34	62	0,29
PL-TRAN-06	Matig tot grote transposities gesteeld	3	78,67	78,00	20,01	59	99	0,25
PL-TRAN-10	Vrije lap naar bovenste romp	3	298,00	276,00	70,62	241	377	0,24
PL-TRAN-20	Transpositie van een huidspierlap naar heupgebied	3	175,33	141,00	64,73	135	250	0,37
PL-ALGE-02	Mitek-anker	2	47,50	48	3,54	45	50	0,07
PL-ALGE-21	Blootleggen en doorsnijden van pezen of spieren	2	121,50	122	3,54	119	124	0,03
PL-ALGE-31	Verwijderen arthromen	2	24,50	25	10,61	17	32	0,43
PL-ARMA-10	Klieven peesschede	2	96,50	97	33,23	73	120	0,34
PL-ARMA-28	Operatieve behandeling vinger fractuur	2	82,00	82	2,83	80	84	0,03
PL-ARMA-35	Arthroscopie pols in combinatie met een ingreep	2	111,50	112	17,68	99	124	0,16
PL-HAND-03	Ruptuur collaterale banden mcp gewricht / trigger vinger	2	69,50	70	13,44	60	79	0,19

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PL-LICH-10	Liposuctie submentale gebied	2	55,00	55,00	18,38	42	68	0,33
PL-LICH-13	Liposuctie mediale zijde knie en / of bovenbeen	2	104,00	104,00	2,83	102	106	0,03
PL-TRAN-09	Vrije lap mond / pharynx / oesophagus	2	99,00	99,00	9,90	92	106	0,10
PL-TRAN-19	Lysis van een transpositie lap	2	52,00	52,00	14,14	42	62	0,27
PL-ALGE-10	Verwijderen van een of meerdere exostosen	1	85,00	85	0,00	85	85	0,00
PL-ALGE-19	Nabloeding (039090)	1	77,00	77	0,00	77	77	0,00
PL-ALGE-20	Verwijderen mergpen / cerclage / k-draad	1	51,00	51	0,00	51	51	0,00
PL-ALGE-23	Extirpatie handwortelbeentjes	1	97,00	97	0,00	97	97	0,00
PL-ALGE-34	Wegnemen 5e teen + metatarsale v	1	60,00	60	0,00	60	60	0,00
PL-ALGE-39	Openbeitelen voor diagnostiek van middelgrote beenderen	1	96,00	96	0,00	96	96	0,00
PL-ALGE-40	Openbeitelen voor diagn. doeleinden van kleine beenderen	1	64,00	64	0,00	64	64	0,00
PL-ALGE-41	Bij combinatie van tenminste 2 verrichtingen van de code's	1	56,00	56	0,00	56	56	0,00
PL-AMPU-01	Amputatie of exarticulatie van vinger	1	49,00	49	0,00	49	49	0,00
PL-AMPU-03	Amputatie vinger	1	30,00	30	0,00	30	30	0,00
PL-AMPU-05	Amputatie straal met straaltranspositie	1	52,00	52	0,00	52	52	0,00
PL-ARMA-01	Synoviectomie pols	1	27,00	27	0,00	27	27	0,00
PL-ARMA-03	Arthrodese duim	1	150,00	150	0,00	150	150	0,00
PL-ARMA-20	Pols arthrodese	1	138,00	138	0,00	138	138	0,00
PL-ARMA-29	Tenolyse flexorpees pols	1	53,00	53	0,00	53	53	0,00
PL-ARMA-30	Synovectomie strekkers handrug	1	42,00	42	0,00	42	42	0,00
PL-ARMA-53	Bandreconstructie pols	1	70,00	70	0,00	70	70	0,00
PL-GELA-08	In- en uitwendige neuscorrectie	1	91,00	91	0,00	91	91	0,00
PL-GELA-10	Rhinophyma	1	122,00	122	0,00	122	122	0,00
PL-GELA-18	Dermabrasie < 1%	1	65,00	65	0,00	65	65	0,00
PL-GELA-20	Excisie bijoor	1	47,00	47	0,00	47	47	0,00
PL-GELA-26	Correctie afstaande oren (weke delen)	1	26,00	26	0,00	26	26	0,00
PL-HAND-02	Prothese impl. interphalangeaal gewricht	1	75,00	75	0,00	75	75	0,00
PL-HAND-04	Bandletsel vinger	1	88,00	88	0,00	88	88	0,00
PL-HAND-05	Derotatie osteotomie phalanx/os metacarpale	1	117,00	117	0,00	117	117	0,00
PL-HAND-06	Operatieve behandeling scaphoidfractuur	1	90,00	90	0,00	90	90	0,00
PL-HAND-07	Kapselplastiek bij luxatie metacarpophalangeaal 1 gewricht	1	43,00	43	0,00	43	43	0,00
PL-LICH-14	Hypospadie, volledige correctie	1	69,00	69,00	0,00	69	69	0,00
PL-LICH-22	Subcutane mastectomie	1	41,00	41,00	0,00	41	41	0,00
PL-LICH-24	Abces incisie	1	69,00	69,00	0,00	69	69	0,00
PL-LICH-28	Wisselen mammaprothese	1	108,00	108,00	0,00	108	108	0,00
PL-LICH-31	Inbrengen specifieke prothese	1	190,00	190,00	0,00	190	190	0,00
PL-TRAN-04	Zeer grote gecompliceerde transplatatie	1	67,00	67,00	0,00	67	67	0,00
PL-TRAN-14	Transplantatie van fascie	1	54,00	54,00	0,00	54	54	0,00
PL-TRAN-15	Transpositie huid-spierslap naar defect extremiteiten	1	155,00	155,00	0,00	155	155	0,00
PL-TRAN-16	Excochleatie en/of sequestrotomie van kleine beenderen	1	91,00	91,00	0,00	91	91	0,00
PL-TRAN-23	Losprepareren van donorplaats + inhechten getransplanteerde huidlap	1	45,00	45,00	0,00	45	45	0,00
PL-ZENU-01	Primaire zenuwhechting	1	77,00	77,00	0,00	77	77	0,00
PL-ZENU-02	Zenuw letsel zonder transplantatie + microscoop	1	60,00	60,00	0,00	60	60	0,00
PL-ZENU-03	Neurolyse eenvoudig	1	36,00	36,00	0,00	36	36	0,00

PL-ZENU-05	Transpositie nervus ulnaris	1	58,00	58,00	0,00	58	58	0,00
PL-ZENU-09	Zenuwdoorsnijding of exereses	1	117,00	117,00	0,00	117	117	0,00

H.5 Gynecology

Table H-5 Descriptive statisticsgynecology (Data: MST general ORs, 2008)

Type	Description	N	Mean (minutes)	Median (minutes)	SDEV (minutes)	Min (minutes)	Max (minutes)	CV
GY-VAGI-15	Abortus curettage	105	24,13	23	7,89	12	61	0,33
GY-ENDO-03	Diagnostische laparoscopie + tubatesten	81	42,69	41	9,07	24	67	0,21
GY-ABDO-02	Sectio met voorbereiding	75	56,27	54	15,98	42	168	0,28
GY-ABDO-08	Abdominale uterus extirpatie	74	98,49	92	25,20	55	160	0,26
GY-ABDO-12	Sectio zonder voorbereiding	68	52,35	53	8,90	35	75	0,17
GY-ENDO-04	Diagnostische laparoscopie	60	45,93	42	13,47	12	93	0,29
GY-ENDO-05	Hysteroscopie diagnostisch	54	34,15	34	8,77	14	71	0,26
GY-VAGI-13	Diagnostische cold-knife conisatie	43	36,49	37	7,13	26	55	0,20
GY-VAGI-33	Vaginale uterus extirpatie / vue	41	84,56	78	24,96	55	198	0,30
GY-LASE-02	Laservaporisatie	40	30,28	24	17,09	16	103	0,56
GY-ENDO-11	Trans cervical endometrium resectie / tcer	36	51,19	49	12,34	31	86	0,24
GY-ENDO-26	Diagnostische laparoscopie + chromopertubatie	35	48,17	44	18,13	26	109	0,38
GY-ENDO-10	Sterilisatie van de vrouw via laparoscopie of culdoscopie	34	44,15	41	13,36	30	96	0,30
GY-ABDO-28	Manchester fothergill + voor- en achterwandplastiek	33	113,61	109	31,13	75	187	0,27
GY-ENDO-33	Therapeutische hysteroscopie, kleine verrichtingen	30	43,70	44	10,70	16	70	0,24
GY-ABDO-26	Manchester fothergill + voorwandplastiek	28	89,21	92	21,83	49	132	0,24
GY-ENDO-01	Laparoscopische uterusextirpatie.	28	141,07	144	33,70	51	219	0,24
GY-ENDO-08	Laparoscopische adnex enkelzijdig	26	70,23	63	21,44	46	126	0,31
GY-ENDO-09	Laparoscopische adnex dubbelzijdig	26	83,62	77	29,16	38	164	0,35
GY-ENDO-15	Hysteroscopische poliep resectie	23	38,35	39	8,04	15	49	0,21
GY-ENDO-20	Trans cervicale myoom resectie / tcmr	22	54,77	48	23,69	32	136	0,43
GY-VAGI-12	Gynaecologisch onderzoek onder narcose	22	29,27	25	13,40	9	60	0,46
GY-VAGI-32	Vaginale uterusextirpatie + voor- en achterwandplastiek	22	108,36	104	21,43	62	148	0,20
GY-VAGI-44	Trans cervicale poliep resectie	22	45,55	42,50	16,32	27	100	0,36
GY-VAGI-05	Tot	21	59,62	44	34,10	31	158	0,57
GY-ABDO-21	Endometrium carcinoom (zonder bekken lymphadenectomie)	18	116,50	113	19,18	88	150	0,16
GY-ABDO-25	Abdominale uterus extirpatie + verwijderen adnexum bdz	15	130,13	123	45,33	81	256	0,35
GY-VAGI-16	Voorwandplastiek	15	59,53	57	17,94	36	100	0,30
GY-ENDO-06	Therapeutische hysteroscopische endometrium resectie	14	51,50	54	9,44	38	68	0,18
GY-VAGI-23	Bartholinische cyste	14	40,64	32	20,83	20	94	0,51
GY-ENDO-21	Laparoscopische cystectomy	13	80,62	67	39,98	54	199	0,50
GY-LASE-01	Laserexconisatie	13	29,85	28	13,95	10	57	0,47
GY-VAGI-14	Curettage	12	30,08	32	9,26	14	43	0,31
GY-ENDO-22	Trans cervicale poliep resectie / tcpr	11	40,73	40	5,31	33	50	0,13
GY-VAGI-17	Achterwandplastiek	11	71,27	55	33,31	41	153	0,47
GY-VAGI-42	Verwijderen mirena	11	35,73	31	14,84	17	69	0,42

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GY-ABDO-03	Abdominale adnex extirpatie enkelzijdig	9	101,89	94	40,60	37	186	0,40
GY-ENDO-16	Laparoscopische adhaesiolysis opheffen	9	57,56	56	12,49	39	80	0,22
GY-ABDO-07	Abdominale adnex extirpatie beiderzijds	8	79,50	72	26,72	43	132	0,34
GY-VAGI-19	Introitus plastiek	8	36,25	33	12,29	24	53	0,34
GY-ABDO-16	Abdominale adnex extirpatie dubbelzijdig	7	94,14	88	20,63	70	120	0,22
GY-ENDO-32	Therapeutische hysteroscopie	7	44,57	39	18,46	29	84	0,41
GY-VAGI-41	Inbrengen mirena	7	26,14	29	8,80	13	35	0,34
GY-ALGE-03	Expolatie litteken	6	34,00	37	11,59	15	45	0,34
GY-VAGI-31	Tvt	6	59,33	59	13,23	45	82	0,22
GY-ABDO-06	Wertheim	5	292,80	282	40,56	249	351	0,14
GY-ABDO-09	Debulking	5	191,80	187	63,42	134	290	0,33
GY-ABDO-11	Rustplastiek	5	123,20	118	28,28	93	170	0,23
GY-ABDO-14	Proeflaparotomie	5	106,60	73	65,47	50	206	0,61
GY-ENDO-02	Laparoscopische rust	5	162,60	164	25,39	124	194	0,16
GY-VAGI-37	Verwijderen zwelling labium	5	44,80	47	8,29	34	56	0,19
GY-ABDO-27	Manchester fothergill + achterwandplastiek	4	99,50	101	25,44	70	127	0,26
GY-ABDO-30	Tot met voor- en/of achterwandplastiek	4	69,00	72	12,25	53	80	0,18
GY-ENDO-23	Endoscopische eenvoudige incontinentie urinae behandeling inclusief voor en achter wandplastiek	4	77,25	64	34,96	52	129	0,45
GY-ENDO-27	Laparoscopische ovariectomie	4	61,00	58	7,44	56	72	0,12
GY-VAGI-10	Plaatsen mirena	4	23,25	24	2,99	19	26	0,13
GY-VAGI-24	Vulvectomy	4	106,25	84	63,64	61	196	0,60
GY-VAGI-25	Vulvectomy + lieslymfklieren	4	162,75	159	29,48	136	198	0,18
GY-VAGI-29	Portio cerclage volgens shirodcar	4	33,00	29	13,44	23	52	0,41
GY-VAGI-39	Reductie labium	4	29,75	29	5,91	24	37	0,20
GY-ABDO-17	Myoomenucleatie	3	96,67	114	36,25	55	121	0,38
GY-ENDO-25	Laparoscopische interventie	3	49,00	48	1,73	48	51	0,04
GY-VAGI-11	Lisexcisie cervix	3	35,00	36	7,55	27	42	0,22
GY-ABDO-05	Stageringslaparotomie	2	241,00	241	4,24	238	244	0,02
GY-ALGE-02	Abces incisie	2	23,50	24	0,71	23	24	0,03
GY-ENDO-12	Laparoscopische sacropexie	2	123,00	123	25,46	105	141	0,21
GY-ENDO-14	Leo dubbelzijdig	2	57,00	57	5,66	53	61	0,10
GY-ENDO-31	Laparoscopische adhaesiolysis + bilaterale tuboneostomie	2	129,00	129	4,24	126	132	0,03
GY-ENDO-35	Laparoscopische tubectomie	2	80,50	81	30,41	59	102	0,38
GY-VAGI-01	Enterocoele plastiek vaginaal	2	47,00	47	8,49	41	53	0,18
GY-VAGI-06	Extirpatie vaginawand cyste	2	44,00	44	5,66	40	48	0,13
GY-VAGI-18	Vaginismus operatie	2	29,50	30	9,19	23	36	0,31
GY-VAGI-20	Resectie labia	2	46,00	46	16,97	34	58	0,37
GY-VAGI-21	Vaginal wall sling	2	81,50	82	2,12	80	83	0,03
GY-VAGI-27	Prolaps , voor en achterwand plastiek	2	92,00	92	0,00	92	92	0,00
GY-ABDO-10	Plastiek volgens burch / mmk	1	218,00	218	0,00	218	218	0,00
GY-ABDO-19	Abdominale cystectomie	1	78,00	78	0,00	78	78	0,00
GY-ABDO-22	Opheffing van adhaesiolysis	1	69,00	69	0,00	69	69	0,00
GY-ABDO-29	Plastische correctie van een oude totaalruptuur	1	134,00	134	0,00	134	134	0,00
GY-ABDO-32	Laparotomische endometriosis, cyste verwijd.enkelz. of dubbelz	1	169,00	169	0,00	169	169	0,00
GY-ABDO-36	Exploratie buikwand	1	49,00	49	0,00	49	49	0,00
GY-ALGE-04	Verwijderen naevus	1	31,00	31	0,00	31	31	0,00

GY-ALGE-05	Rectoscopie	1	38,00	38	0,00	38	38	0,00
GY-ENDO-07	Extra uterine graviditeit / eug	1	64,00	64	0,00	64	64	0,00
GY-ENDO-17	Laparoscopische refertilisatie	1	116,00	116	0,00	116	116	0,00
GY-ENDO-28	Laparoscopische endometriosis,cyste verwijd. enkelz. of dubbelz	1	90,00	90	0,00	90	90	0,00
GY-VAGI-08	Voor en achterwandplastiek vlgs. richter	1	59,00	59	0,00	59	59	0,00
GY-VAGI-09	Supra vaginale uterusextirpatie	1	92,00	92	0,00	92	92	0,00
GY-VAGI-30	Prolapsplastiek	1	89,00	89	0,00	89	89	0,00
GY-VAGI-35	Verwijderen mirena - curettage	1	36,00	36	0,00	36	36	0,00
GY-VAGI-40	Overhechten vaginatop	1	39,00	39	0,00	39	39	0,00
GY-VAGI-43	Nabloeding vaginaal	1	42,00	42,00	0,00	42	42	0,00

H.6 ENT surgery

Table H-6 Descriptive statistics ENT surgery (Data: MST general ORs, 2008)

Type	Description	N	Mean (minutes)	Median (minutes)	SDEV (minutes)	Min (minutes)	Max (minutes)	CV
KN-ALGE-53	Tonsillectomie vanaf 16 jaar	221	45,76	44	11,37	25	104	0,25
KN-ALGE-30	Partiele conchotomie	110	63,55	59	28,76	25	205	0,45
KN-ALGE-40	Infundibulotomie	69	70,68	66	20,08	37	135	0,28
KN-ALGE-51	Tonsillectomie onder 11 jaar	54	11,74	8	11,19	4	56	0,95
KN-ALGE-47	Therapeutisch microlaryngoscopie	53	37,64	35	11,66	23	80	0,31
KN-ALGE-36	Micro-laryngoscopie therapeutisch	42	37,79	34	13,74	20	90	0,36
KN-ALGE-64	Septumcorrectie	42	70,33	68	32,40	32	237	0,46
KN-ALGE-67	Buisjes inbrengen	41	16,95	10	22,66	5	122	1,34
KN-ALGE-54	Adenotomie	35	12,31	9	8,84	5	48	0,72
KN-ALGE-79	Tympanoplastiek	35	77,94	74	20,33	45	117	0,26
KN-ALGE-52	Tonsillectomie 11 t/m 15 jaar	33	42,39	42	6,89	29	61	0,16
KN-ALGE-70	Sanering oor	32	132,31	101	70,19	58	291	0,53
KN-ALGE-31	Septumcorrectie / conchotomie	31	70,81	67	23,56	48	171	0,33
KN-ALGE-19	Tympanoplastiek + sanering	25	124,44	102	49,99	68	220	0,40
KN-ALGE-18	Tympanoplastiek / ketenreconstructie / exploratie	20	108,40	80	62,59	51	275	0,58
KN-ALGE-28	Poliepectomie	20	66,80	67	18,94	17	97	0,28
KN-ALGE-13	Buisjes plaatsen / verwijderen / oortoilet / aviveren	17	35,53	13	56,90	7	226	1,60
KN-ALGE-68	Buisjes verwijderen	17	10,41	10	3,48	7	19	0,33
KN-ALGE-33	In- en uitwendige neuscorrectie	16	125,94	119	35,09	76	210	0,28
KN-ALGE-20	Stapedectomie inspectie middenoor	14	78,64	71	23,66	59	139	0,30
KN-ALGE-38	Micro-laryngoscopie diagnostisch direct evt biops	14	36,21	35	18,20	12	75	0,50
KN-ALGE-41	Ethmoidalis / ethmoidectomie	12	75,58	72	25,63	46	135	0,34
KN-ALGE-12	Inbrengen t-drain	11	11,82	11	3,46	6	18	0,29
KN-ALGE-21	Attico-antrotomie enkelzijdig	11	116,82	99	46,48	70	228	0,40
KN-ALGE-29	Poliepectomie / clauwe	10	66,20	69	17,62	38	95	0,27
KN-ALGE-23	Radicalisatie mastoid	9	165,11	182	53,46	69	240	0,32
KN-ALGE-24	Myringoplastiek	9	76,78	80	11,26	55	87	0,15
KN-ALGE-26	Verwijderen kleine gezwellen	9	38,44	39	12,02	23	64	0,31
KN-ALGE-02	Meatusplastiek	8	58,25	56	14,52	45	87	0,25
KN-ALGE-04	Poliepectomie oor	7	51,86	30	43,35	17	135	0,84
KN-ALGE-34	Fess (uitgebreid)	7	72,57	75	17,48	41	94	0,24

KN-ALGE-86	Meatoplastiek-oor	7	65,14	67	13,69	42	87	0,21
KN-ALGE-10	Middenoorinspectie	5	94,20	83	37,44	69	160	0,40
KN-ALGE-37	Micro-laryngoscopie diagnostisch direct evt biopt	5	44,40	37	16,67	30	67	0,38
KN-ALGE-17	Trommelmvies sluiting enkelzijdig	4	75,50	73	21,63	53	103	0,29
KN-ALGE-35	Vestibulum / dorsum correctie	4	108,75	109	21,78	86	132	0,20
KN-ALGE-01	Klassieke tracheotomie	3	72,33	59	23,09	59	99	0,32
KN-ALGE-25	Verwijderen grote gezwellen	3	51,00	51	11,00	40	62	0,22
KN-ALGE-27	Verwijderen diep gelegen gezwellen	3	56,00	44	34,60	29	95	0,62
KN-ALGE-50	Graat verwijderen keel	3	41,00	41	6,00	35	47	0,15
KN-ALGE-55	Excisie zwelling subcutaan	3	85,33	96	22,94	59	101	0,27
KN-ALGE-63	Mastoidectomie	3	87,33	87	4,51	83	92	0,05
KN-ALGE-69	Glandula parotis / partiele extirpatie van het oppervlakkige deel	3	203,00	248	89,44	100	261	0,44
KN-ALGE-77	Uvulo palato pharyngoplastiek (uppp)	3	67,33	70	8,33	58	74	0,12
KN-ALGE-15	Exostosen / uitwendig oor	2	66,00	66	24,04	49	83	0,36
KN-ALGE-59	Glandula submandibularis	2	112,00	112	11,31	104	120	0,10
KN-ALGE-65	Hypofysetumor transnasaal deel kno-arts	2	180,50	181	61,52	137	224	0,34
KN-ALGE-71	Septumcorrectie + correctie neusvleugels en vestibulum	2	103,50	104	3,54	101	106	0,03
KN-ALGE-74	Stapedectomie met plaatsen van stapesprothese	2	138,50	139	38,89	111	166	0,28
KN-ALGE-80	Endonasale sinus sphenoidalis	2	196,50	197	177,48	71	322	0,90
KN-ALGE-81	Exploratie van het cavum tympani of trommelmvies	2	122,00	122	98,99	52	192	0,81
KN-ALGE-93	Gehoorgang verwijderen	2	57,50	58	14,85	47	68	0,26
KN-ALGE-05	Oorschelpcorrectie	1	129,00	129	0,00	129	129	0,00
KN-ALGE-09	Otoplastiek - oorschelpcorrectie (weke delen)	1	62,00	62	0,00	62	62	0,00
KN-ALGE-11	Buisjes en inspectie middenoor + adenotomie	1	13,00	13	0,00	13	13	0,00
KN-ALGE-16	Adenotomie + paracentese	1	8,00	8	0,00	8	8	0,00
KN-ALGE-22	Attici-antrotomie dubbelzijdig	1	167,00	167	0,00	167	167	0,00
KN-ALGE-39	Micro-laryngoscopie diagnostisch / therapeutisch / indirect + biopt	1	55,00	55	0,00	55	55	0,00
KN-ALGE-43	Pansinusitis / antroscopie	1	120,00	120	0,00	120	120	0,00
KN-ALGE-48	Diagnostische laryngo-pharyngoscopie (direct)	1	37,00	37	0,00	37	37	0,00
KN-ALGE-61	Therapeutische oesophagoscopie	1	49,00	49	0,00	49	49	0,00
KN-ALGE-73	Endonasal sinus frontalis operatie	1	79,00	79	0,00	79	79	0,00
KN-ALGE-78	Kaakspoeling bij kinderen onder de 12 jaar	1	38,00	38	0,00	38	38	0,00
KN-ALGE-84	Nasendoscopie	1	60,00	60	0,00	60	60	0,00
KN-ALGE-87	Reven pharynxbogen	1	44,00	44	0,00	44	44	0,00
KN-ALGE-89	Laterale halscyste	1	140,00	140	0,00	140	140	0,00
KN-ALGE-90	Septum resectie + evt. conchotomie	1	84,00	84	0,00	84	84	0,00
KN-ALGE-97	Kaakspoeling 12 jaar en ouder	1	74,00	74	0,00	74	74	0,00

H.7 Urology

Table H-7 Descriptive statistics urology (Data: MST general ORs, 2008)

Type	Description	N	Mean (minutes)	Median (minutes)	SDEV (minutes)	Min (minutes)	Max (minutes)	CV
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Improving elective OR planning at general ORs of Medisch Spectrum Twente - Appendix

UR-ALGE-012	Tur blaas	184	51,01	46	19,73	21	170	0,39
UR-ALGE-013	Tur prostaat	164	68,66	62	25,39	12	180	0,37
UR-ALGE-077	Circumcisie	68	41,41	38	14,62	26	129	0,35
UR-ALGE-070	Orchidopexie	51	58,47	56	16,99	11	99	0,29
UR-ALGE-018	Cystoscopie	27	37,59	35	13,16	19	69	0,35
UR-ALGE-055	Sachse	22	37,09	34	7,89	23	55	0,21
UR-ALGE-048	Tvt	18	51,17	47	9,98	39	71	0,20
UR-ALGE-069	Orchidectomie	16	49,44	49	9,61	34	70	0,19
UR-ALGE-063	Hydrocele	15	51,93	51	11,57	30	73	0,22
UR-ALGE-002	Verwijderen niersteen pnl	14	126,07	125	31,45	72	170	0,25
UR-ALGE-005	Laparoscopische nefrectomie	14	230,21	221	41,21	165	319	0,18
UR-ALGE-015	Uretero-reno-scopie / urs	14	78,36	74	20,65	53	118	0,26
UR-ALGE-025	Nefrectomie	14	167,00	158	77,35	73	383	0,46
UR-ALGE-046	Fascia sling	14	65,07	57	24,28	41	130	0,37
UR-ALGE-020	Lithotripsie	13	61,23	62	18,93	36	100	0,31
UR-ALGE-072	Vasectomie	12	47,50	37	22,69	27	105	0,48
UR-ALGE-008	Blaasbipten	10	42,70	42	10,98	27	62	0,26
UR-ALGE-041	Cystectomie + bricker	8	348,63	338	66,33	295	493	0,19
UR-ALGE-062	Hydrocele omklapplastiek + hernia inguinalis	8	49,25	47	10,21	35	64	0,21
UR-ALGE-073	Epididymectomie	8	51,63	48	11,06	39	70	0,21
UR-ABDO-01	Stagerings lymfadenectomie van het kleine bekken	7	398,71	370	67,11	324	498	0,17
UR-ALGE-064	Spermatocele	7	50,00	49	13,48	35	77	0,27
UR-ALGE-081	Hypospadie, volledige correctie	7	75,57	68	18,42	53	105	0,24
UR-ALGE-024	Pyelumplastiek / ah plastiek	6	138,17	124	35,79	116	209	0,26
UR-ALGE-027	Nefrectomie tumor	6	157,67	154	30,26	121	213	0,19
UR-ALGE-050	Botox injectie	6	38,50	38	3,02	35	42	0,08
UR-ALGE-082	Nesbitt	6	59,00	57	6,48	53	71	0,11
UR-ALGE-016	Cysto- urethoscopie	5	48,80	53	27,49	10	86	0,56
UR-ALGE-043	Meatotomie	5	35,60	35	6,99	29	47	0,20
UR-ALGE-060	Cystoprostatactomie	5	401,60	376	58,80	350	486	0,15
UR-ALGE-075	Vaso - vasostomie herstel na vasectomie	5	101,80	103	5,89	93	109	0,06
UR-ALGE-014	Uretero-reno-litholapaxie	4	103,00	103	20,64	81	126	0,20
UR-ALGE-045	Sting	4	33,50	36	7,19	23	39	0,21
UR-ALGE-047	Las	4	55,75	53	14,43	42	75	0,26
UR-ALGE-121	Meatus plastiek	4	31,75	32	4,11	27	37	0,13
UR-ALGE-010	Transurethrale resectie van een ureterocele	3	70,67	58	42,44	36	118	0,60
UR-ALGE-011	Tur blaashals	3	47,00	40	14,80	37	64	0,31
UR-ALGE-037	Partiele cystectomie zonder brachytherapie	3	159,67	168	18,93	138	173	0,12
UR-ALGE-038	Cystectomie met lymfklierdissectie	3	368,00	372	9,64	357	375	0,03
UR-ALGE-054	Macroplastiek	3	37,67	35	7,37	32	46	0,20
UR-ALGE-068	Palomo	3	67,67	60	33,17	39	104	0,49
UR-ALGE-088	Partiele penisamputatie	3	82,33	86	25,70	55	106	0,31
UR-ALGE-098	Verwijderen gezwellen	3	35,00	35	1,00	34	36	0,03
UR-ALGE-099	Verwijderen lipoom / atheroom / cyste	3	38,67	44	10,12	27	45	0,26
UR-ALGE-101	Hypospadie, eerste stadium	3	105,67	93	26,39	88	136	0,25
UR-ALGE-029	Ureterimplantatie in blaas enkelzijdig	2	215,00	215	16,97	203	227	0,08
UR-ALGE-032	Uretero-lithotomie	2	108,50	109	14,85	98	119	0,14

UR-ALGE-044	Sectio alta	2	64,50	65	4,95	61	68	0,08
UR-ALGE-066	Lord's plastiek	2	50,00	50	8,49	44	56	0,17
UR-ALGE-076	Excisie spermagranuloom	2	48,50	49	23,33	32	65	0,48
UR-ALGE-080	Sluiten urethra fistel (s)	2	62,50	63	0,71	62	63	0,01
UR-ALGE-085	Verwisselen dubbel j catheter	2	87,50	88	40,31	59	116	0,46
UR-ALGE-094	Cystectomie + bricker	2	373,00	373	53,74	335	411	0,14
UR-ALGE-095	Open ureteroperatie	2	124,00	124	33,94	100	148	0,27
UR-ALGE-105	Liesbreuk	2	44,50	45	0,71	44	45	0,02
UR-ALGE-111	Biopien penis	2	43,00	43	8,49	37	49	0,20
UR-ALGE-131	Laparoscopische partiele cystectomie	2	95,50	96	50,20	60	131	0,53
UR-ABDO-03	Stoma correctie	1	235,00	235	0,00	235	235	0,00
UR-ABDO-04	Eenvoudige incontinentiebehandeling + voor- en achterwandplastiek	1	28,00	28	0,00	28	28	0,00
UR-ABDO-06	Therapeutische laparoscopie	1	61,00	61	0,00	61	61	0,00
UR-ALGE-001	Laparoscopische pelviene lymfeklierdissectie	1	150,00	150	0,00	150	150	0,00
UR-ALGE-023	Pyelotomie	1	117,00	117	0,00	117	117	0,00
UR-ALGE-026	Nefrectomie + ureterectomie	1	378,00	378	0,00	378	378	0,00
UR-ALGE-035	Supra pubische catheter	1	25,00	25	0,00	25	25	0,00
UR-ALGE-040	Cystectomie + studer	1	456,00	456	0,00	456	456	0,00
UR-ALGE-053	Urethrotoma interna	1	41,00	41	0,00	41	41	0,00
UR-ALGE-057	Klepincisie (urethra)	1	33,00	33	0,00	33	33	0,00
UR-ALGE-065	Winkelmann	1	58,00	58	0,00	58	58	0,00
UR-ALGE-067	Variocel	1	44,00	44	0,00	44	44	0,00
UR-ALGE-071	Testisprothese	1	42,00	42	0,00	42	42	0,00
UR-ALGE-078	Verwijdings plastiek preputium	1	56,00	56	0,00	56	56	0,00
UR-ALGE-083	Blaas spoelen	1	55,00	55	0,00	55	55	0,00
UR-ALGE-084	Dubbel j catheter inbrengen	1	75,00	75	0,00	75	75	0,00
UR-ALGE-090	Brachii therapie	1	70,00	70	0,00	70	70	0,00
UR-ALGE-092	Doornemen sling	1	39,00	39	0,00	39	39	0,00
UR-ALGE-103	Coaguleren blaastumor	1	37,00	37	0,00	37	37	0,00
UR-ALGE-104	Nierbiopsie	1	38,00	38	0,00	38	38	0,00
UR-ALGE-109	Blaas augmentatie	1	199,00	199	0,00	199	199	0,00
UR-ALGE-112	Kleinere en / of weinig gecompliceerde transplantatie	1	163,00	163	0,00	163	163	0,00
UR-ALGE-113	Urethraruptuur/stricture dmv aanleggen urethrafistel mbv huidplastiek	1	107,00	107	0,00	107	107	0,00
UR-ALGE-114	Totale cystectomie zonder urinedeviatie	1	198,00	198	0,00	198	198	0,00
UR-ALGE-115	Urethrectomie	1	57,00	57	0,00	57	57	0,00
UR-ALGE-117	Dilatatie en catheterisatie	1	9,00	9	0,00	9	9	0,00
UR-ALGE-119	Testis biopsie	1	33,00	33	0,00	33	33	0,00
UR-ALGE-122	Platzbauch	1	66,00	66	0,00	66	66	0,00
UR-ALGE-123	Laparoscopische nefro-ureterectomie	1	227,00	227	0,00	227	227	0,00
UR-ALGE-124	Appendico-vesicostomie	1	172,00	172	0,00	172	172	0,00
UR-ALGE-127	Abces incisie	1	20,00	20	0,00	20	20	0,00
UR-ALGE-128	Extirpatie nodus scrotum	1	44,00	44	0,00	44	44	0,00
UR-ALGE-133	Debulking	1	136,00	136	0,00	136	136	0,00

H.8 Ophthalmology

Table H-8 Descriptive statistics eye surgery (Data: MST general ORs, 2008)

Type	Description	N	Mean (minutes)	Median (minutes)	SDEV (minutes)	Min (minutes)	Max (minutes)	CV
OO-ALGE-15	Phaco cataract + implantaat	1340	32,46	30	10,09	13	115	0,31
OO-ALGE-03	Strabismus 4 spieren	75	62,51	62	13,56	30	98	0,22
OO-ALGE-28	Avastin	73	12,53	13	1,19	8	16	0,10
OO-ALGE-14	Trabeculectomie	16	55,50	54	13,61	26	73	0,25
OO-ALGE-21	Sondage traanwegstenosen	15	22,13	23	6,35	12	30	0,29
OO-ALGE-10	Pterygium	7	39,71	43	18,13	14	63	0,46
OO-ALGE-17	Chalazion	4	20,50	22	5,20	13	25	0,25
OO-ALGE-32	Secundaire lens implantatie	4	45,00	39	14,81	35	67	0,33
OO-ALGE-37	Ecle (extra capsulaire lens extractie)	3	42,33	47	21,39	19	61	0,51
OO-ALGE-18	Ectropion	2	48,50	49	13,44	39	58	0,28
OO-ALGE-29	Verwijdering corpora aliena, subconjunctivaal	2	16,50	17	17,68	4	29	1,07
OO-ALGE-30	Verwijderen plombe	2	30,00	30	16,97	18	42	0,57
OO-ALGE-36	Edta spoeling	2	37,00	37	5,66	33	41	0,15
OO-ALGE-09	Sclerahechting	1	16,00	16	0,00	16	16	0,00
OO-ALGE-24	Vitrectomie	1	35,00	35	0,00	35	35	0,00
OO-ALGE-31	Algehele anesthesie bij specialistisch onderzoek	1	32,00	32	0,00	32	32	0,00
OO-ALGE-33	Abces ooglid	1	30,00	30	0,00	30	30	0,00
OO-ALGE-34	Ecce + implantaat	1	29,00	29	0,00	29	29	0,00
OO-ALGE-35	Herstel van de bedekkende delen van een geheel ooglid	1	37,00	37	0,00	37	37	0,00
OO-ALGE-38	Phaco zonder lens implantatie	1	51,00	51	0,00	51	51	0,00
OO-ALGE-39	Voorste oogkamer punctie (vok)	1	21,00	21	0,00	21	21	0,00

H.9 Jaw surgery

Table H-9 Descriptive statistics Jaw surgery (Data: MST general ORs, 2008)

Type	Description	N	Mean (minutes)	Median (minutes)	SDEV (minutes)	Min (minutes)	Max (minutes)	CV
KA-ALGE-068	Extracties / m	105	47,24	46	16,96	13	106	0,36
KA-ALGE-033	Totaal extractie	27	68,22	62	22,52	38	121	0,33
KA-ALGE-063	Verwijderen osteosynthese materiaal	26	59,73	57	19,56	31	109	0,33
KA-ALGE-058	Plaatsen implantaten	18	59,78	59	18,42	32	94	0,31
KA-ALGE-059	Plaatsen van eerste permucosale implantaat	12	78,08	69	33,51	40	145	0,43
KA-ALGE-005	Verwijderen grote cyste(n)	10	77,30	81	19,30	48	107	0,25
KA-ALGE-025	Extracties per kaakhelft	9	44,33	45	14,44	25	68	0,33
KA-ALGE-043	Le fort 1	8	157,50	140	42,71	118	229	0,27
KA-ALGE-054	Zygoma fractuur	8	38,13	36	8,20	30	53	0,22
KA-ALGE-004	Verwijderen kleinere cyste(n)	7	59,86	49	30,30	38	120	0,51
KA-ALGE-035	Halve bovenkaak resectie / resectie palatum molle	7	146,29	132	52,83	64	217	0,36
KA-ALGE-083	Opbouw maxilla	7	121,86	121	34,02	71	171	0,28
KA-ALGE-003	Extirpatie lymfklier enkelzijdig regionaal	6	257,67	206	216,15	58	674	0,84
KA-ALGE-048	Verlengings-osteotomie onderkaak	6	100,00	103	18,89	69	125	0,19
KA-ALGE-007	Kleine verrichtingen	5	53,80	44	29,18	30	104	0,54
KA-ALGE-031	Extracties per kaakhelft	4	41,75	36	31,37	10	85	0,75
KA-ALGE-040	Corticotomie	4	63,25	56	30,41	36	106	0,48
KA-ALGE-046	Bimaxillaire osteotomie	4	173,25	153	44,71	147	240	0,26

Improving elective OR planning at general ORs of Medisch Spectrum Twente - Appendix

KA-ALGE-011	Partiele tong resectie	3	54,67	51	14,84	42	71	0,27
KA-ALGE-030	Pre maxillo osteotomie mbv bekkenkambot	3	165,67	176	36,61	125	196	0,22
KA-ALGE-034	Apex resectie per kaak	3	53,00	55	18,08	34	70	0,34
KA-ALGE-062	Verwijderen implantaten	3	62,67	60	16,17	48	80	0,26
KA-ALGE-071	Vrij prepareren met aanbrengen van een ligatuur of extensie	3	54,00	47	14,80	44	71	0,27
KA-ALGE-077	Wondtoilet	3	46,67	30	30,62	28	82	0,66
KA-ALGE-082	Sequesterectomie	3	57,67	51	17,01	45	77	0,29
KA-ALGE-102	Bot bijwerken na schizis	3	80,33	84	37,63	41	116	0,47
KA-ALGE-108	Vrij prepareren geïmpacteerd element	3	44,33	47	7,37	36	50	0,17
KA-ALGE-109	Decorticalisatie	3	68,33	67	31,02	38	100	0,45
KA-ALGE-002	Radicale halsklierdissectie + supraomohyoidale	2	215,00	215	1,41	214	216	0,01
KA-ALGE-012	Extirpatie tumor weke delen van de mond	2	275,50	276	330,22	42	509	1,20
KA-ALGE-038	Halve resectie onderkaak	2	198,50	199	45,96	166	231	0,23
KA-ALGE-041	Osteotomie van de processus alveolaris	2	63,50	64	27,58	44	83	0,43
KA-ALGE-052	Mandibulafractuur enkelvoudig	2	56,50	57	23,33	40	73	0,41
KA-ALGE-074	Omslagplooiplastiek en/of correctie processus alveolaris	2	71,50	72	0,71	71	72	0,01
KA-ALGE-088	Klos wissel	2	81,00	81	8,49	75	87	0,10
KA-ALGE-096	Radicale halsklieruitruiming	2	218,00	218	48,08	184	252	0,22
KA-ALGE-001	Tracheotomie	1	504,00	504	0,00	504	504	0,00
KA-ALGE-006	Frenulum extirpatie	1	52,00	52	0,00	52	52	0,00
KA-ALGE-009	Gingiva correctie	1	108,00	108	0,00	108	108	0,00
KA-ALGE-013	Schizis achterste deel gehemelte	1	111,00	111	0,00	111	111	0,00
KA-ALGE-016	Schizis lipsluiting primair	1	133,00	133	0,00	133	133	0,00
KA-ALGE-017	Verwijderen submandibulaire klier	1	39,00	39	0,00	39	39	0,00
KA-ALGE-018	Commando resectie + reconstructie	1	505,00	505	0,00	505	505	0,00
KA-ALGE-020	Extirpatie frenulum labii en linguae	1	11,00	11	0,00	11	11	0,00
KA-ALGE-026	Extracties in 2 kaakhelften	1	26,00	26	0,00	26	26	0,00
KA-ALGE-036	Totale resectie bovenkaak	1	146,00	146	0,00	146	146	0,00
KA-ALGE-039	Correctie benigne kin	1	74,00	74	0,00	74	74	0,00
KA-ALGE-042	Osteotomie van het os zygomaticum	1	113,00	113	0,00	113	113	0,00
KA-ALGE-049	Sagittale splijtingsosteotomie	1	86,00	86	0,00	86	86	0,00
KA-ALGE-050	Distractie volgens mommaerts	1	73,00	73	0,00	73	73	0,00
KA-ALGE-053	Mandibula fractuur meervoudig	1	56,00	56	0,00	56	56	0,00
KA-ALGE-057	Tuberculum extirpatie / le clerck	1	147,00	147	0,00	147	147	0,00
KA-ALGE-061	Verwijderen transmandibulair implantaat	1	47,00	47	0,00	47	47	0,00
KA-ALGE-064	Radices	1	37,00	37	0,00	37	37	0,00
KA-ALGE-065	Extirpatie oppervlakkige gedeelte van de parotis	1	126,00	126	0,00	126	126	0,00
KA-ALGE-070	Bot transpantaat bij schisis	1	204,00	204	0,00	204	204	0,00
KA-ALGE-073	Partiele extirpatie glandula parotis	1	130,00	130	0,00	130	130	0,00
KA-ALGE-075	Caldwell luc	1	65,00	65	0,00	65	65	0,00
KA-ALGE-078	Tijdelijke intra orale voorzieningen	1	161,00	161	0,00	161	161	0,00
KA-ALGE-079	Ankylose kaakgewricht	1	215,00	215	0,00	215	215	0,00
KA-ALGE-080	Verkortingsosteotomie onderkaak	1	76,00	76	0,00	76	76	0,00
KA-ALGE-085	Extracties, verhoogd per element	1	15,00	15	0,00	15	15	0,00
KA-ALGE-089	Vestibulumplastiek	1	45,00	45	0,00	45	45	0,00
KA-ALGE-090	Plaatsen klosprothese	1	91,00	91	0,00	91	91	0,00

KA-ALGE-095	Thierschplastiek	1	53,00	53	0,00	53	53	0,00
KA-ALGE-097	Reconstructie gnatopalatinaal schizis defect	1	121,00	121	0,00	121	121	0,00
KA-ALGE-099	Sinus frontalis fractuur	1	94,00	94	0,00	94	94	0,00
KA-ALGE-100	Verwijderen speekselsteen	1	40,00	40	0,00	40	40	0,00
KA-ALGE-103	Mediane halscyste	1	49,00	49	0,00	49	49	0,00
KA-ALGE-104	Arcus fractuur	1	37,00	37	0,00	37	37	0,00
KA-ALGE-105	Behandeling uitgebreide weke delen letsel gelaat	1	43,00	43	0,00	43	43	0,00
KA-ALGE-106	Operatie van grote gecompliceerde gezwellen	1	69,00	69	0,00	69	69	0,00
KA-ALGE-107	Replantatie / transplantatie van elementen	1	46,00	46	0,00	46	46	0,00
KA-ALGE-110	Commando operatie	1	640,00	640	0,00	640	640	0,00
KA-ALGE-111	Litteken correctie	1	41,00	41	0,00	41	41	0,00
KA-ALGE-112	Orbitabodemfractuur	1	80,00	80	0,00	80	80	0,00

H.10 Other

Table H-10 Descriptive statistics unspecified specialties (Data: MST general ORs, 2008)

Type	Description	N	Mean (minutes)	Median (minutes)	SDEV (minutes)	Min (minutes)	Max (minutes)	CV
IN-ALGE-01	Gastroscoopie	22	27,68	25	10,91	16	69	0,39
IN-ALGE-06	Behandeling zenker divertikel	14	40,21	40	9,06	28	54	0,23
IN-ALGE-02	Coloscopie	12	33,00	32	8,17	24	52	0,25
IN-ALGE-04	Ercp therapeutische duodenoscopie	1	58,00	58	0,00	58	58	0,00
IN-ALGE-07	Plaatsen peg sonde	1	34,00	34	0,00	34	34	0,00
RE-ALGE-01	Injectie onder narcose	2	9,50	10	3,54	7	12	0,37
LO-ALGE-01	Bronchoscoopie	6	43,33	48	13,31	27	61	0,31
BT-ALGE-03	Tandheelkundige behandeling per kwadrant (90 minuten)	133	83,59	82	20,10	37	164	0,24
BT-ALGE-04	Tandheelkundige behandeling per kwadrant (120 minuten)	47	100,57	100	25,11	54	190	0,25
BT-ALGE-02	Tandheelkundige behandeling per kwadrant (60 minuten)	44	63,20	63	18,80	22	116	0,30
BT-ALGE-05	Tandheelkundige behandeling per kwadrant (150 minuten)	15	140,00	135	44,01	77	203	0,31
BT-ALGE-06	Tandheelkundige behandeling per kwadrant (180 minuten)	7	164,14	168	38,01	95	214	0,23
BT-ALGE-01	Tandheelkundige behandeling per kwadrant (30 minuten)	6	41,67	42	16,43	19	60	0,39
BT-ALGE-07	Tandheelkundige behandeling per kwadrant (210 minuten)	4	170,50	182	37,89	119	199	0,22
BT-ALGE-10	Tandheelkundige behandeling per kwadrant (270 minuten)	2	195,50	196	21,92	180	211	0,11
BT-ALGE-11	Extracties	2	58,00	58	16,97	46	70	0,29
BT-ALGE-09	Tandheelkundige behandeling per kwadrant (45 minuten)	1	58,00	58	0,00	58	58	0,00
BT-ALGE-12	Tandheelkundige behandeling per kwadrant (240 minuten)	1	267,00	267	0,00	267	267	0,00
999999	Onbekende activiteit / zie opmerking !	17	80,06	61	51,50	8	210	0,64

Appendix I. Deviation from planning

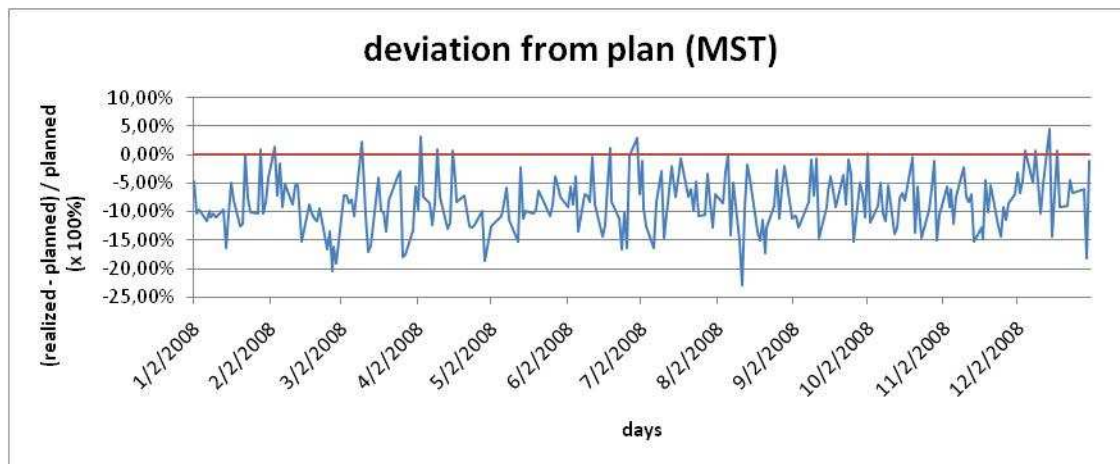


Figure I-1 Deviation from plan. Difference between sum of realized surgery durations and sum of planned surgery durations per day (negative values represent overestimated surgery durations). (Data: ORSuite, general ORs, 2008)

MST uses planning software that forecasts surgery durations based on historical data. The use of historical data in forecasting surgery durations should result in an average deviation from planned surgery durations that fluctuates around zero. Figure I-1 however shows that the daily deviation from planning for 2008 is structurally below zero. Figure I-2 supports this observation by showing a positive skew in the distribution of the deviation from planned surgery durations per surgical case. This indicates that planners schedule surgeries based on overestimated surgery durations. Overestimated surgery durations prevent planners from efficiently filling an OR program.

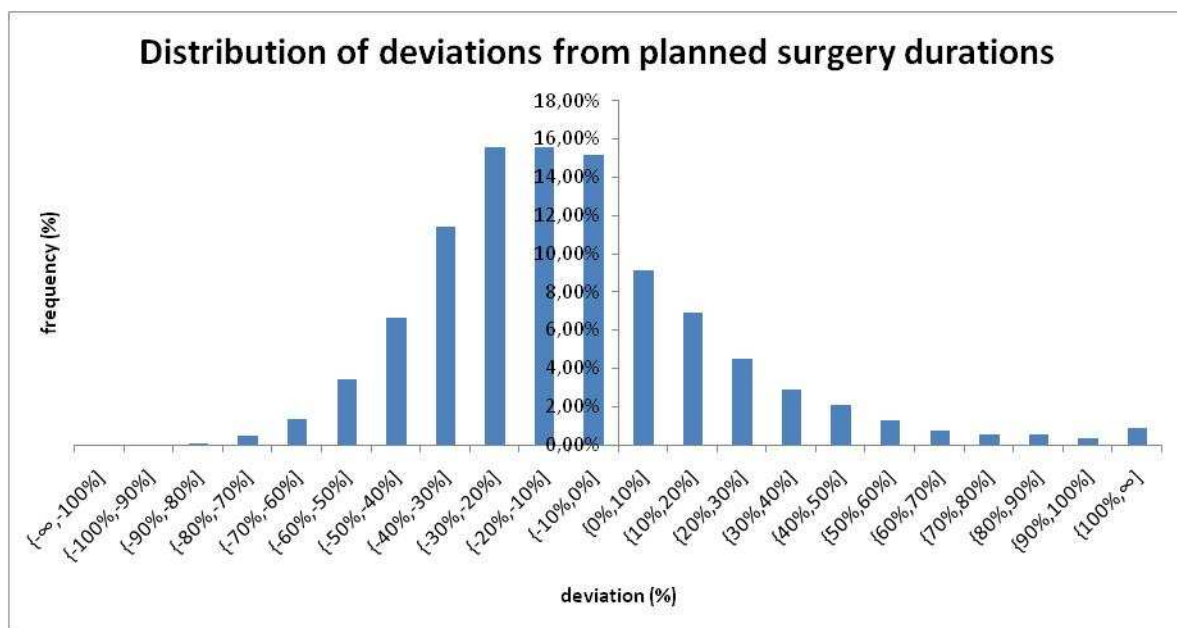


Figure I-2 Difference realized surgery duration and planned duration, (negative values represent overestimated surgery durations), N=16290. (Data: ORSuite general ORs, 2008)

Since the forecasting tool over time obtains more and more historical data, we expect the (absolute) deviation from planning to gradually converge to zero, assuming that surgery durations do not significantly decrease during the year. Figure I-3 shows the absolute deviation from plan per day. The absolute deviation hardly improves over time, indicating that the learning effect of the planning tool is negligible.

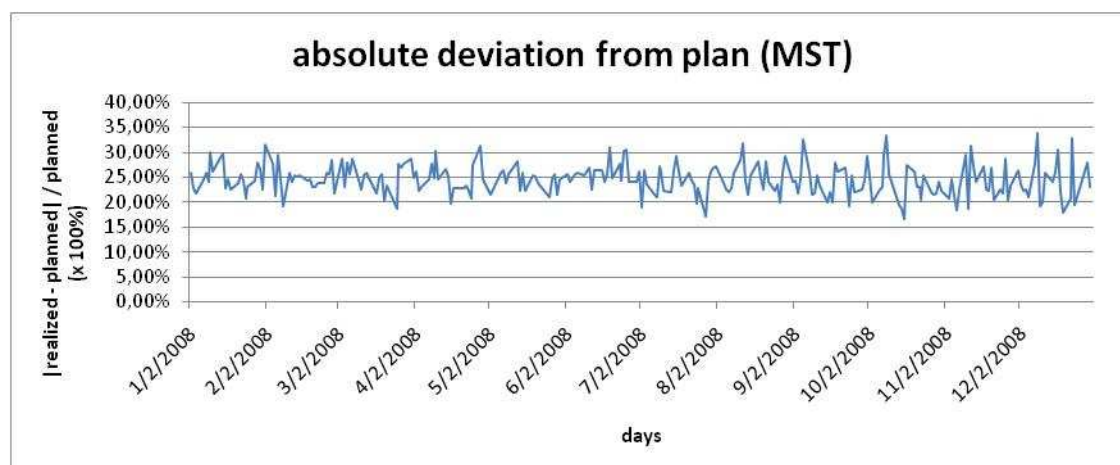


Figure I-3 Absolute daily deviation of realized surgery durations from planned surgery durations in 2008.
(Data: ORSuite general ORs, 2008)

Surgery duration includes incision time as well as time for preparing the patient, and time for inducing anesthetics by an anesthesiologist. In order to find out which part of the surgery causes these negative deviations, we examine the incision times. The incision time represents the largest part of the surgery duration. Figure I-4 and Table I-1 show that the deviation from planning for incision times is even more negative than the deviation for surgery durations. This shows that the overestimation of incision times is the primary cause for the overestimated surgery durations. In order to verify that conclusion can be generalized, we also examined the surgery durations from January 1, 2009 until October 20, 2009. This data shows the same negative deviation from planning and the lack of a learning effect of the planning tool.

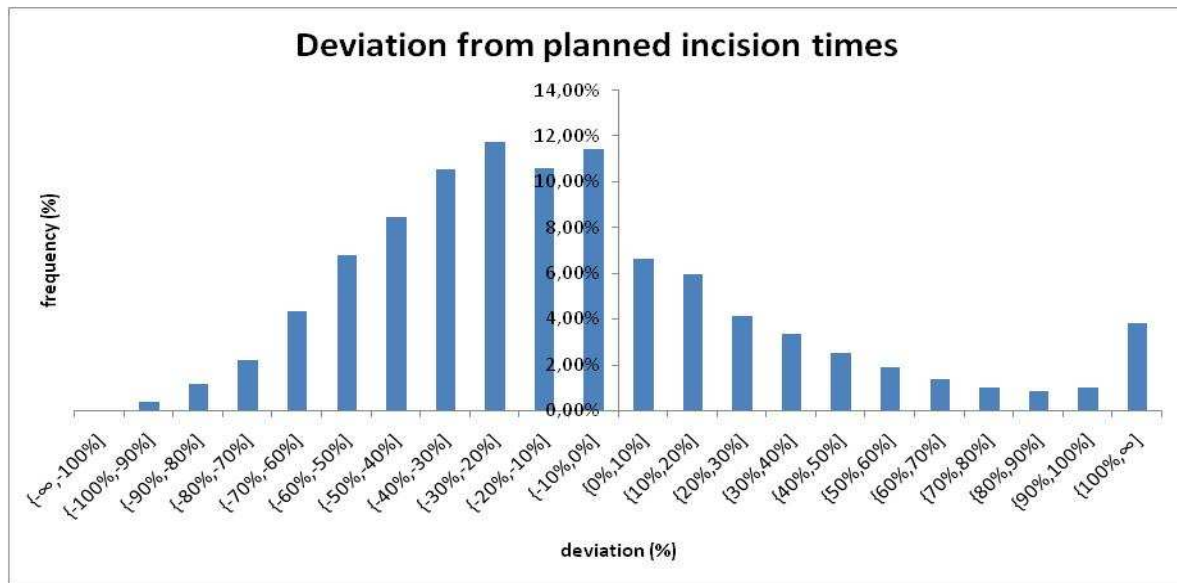


Figure I-4 Deviation from planning. Difference between realized and planned incision times, negative values represent an overestimation of incision times (N= 16258) (*Data ORSuite general ORs, 2008*)

Table I-1 Key performance indicators for deviation from plan. (*Data ORSuite general ORs, 2008*)

	Average deviation from plan:	Absolute deviation from plan:
Surgery durations	-8,6% (N=16290)	24,7% (N=16390)
Incision times	-10,5% (N=16258)	32,8% (N=16386)

Deviation from plan versus starting time of surgeries

We suspect the deviation from planning to depend on the time of day a surgery starts. Figure I-5 shows the average deviation from planning for various time intervals. We see that, although it represents only a small part of all surgeries, the deviation of planned surgery durations is positive for surgeries that start before 8:00 AM. When we focus on surgeries that start within regular working hours (8:00 AM – 4:00 PM), we see in fact that the deviation in planning becomes more negative during the day.

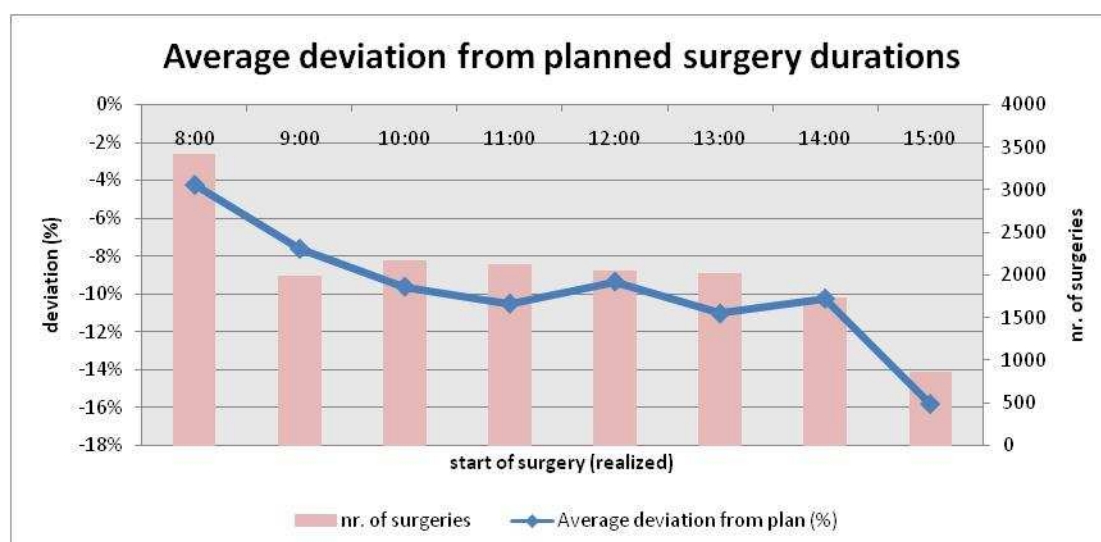


Figure I-5 Average deviation of realized surgery durations from planned surgery durations versus starting times of surgeries (Primary axis: average deviation from planning, Secondary axis: Number of surgeries)
(Data: ORSuite general ORs, 2008)

The smaller deviation at the start of the day however can be explained by the fact that not all surgeries start at the same time. An anesthesiologist serves two ORs simultaneously, therefore causing one OR having to wait for the anesthesiologist to finish in the other OR. Figure I-6 supports this explanation. The average deviation of realized and planned incision times between 8:00 AM and 9:00 AM is -9%, while the deviation from planned surgery durations is only -4%. This means that other factors determining the surgery durations show a positive deviation between planned and realized surgery durations (e.g. preparation times and time for inducing anesthetics).

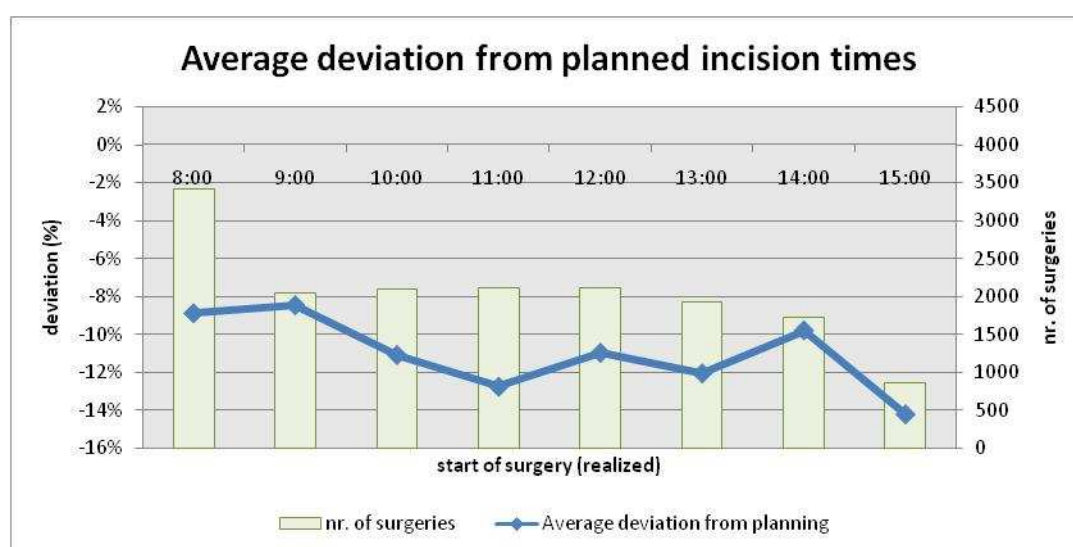


Figure I-6 Average deviation from planning of incision times versus starting times of surgeries (Primary axis: average deviation from planning, Secondary axis: Number of surgeries)
(Data: ORSuite general ORs, 2008)

I.1 Current forecasting method (Quantile method)

Currently, MST uses the quantile method to buffer for uncertainty in surgery durations. Forecasts for surgery durations are based on a combination of a surgeon s and a surgery type j . Let D_{sj} be a random variable representing the surgery duration for combination (s,j) . MST currently calculates the planned surgery duration H_{sj} by taking the 0.70 quantile over the last n observations in period T .

$$P(D_{sj} < H_{sj}) = 0.70$$

Besides the quantile percentage, the central planner can adjust the number of observations n , and the period T . By adjusting n and T , the planner can influence the number of observations and the observation period. These settings can only be generally applied. The quantile, number of observations, and observation period is the same for every surgeon-surgery type combination. Figure I-7 shows an example of loading surgeries in an ORday using the quantile method. The amount the forecast deviates from the mean surgery duration depends on the variation and skewness of the probability distribution.

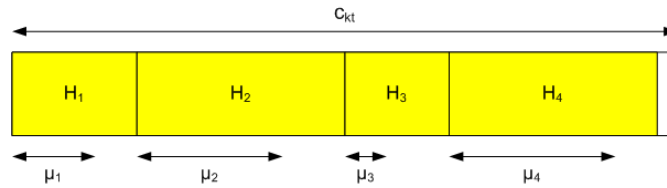


Figure I-7 Example of using quantile method

Disadvantage of the current algorithm that calculates the quantile value is that it does not use any form of interpolation. The algorithm sorts all surgeries that correspond to a certain combination of specialist and surgery and then calculates the percentage of cases that have a surgery smaller or equal to that of the selected case. The case with the largest percentage smaller or equal to the quantile value is chosen as the expected surgery duration. Table I-2 shows an example, where the fourth out of seven cases is chosen when the percentile value is set to 70%. Although a percentile value of 70% should mean that 70% of all cases did finish within the selected time period, in this case the actual percentage of cases finishing within the selected time period is only 57%.

Table I-2 Example of calculating quantile value (70%), (Data: ORSuite,2009)

Case	Surgeon	Surgery Type	Surgery duration	Percentage smaller or equal to surgery duration
223532	Bruijn	PL-TRAN-06	15	14%
209073	Bruijn	PL-TRAN-06	19	29%
198162	Bruijn	PL-TRAN-06	23	43%
<u>198184</u>	<u>Bruijn</u>	<u>PL-TRAN-06</u>	<u>23</u>	<u>57%</u>
211035	Bruijn	PL-TRAN-06	44	71%
214217	Bruijn	PL-TRAN-06	46	86%
211826	Bruijn	PL-TRAN-06	58	100%

Another disadvantage is that by taking the percentile value, slack is calculated for each surgery instead of calculating slack for a combination of surgeries within a specific OR block.

Appendix J. Calculating case mix repetitiveness

In this appendix, we describe how we calculate the part of the case mix that repeats itself every period. In 2008, we count 254 regular days with scheduled sessions. We determine the average number of surgical cases per day for each elective surgery type. After multiplying the number of surgeries per day by the length of the planning cycle, we round the number of surgeries per planning cycle down to the nearest integer.

J.1 Results

The total amount of surgeries performed in 2008 is 15426, 53 % of are inpatient surgeries and 47% outpatient surgeries.

Table J-1 shows the for a planning cycle of 20 days (4 weeks).

Table J-1 Repetitiveness of case mix with planning cycle of 4 weeks (Data: ORSUITE, 2008)

Repetitiveness = Nr of Patients per cycle (rounded down) / Nr. Patients per cycle

	Nr. Elective Patients	Nr. Patients/Cycle (+ round down)	Repetitiveness
Inpatients	8208	351	54%
Outpatients	7218	399	70%
Total	15426	750	62%

Table J-2 Repetitiveness of surgery types for which at least 30% of all surgeries is performed in Oldenzaal during 2008 with planning cycle of 4 weeks (Data: ORSUITE, 2008)

	Nr. Elective Patients	Nr. Elective Patients/Cycle	Nr. Patients/Cycle (round down)	Repetitiveness
Inpatients	633	49.84	25	50%
Outpatients	4828	380.16	303	80%
Total	5461	430	328	76%

Repetitiveness per surgery type

Table J-3 Number of surgeries per 4 weeks per specialty type per patient type rounded down to nearest integer (surgery types that occur less than once per 4 weeks are left out), (Data ORSuite, general ORs, 2008)

Patient Type	SpecID	SUBSPEC	Type	# Cases	MSS Slots	Repetitiveness
Inpatient	CH	GENERAL	CH-ENDO-17	212	16	96%
Inpatient	CH	GENERAL	CH-ALGE-015	185	14	96%
Inpatient	CH	GENERAL	CH-THOR-07	40	3	95%
Inpatient	CH	GENERAL	CH-ALGE-017	35	2	73%
Inpatient	CH	GENERAL	CH-ALGE-013	24	1	53%
Inpatient	CH	GENERAL	CH-ALGE-052	24	1	53%

Patient Type	SpecID	SUBSPEC	Type	# Cases	MSS Slots	Repetitiveness
Inpatient	CH	GENERAL	CH-ALGE-036	20	1	64%
Inpatient	CH	GENERAL	CH-ABDO-07_CH-ENDO-18	17	1	75%
Inpatient	CH	GENERAL	CH-ALGE-053	14	1	91%
Inpatient	CH	GENERAL	CH-ENDO-26	13	1	98%
Inpatient	CH	GE-ONCO	CH-MAMA-06	70	5	91%
Inpatient	CH	GE-ONCO	CH-ABDO-07	68	5	93%
Inpatient	CH	GE-ONCO	CH-MAMA-08	60	4	85%
Inpatient	CH	GE-ONCO	CH-ABDO-12	57	4	89%
Inpatient	CH	GE-ONCO	CH-MAMA-02	55	4	92%
Inpatient	CH	GE-ONCO	CH-ALGE-028	38	2	67%
Inpatient	CH	GE-ONCO	CH-ABDO-18	37	2	69%
Inpatient	CH	GE-ONCO	CH-MAMA-03	34	2	75%
Inpatient	CH	GE-ONCO	CH-THOR-03	31	2	82%
Inpatient	CH	GE-ONCO	CH-ALGE-012	26	2	98%
Inpatient	CH	GE-ONCO	CH-ALGE-007	25	1	51%
Inpatient	CH	GE-ONCO	CH-HOHA-20	25	1	51%
Inpatient	CH	GE-ONCO	CH-ALGE-024	23	1	55%
Inpatient	CH	GE-ONCO	CH-ABDO-28	22	1	58%
Inpatient	CH	GE-ONCO	CH-MAMA-05	19	1	67%
Inpatient	CH	GE-ONCO	CH-ALGE-021	18	1	71%
Inpatient	CH	GE-ONCO	CH-ABDO-44	17	1	75%
Inpatient	CH	GE-ONCO	CH-ABDO-27	16	1	79%
Inpatient	CH	GE-ONCO	CH-ABDO-31	16	1	79%
Inpatient	CH	GE-ONCO	CH-ALGE-008	16	1	79%
Inpatient	CH	GE-ONCO	CH-ABDO-08	15	1	85%
Inpatient	CH	GE-ONCO	CH-ABDO-37	15	1	85%
Inpatient	CH	GE-ONCO	CH-ABDO-29	14	1	91%
Inpatient	CH	GE-ONCO	CH-ENDO-13	14	1	91%
Inpatient	CH	GE-ONCO	CH-MAMA-07	14	1	91%
Inpatient	CH	GE-ONCO	CH-ABDO-48	13	1	98%
Inpatient	CH	GE-ONCO	CH-MAMA-15	13	1	98%
Inpatient	CH	TRAUMA	CH-TRAU-021	28	2	91%
Inpatient	CH	TRAUMA	CH-ALGE-033	14	1	91%
Inpatient	CH	VASCULAR	CH-ALGE-126	32	2	79%
Inpatient	CH	VASCULAR	CH-ALGE-022	30	2	85%
Inpatient	CH	VASCULAR	CH-VAAT-40	30	2	85%
Inpatient	CH	VASCULAR	CH-ALGE-042	29	2	88%
Inpatient	CH	VASCULAR	CH-VAAT-20	28	2	91%
Inpatient	CH	VASCULAR	CH-VAAT-51	24	1	53%
Inpatient	CH	VASCULAR	CH-VAAT-24	22	1	58%
Inpatient	CH	VASCULAR	CH-VAAT-59	19	1	67%
Inpatient	CH	VASCULAR	CH-ENDO-15	16	1	79%
Inpatient	CH	VASCULAR	CH-VAAT-07	15	1	85%
Inpatient	CH	VASCULAR	CH-VAAT-15_CH-VAAT-41	15	1	85%

Patient Type	SpecID	SUBSPEC	Type	# Cases	MSS Slots	Repetitiveness
Inpatient	CH	VASCULAR	CH-VAAT-28	15	1	85%
Inpatient	CH	VASCULAR	CH-VAAT-02	14	1	91%
Inpatient	CH	VASCULAR	CH-ALGE-005	13	1	98%
Inpatient	GY		GY-ABDO-08	73	5	87%
Inpatient	GY		GY-ABDO-12	64	5	99%
Inpatient	GY		GY-ABDO-02	62	4	82%
Inpatient	GY		GY-VAGI-33	40	3	95%
Inpatient	GY		GY-ABDO-28	29	2	88%
Inpatient	GY		GY-ENDO-01	28	2	91%
Inpatient	GY		GY-ABDO-26	26	2	98%
Inpatient	GY		GY-VAGI-32	22	1	58%
Inpatient	GY		GY-ENDO-09	20	1	64%
Inpatient	GY		GY-ABDO-21	18	1	71%
Inpatient	GY		GY-ENDO-08	18	1	71%
Inpatient	GY		GY-VAGI-05	18	1	71%
Inpatient	GY		GY-VAGI-16	17	1	75%
Inpatient	GY		GY-ABDO-25	15	1	85%
Inpatient	IN		IN-ALGE-06	13	1	98%
Inpatient	KN		KN-ALGE-053	214	16	95%
Inpatient	KN		KN-ALGE-064_KN-ALGE-30	55	4	92%
Inpatient	KN		KN-ALGE-064	38	2	67%
Inpatient	KN		KN-ALGE-070	32	2	79%
Inpatient	KN		KN-ALGE-079	32	2	79%
Inpatient	KN		KN-ALGE-040_KN-ALGE-041	30	2	85%
Inpatient	KN		KN-ALGE-052	30	2	85%
Inpatient	KN		KN-ALGE-31	26	2	98%
Inpatient	KN		KN-ALGE-019	24	1	53%
Inpatient	KN		KN-ALGE-047	19	1	67%
Inpatient	KN		KN-ALGE-018	18	1	71%
Inpatient	KN		KN-ALGE-033	15	1	85%
Inpatient	KN		KN-ALGE-020	14	1	91%
Inpatient	NE		NE-WVKL-06	368	28	97%
Inpatient	NE		NE-WVKL-04	115	9	99%
Inpatient	NE		NE-CRAN-10	51	4	100%
Inpatient	NE		NE-WVKL-14	36	2	71%
Inpatient	NE		NE-WVKL-15	26	2	98%
Inpatient	NE		NE-PIJN-02	23	1	55%
Inpatient	NE		NE-WVKL-21	23	1	55%
Inpatient	NE		NE-WVKL-26	21	1	60%
Inpatient	NE		NE-WVKL-05	19	1	67%
Inpatient	NE		NE-CRAN-07	18	1	71%
Inpatient	NE		NE-NVST-01	18	1	71%
Inpatient	NE		NE-CRAN-22	16	1	79%
Inpatient	NE		NE-WVKL-13	16	1	79%

Patient Type	SpecID	SUBSPEC	Type	# Cases	MSS Slots	Repetitiveness
Inpatient	NE		NE-ALGE-10	15	1	85%
Inpatient	NE		NE-WVKL-03	15	1	85%
Inpatient	NE		NE-WVKL-29	15	1	85%
Inpatient	OR		OR-HEUP-12	233	18	98%
Inpatient	OR		OR-KNIE-04	166	13	99%
Inpatient	OR		OR-KNIE-05	141	11	99%
Inpatient	OR		OR-SCHO-15	77	6	99%
Inpatient	OR		OR-HEUP-36	59	4	86%
Inpatient	OR		OR-SCHO-13	54	4	94%
Inpatient	OR		OR-HEUP-14	47	3	81%
Inpatient	OR		OR-KNIE-17	46	3	83%
Inpatient	OR		OR-SCHO-04	37	2	69%
Inpatient	OR		OR-VOET-24	30	2	85%
Inpatient	OR		OR-SCHO-22	25	1	51%
Inpatient	OR		OR-VOET-09	17	1	75%
Inpatient	OR		OR-VOET-10	17	1	75%
Inpatient	OR		OR-CLAV-03	16	1	79%
Inpatient	OR		OR-VOET-16	15	1	85%
Inpatient	OR		OR-HAND-13	13	1	98%
Inpatient	OR		OR-SCHO-14	13	1	98%
Inpatient	PL		PL-LICH-01	78	6	98%
Inpatient	PL		PL-LICH-03	42	3	91%
Inpatient	PL		PL-LICH-08	36	2	71%
Inpatient	PL		PL-LICH-09	27	2	94%
Inpatient	PL		PL-GELA-16	18	1	71%
Inpatient	UR		UR-ALGE-012	160	12	95%
Inpatient	UR		UR-ALGE-013	142	11	98%
Inpatient	UR		UR-ALGE-055	21	1	60%
Inpatient	UR		UR-ALGE-048	17	1	75%
Inpatient	UR		UR-ALGE-025	14	1	91%
Inpatient	UR		UR-ALGE-005	13	1	98%
Inpatient	UR		UR-ALGE-046	13	1	98%
Outpatient	CH	GENERAL	CH-ENDO-17	209	16	97%
Outpatient	CH	GENERAL	CH-ALGE-015	215	16	95%
Outpatient	CH	GENERAL	CH-THOR-07	46	3	83%
Outpatient	CH	GENERAL	CH-ALGE-017	35	2	73%
Outpatient	CH	GENERAL	CH-ALGE-013	14	1	91%
Outpatient	CH	GENERAL	CH-ALGE-052	25	1	51%
Outpatient	CH	GENERAL	CH-ALGE-036	16	1	79%
Outpatient	CH	GE-ONCO	CH-MAMA-06	87	6	88%
Outpatient	CH	GE-ONCO	CH-ABDO-07	66	5	96%
Outpatient	CH	GE-ONCO	CH-MAMA-08	51	4	100%
Outpatient	CH	GE-ONCO	CH-ABDO-12	59	4	86%
Outpatient	CH	GE-ONCO	CH-MAMA-02	55	4	92%

Patient Type	SpecID	SUBSPEC	Type	# Cases	MSS Slots	Repetitiveness
Outpatient	CH	GE-ONCO	CH-ALGE-028	41	3	93%
Outpatient	CH	GE-ONCO	CH-ABDO-18	39	3	98%
Outpatient	CH	GE-ONCO	CH-MAMA-03	36	2	71%
Outpatient	CH	GE-ONCO	CH-THOR-03	38	2	67%
Outpatient	CH	GE-ONCO	CH-ALGE-012	33	2	77%
Outpatient	CH	GE-ONCO	CH-ALGE-007	19	1	67%
Outpatient	CH	GE-ONCO	CH-HOHA-20	15	1	85%
Outpatient	CH	GE-ONCO	CH-ALGE-024	21	1	60%
Outpatient	CH	GE-ONCO	CH-ABDO-28	15	1	85%
Outpatient	CH	GE-ONCO	CH-MAMA-05	15	1	85%
Outpatient	CH	GE-ONCO	CH-ALGE-021	14	1	91%
Outpatient	CH	TRAUMA	CH-TRAU-021	38	2	67%
Outpatient	CH	VASCULAR	CH-ALGE-126	29	2	88%
Outpatient	CH	VASCULAR	CH-ALGE-022	26	2	98%
Outpatient	CH	VASCULAR	CH-VAAT-40	38	2	67%
Outpatient	CH	VASCULAR	CH-ALGE-042	27	2	94%
Outpatient	CH	VASCULAR	CH-VAAT-20	32	2	79%
Outpatient	CH	VASCULAR	CH-VAAT-51	19	1	67%
Outpatient	CH	VASCULAR	CH-VAAT-24	24	1	53%
Outpatient	CH	VASCULAR	CH-VAAT-59	13	1	98%
Outpatient	GY		GY-ABDO-08	78	6	98%
Outpatient	GY		GY-ABDO-12	74	5	86%
Outpatient	GY		GY-ABDO-02	74	5	86%
Outpatient	GY		GY-VAGI-33	45	3	85%
Outpatient	GY		GY-ABDO-28	32	2	79%
Outpatient	GY		GY-ENDO-01	29	2	88%
Outpatient	GY		GY-ABDO-26	20	1	64%
Outpatient	GY		GY-VAGI-32	13	1	98%
Outpatient	GY		GY-ENDO-09	16	1	79%
Outpatient	GY		GY-ABDO-21	16	1	79%
Outpatient	KN		KN-ALGE-053	222	17	97%
Outpatient	KN		KN-ALGE-064_KN-ALGE-30	56	4	91%
Outpatient	KN		KN-ALGE-064	48	3	79%
Outpatient	KN		KN-ALGE-070	28	2	91%
Outpatient	KN		KN-ALGE-079	28	2	91%
Outpatient	KN		KN-ALGE-040_KN-ALGE-041	29	2	88%
Outpatient	KN		KN-ALGE-052	29	2	88%
Outpatient	KN		KN-ALGE-31	22	1	58%
Outpatient	KN		KN-ALGE-019	22	1	58%
Outpatient	KN		KN-ALGE-047	14	1	91%
Outpatient	NE		NE-WVKL-06	1364	107	100%
Outpatient	NE		NE-WVKL-04	123	9	93%
Outpatient	NE		NE-CRAN-10	51	4	100%
Outpatient	NE		NE-WVKL-14	41	3	93%

Patient Type	SpecID	SUBSPEC	Type	# Cases	MSS Slots	Repetitiveness
Outpatient	NE		NE-WVKL-15	15	1	85%
Outpatient	NE		NE-PIJN-02	15	1	85%
Outpatient	NE		NE-WVKL-21	21	1	60%
Outpatient	NE		NE-WVKL-26	22	1	58%
Outpatient	NE		NE-WVKL-05	22	1	58%
Outpatient	OR		OR-HEUP-12	329	25	97%
Outpatient	OR		OR-KNIE-04	140	11	100%
Outpatient	OR		OR-KNIE-05	118	9	97%
Outpatient	OR		OR-SCHO-15	104	8	98%
Outpatient	OR		OR-HEUP-36	56	4	91%
Outpatient	OR		OR-SCHO-13	51	4	100%
Outpatient	OR		OR-HEUP-14	55	4	92%
Outpatient	OR		OR-KNIE-17	61	4	83%
Outpatient	OR		OR-SCHO-04	44	3	87%
Outpatient	OR		OR-VOET-24	35	2	73%
Outpatient	OR		OR-SCHO-22	20	1	64%
Outpatient	PL		PL-LICH-01	111	8	92%
Outpatient	PL		PL-LICH-03	42	3	91%
Outpatient	PL		PL-LICH-08	46	3	83%
Outpatient	PL		PL-LICH-09	34	2	75%
Outpatient	UR		UR-ALGE-012	147	11	95%
Outpatient	UR		UR-ALGE-013	128	10	99%
Outpatient	UR		UR-ALGE-055	15	1	85%

J.2 Cycle length

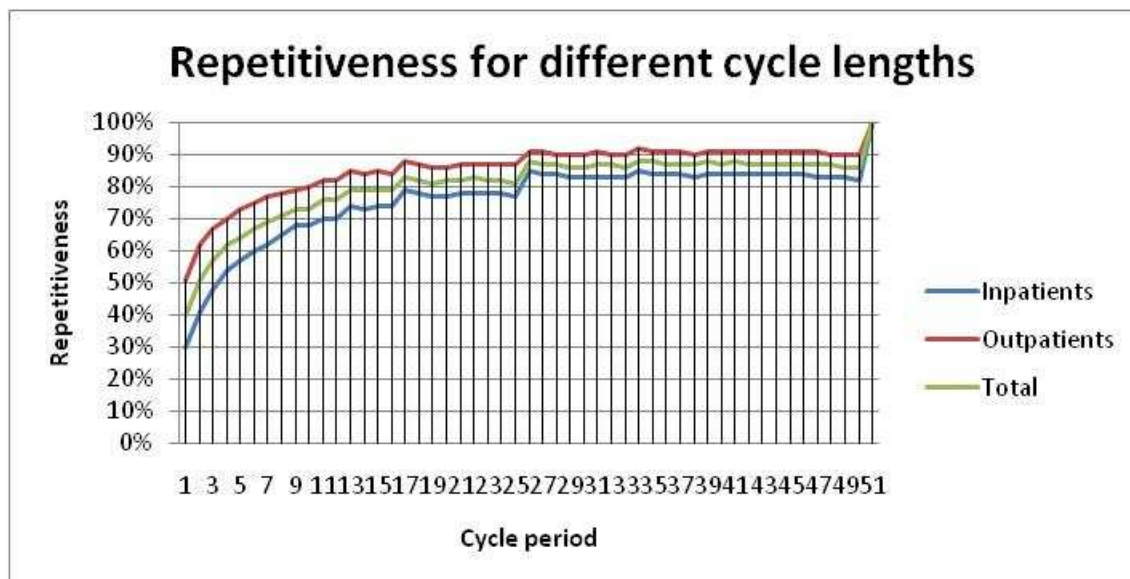


Figure J-1 Repetitiveness OR program versus planning cycle (Data: ORSuite, general ORs, 2008)

Appendix K. Master Surgical Scheduling approach

This Appendix describes the model used by Van Oostrum et al. (2008) to generate a master surgical schedule that replaces the tactical block plan. For more information, we refer the reader to the original paper.

The objective of the MSS approach is twofold. On the one hand required OR capacity is minimized, while on the other hand hospital bed requirements are leveled. The weighted objective function therefore states both objectives:

$$\text{Min } Z = \theta_1 \left\{ \sum_{t=1}^T \sum_{j=1}^J o_{jt} \cdot W_{jt} \right\} + \theta_2 \left\{ \sum_{b=1}^B \left[\frac{c_b}{\left\lceil \sum_{i=1}^I l_{ib} \cdot s_i \right\rceil / T} \cdot \max_{\tau \in C} \sum_{i=1}^I \sum_{j=1}^J \sum_{t=1}^T \psi_{t\tau ib} \cdot V_{ijt} \right] \right\}$$

θ_1 : weight of OR utilization

θ_2 : weight of Bed capacity demand

T : length of planning cycle, $t = 1, \dots, T$

C : all days in a Planning cycle, $t \in C$, for all $t = 1, \dots, T$

J : number of ORs, $j = 1, \dots, J$

I : Number of Surgery types $i = 1, \dots, I$

B : number of different bed type (surgical wards), $b = 1, \dots, B$

o_{jt} : the capacity of ORday (j, t);

$W_{jt} = \begin{cases} 1 & \text{if OR } j \text{ is used on day } T \\ 0 & \text{otherwise} \end{cases}$ (binary variable)

l_{ib} : LOS for the recovery of surgery i in bed b

c_b : priority factor of bed type b

s_i number of procedures of type i that have to be scheduled.

$\psi_{t\tau ib}$: bed requirement of bed b on day τ , for surgery i that is performed on day t .

V_{ijt} : the number of surgeries of type i that is scheduled on ORday (j, t)

Appendix L. Ward Occupancy as a function of tactical block plan

Vanberkel et al. (2009) present an approach to determine ward occupancy distributions and patient admission/discharge distributions. Parameters $c_j(x)$ and d_n^j are used to compute the probability distribution for the number of recovering patients on each day t . $c_j(x)$ Is a discrete distribution of specialty j completing x surgeries in one ORday. d_n^j Is the probability that a patient of specialty j , is discharged at day n , given that the patient has not been discharged before day n . For more information, we refer the reader to the original paper.

Step 1.

$h_n^j(x)$ denotes the probability distribution that n days after performing a surgical block of type j , x patients are still at the ward. By using an iterative approach, each $h_n^j(x)$ can be calculated.

$$h_n^j(x) = \begin{cases} c_j(x) & \text{when } n = 0 \\ \sum_{k=x}^{c_j} \binom{k}{x} (d_n^j)^{k-x} (1 - d_n^j)^x h_{n-1}^j(k) & \text{otherwise} \end{cases}$$

Step 2.

In the second stage $h_n^j(x)$ is used to determine $\bar{h}_m^{i,q}$, which denotes the probability distribution of x patients still in recovery on day m (single block schedule) resulting from surgery on OR block $b_{i,q}$. which is denoted by j .

$$\bar{h}_m^{i,q}(x) = \begin{cases} 0 & \text{if } m \leq q \\ h_{m-q}^j(x) & \text{if } m \geq q \end{cases}$$

$H_m(x)$: Probability distribution of x recovering patients on day m resulting from a single block schedule.

(Let $*$ indicate convolution)

$$H_m(x) = \bar{h}_m^{1,1} * \bar{h}_m^{1,2} * \dots * \bar{h}_m^{1,Q} * \bar{h}_m^{2,1} * \dots * \bar{h}_m^{I,Q}$$

Step 3.

Repeating the schedule: $H_q^{SS}(x)$ represents the Steady state probability distribution of x recovering patient on day q .

$$H_q^{SS}(x) = H_q * H_{q+Q} * H_{q+2Q} * \dots * H_{q+yQ}$$

Appendix M. clustering algorithm

Clustering of surgical cases. We use a derivative of the methodology described by van Oostrum et al. (2009). We consider elective surgeries only and determine the clusters using the data of MST's general ORs in 2008.

M.1 Heuristic

We use the following heuristic to cluster surgeries:

Step1 (for each surgery type):

Assign the realized surgery types to specific groups based on:

1. Specialty (or sub specialty)
2. Ward occupancy
 - a. Outpatients
 - b. Inpatients: LOS ≤ 0 night
 - c. Inpatients: $0 \text{ nights} < \text{LOS} \leq 1 \text{ night}$
 - d. Inpatients: $1 \text{ night} < \text{LOS} \leq 2 \text{ nights}$
 - e. Inpatients: $2 \text{ nights} < \text{LOS}$
3. Treatment code (part of DRG code)
4. Surgery duration
 - a. 0-20 minutes
 - b. 20 -40 minutes
 - c. 40-60 minutes
 - d. 60-90 minutes
 - e. 90 – 120 minutes
 - f. > 120 minutes

Step 2 (for each group):

Start by assigning each surgery type $i=1,...,n$ to a single cluster, so that $c = 1,...,n$.

Step 3 (for each group)

Sort the clusters on increasing standard deviations of surgery durations

Step 4 (for each group):

Start with cluster $c=1$. Assume m_c describes the number of realized surgeries of type c . CV_c describes the coefficient of variation for cluster c .

Add cluster $c+1$ to cluster c , if:

- $m_c < nr \text{ cycles per year}$, or
- $m_c CV_c + m_{c+1} CV_{c+1} > (m_c + m_{c+1}) CV_{c \& c+1}$ and $(m_c + m_{c+1}) CV_{c \& c+1} \leq (m_{c+1} + m_{c+2}) CV_{c+1 \& c+2}$, or

- $m_{c+1} < nr \text{ cycles per year}$ and
 $(m_c + m_{c+1})CV_{c\&c+1} < (m_{c+1} + m_{c+2})CV_{c+1\&c+2}$

M.2 Discussion

The more groups we identify, the smaller the number of surgeries per cluster, the larger the number of surgeries that cannot be scheduled using the MSS. Surgery characteristics that we do not take into account when grouping surgery types are:

- Demand for perioperative nurses
- Usage of medical equipment
- Required level of care at surgical ward

Historical data on the number of required perioperative nurses for each surgery and the role of these nurses is available. However, we are not able to link this data to the actual demand per surgery type and therefore do not consider this characteristic in clustering surgery types. Additionally, the available data is contaminated by the occurrence of breaks. During breaks additional nurses enter the OR to temporarily relieve other nurses. During these surgeries, the number of registered nurses in the OR exceeds the actual demand for that surgery type.

Historical data on the demand for medical equipment per surgery type is not available. Therefore we are not able to link this data to that of the various surgery types. Since the demand for equipment is in fact an important restriction for the creation of a feasible OR program. Measuring the demand for equipment ourselves however is not possible within scope of this research.

No data is available for the level of care a certain patient requires or receives at the surgical ward. Therefore we are not able to take into account this information. Measuring these levels of care is out of the scope of this research.

Location Oldenzaal shows less variability in the patient's required level of care at surgical wards, and in the demand for perioperative nurses. Therefore, not being able to take into account these characteristics can be justified. The availability of medical equipment however is an important factor and therefore should not be neglected. We therefore suggest further research to match demand for equipment (and instrument trays) to surgery types.

Appendix N. Input distributions

This appendix reports on the input distributions used in the simulation model. We determine the distribution and parameters for surgery durations as well as changeover times.

N.1 Surgery durations

The surgery duration is defined as the time between the moment the patient enters the OR until the moment the patient leaves the OR. This appendix describes how we determine the input distribution and parameters for the surgery duration, using historic data of 2009.

Table N-1 descriptive statistics of surgery durations 2008 (Data: ORsuite, 2009)

Descriptives			
Duration	Count		18485
	Mean	Statistic	74.51
		Std. Error	.426
	95% Confidence Interval for Mean	Lower Bound	73.68
		Upper Bound	75.35
	5% Trimmed Mean		67.70
	Median		59.00
	Variance		3351.268
	Std. Deviation		57.890
	Minimum		4
	Maximum		845
	Range		841
	Interquartile Range		55
	Skewness	Statistic	3.021
		Std. Error	.018
	Kurtosis	Statistic	16.544
		Std. Error	.036

Summary statistics

Based on the summary statistic, we see changeover times are not symmetrically distributed (skewness > 0). The minimum value is larger than 0. This is expected, based on the definition of surgery durations.

Histogram

The histogram of the surgery durations shows an asymmetrical distribution. The histogram of the natural logarithm of surgery durations shows a distribution that appears similar to that of the normal distribution. (Figure N-1 and Figure N-2)

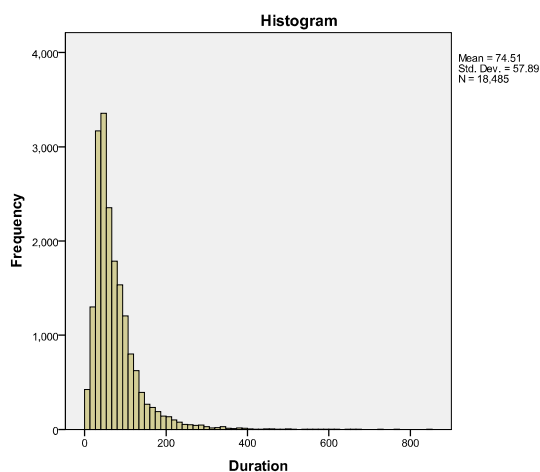


Figure N-1 Histogram of surgery durations in 2008 (Data: ORSuite, 2009)

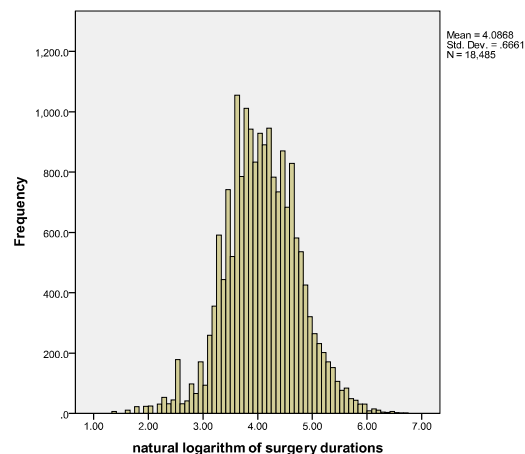


Figure N-2 Histogram of natural logarithm of surgery durations in 2008 (Data: ORSuite, 2009)

Goodness of fit

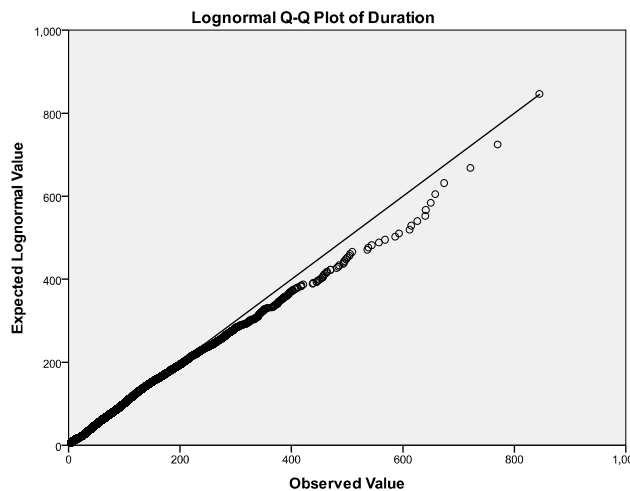


Figure N-4 Q-Q plot of lognormal distribution compared to historical surgery durations in 2008 (*Data: ORSuite, 2009*)

The Q-Q plot contributes to the expectation that surgery durations are lognormal distributed.

Statistical test

In statistical testing, we do not consider the entire population at once. Instead we determine the estimators for the lognormal distribution per surgery type. We assume surgery durations are random independent values. We test the hypothesis by examining the most frequently occurring surgery types of the seven most frequent users of OR capacity.

H_0 : surgery durations are lognormal distributed with parameters μ and σ^2

H_1 : surgery durations are not lognormal distributed

We test the null hypothesis for the most frequently occurring activities per specialty, using a chi square test.

Table N-3 Test values for Chi square tests

Specialty	activity	μ	σ	count	df	χ^2	$\chi^2(df, \alpha = .1)$	
General surgery	CH-ALGE-015	4.19	0.29	303	25	14.92	35.56	
Orthopedic surgery	OR-KNIE-18	3.68	0.22	333	21	26.20	30.81	
Ophthalmology	OO-ALGE-15	3.44	0.27	1375	23	62.7	33.20	Reject H_0
Gynecology	GY-VAGI-15	3.14	0.29	111	16	9.05	24.77	
Neurosurgery	NE-WVKL-06	4.30	0.28	368	25	25.11	35.56	
ENT surgery	KN-ALGE-053	3.78	0.27	223	24	39.7	34.4	Reject H_0
Plastic surgery	PL-LICH-01	4.96	0.25	79	7	8.39	13.36	
Urology	UR-ALGE-012	3.81	0.27	161	17	13.30	25.99	

Table N-3 shows that, except for Ophthalmology and ENT surgery, the null hypothesis cannot be rejected. Therefore, it is plausible to model surgery durations using a lognormal distribution. Ophthalmology in general and this particular activity of ENT surgery differ from the other surgeries in the use of anesthetics, which could explain why these surgery types have a different distribution. However, when we look at the histograms for these specific surgery types, we see the lognormal distribution fits the historical data well, except for the values with the highest frequencies. The significant difference between the data and the lognormal distribution can also be caused by measurement errors in the registering surgical time intervals in the OR. Since the lognormal distribution is a common input distribution for surgery durations, and by reasons of simplicity, we decide to fit the lognormal distribution to all surgery types.

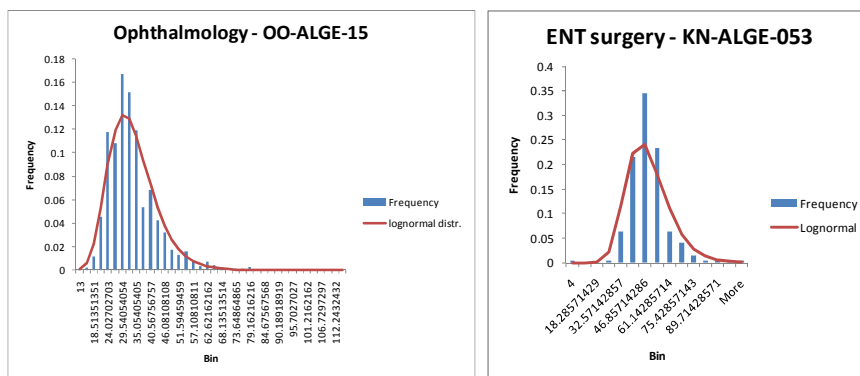


Figure N-5 Histogram of surgery durations for surgery OO-ALGE-15 (cataract surgery) compared to lognormal distribution.

Figure N-6 Histogram of surgery durations for surgery KN-ALGE-053 (tonsillectomy) compared to lognormal distribution.

(Data: ORsuite, 2008)

Conclusion

We describe surgery durations using a lognormal distribution.

N.2 Changeover times

Since we are not able to assign changeover times to specific surgery types, we calculate changeover times for each specialty. MST does not register changeover times between surgeries. It does register the time a patient leaves an OR and the time the next patient enters the OR. We use these time stamps to calculate the changeover times. It is not uncommon that an emergency surgery is scheduled in an OR where the elective surgeries have already been performed. The time between the last elective surgery and the emergency surgery, or the time between consecutive emergency surgeries may differ from the actual changeover time. An OR on which the elective program has been finished is likely to be idle. This idle time is not representative for the actual changeover time. Therefore in calculating changeover times per session block, we only consider the time between consecutive elective surgeries. Additionally, changeover times longer than 45 minutes do not occur, other than surgeries on patients

that have certain infections. As a rule, these patients are scheduled at the end of an OR program. Therefore, for our definition of changeover times, we can discard changeover times larger than 45 minutes. Occurrence of these times can be explained by surgeons suddenly being prevented from continuously performing their elective programs (eg. in case an emergency patients is prepared in another OR). Since these interruptions are not caused by the actual changeover time, we only consider changeover times smaller than or equal to 45 minutes. We evaluate and determine the distribution and parameters concerning the changeover times using historical data of 2009.

Since the location of the recovery and holding influences changeover times, we determine the parameters for each specialty and each location.

Summary statistics

Enschede

Table N-4 Summary statistics of changeover times for location Enschede per specialty (Data: ORSuite, 2009)

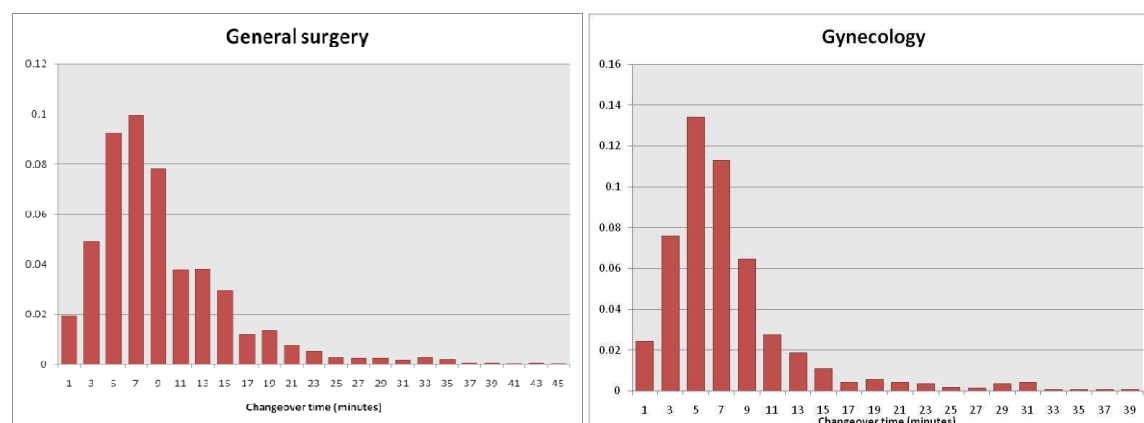
	General surgery	Dental surgery	Plastic surgery (private)	Gynecology	Internal Medicine	Jaw surgery	ENT surgery	Neuro surgery	Ophthalmology	Orthopedic surgery	Plastic surgery (general)	Urology
N	2251	45	5	823	28	235	703	841	470	1790	309	605
Mean	9.53	9.91	13.00	7.75	6.96	7.93	8.12	8.53	5.69	8.23	9.09	9.15
Std. Error of Mean	0.13	1.31	3.62	0.18	1.37	0.31	0.19	0.21	0.30	0.11	0.36	0.24
Median	8.00	8.00	10.00	6.00	5.00	7.00	7.00	7.00	4.00	7.00	8.00	8.00
Mode	8	5	5	6	5	5	7	5	0	7	7	7
Std. Deviation	6.22	8.82	8.09	5.25	7.23	4.71	5.10	6.02	6.45	4.77	6.38	5.90
Skewness	1.98	1.39	1.26	2.54	2.77	2.58	2.57	2.00	2.11	2.05	1.92	1.77
Std. Error of	0.05	0.35	0.91	0.09	0.44	0.16	0.09	0.08	0.11	0.06	0.14	0.10
Coeff. of variation	0.65	0.89	0.62	0.68	1.04	0.59	0.63	0.71	1.14	0.58	0.70	0.64
Kurtosis	5.50	1.28	1.62	8.38	8.03	14.08	10.16	6.70	5.92	7.31	6.05	4.43
Std. Error of Kurtosis	0.10	0.69	2.00	0.17	0.86	0.32	0.18	0.17	0.22	0.12	0.28	0.20
Range	45	34	21	38	33	43	44	45	42	43	45	44
Minimum	0	0	5	0	1	0	0	0	0	0	0	0
Maximum	45	34	26	38	34	43	44	45	42	43	45	44
Percentiles												
25	6	4.5	7	5	3.25	5	5	5	1	5	5	5
50	8	8	10	6	5	7	7	7	4	7	8	8
75	11	12.5	20.5	9	7	10	9	11	8	10	11	11

Table N-4 describes the summary statistics for the changeover times at specialty's OR programs in Enschede. Because the first patient has to leave the OR before the next patients is able to enter the OR, changeover times are generally positive. Except for dental surgery and private plastic surgery, average changeover times are about 8-9 minutes for all specialties. Table N-4 shows a positive skewness for all specialties. This indicates that changeover times are not symmetrically distributed. Although mean, standard deviation, and skewness are comparable for all specialties, the kurtosis shows large differences between specialties. Remarkable is the mode for Ophthalmology, the minimum value is the value that appears most often.

Oldenzaal**Table N-5 Summary statistics of changeover times for location Oldenzaal per specialty (Data: ORsuite, 2009)**

	General surgery	Dental surgery	Plastic surgery (private)	Gynecology	Jaw surgery	ENT surgery	Ophthalmology	Orthopedic surgery	Plastic surgery (general)	Urology
N	801	167	193	99	67	146	1282	291	274	58
Mean	6.05	9.53	8.66	6.49	9.34	7.09	6.06	4.86	8.15	7.12
Std. Error of Mean	0.19	0.55	0.51	0.75	1.14	0.66	0.22	0.23	0.43	0.83
Median	5.00	8.00	7.00	5.00	6.00	4.00	4.00	4.00	6.00	6.00
Mode	4	5	3	4	2	3	0	4	5	6
Std. Deviation	5.41	7.10	7.05	7.42	9.30	7.95	7.84	3.91	7.04	6.34
Skewness	2.97	1.29	1.78	3.57	1.65	1.94	2.37	3.73	1.78	1.61
Std. Error of Coeff. of Variation	0.09	0.19	0.17	0.24	0.29	0.20	0.07	0.14	0.15	0.31
Kurtosis	12.22	2.44	3.45	14.71	2.33	3.08	5.90	22.08	3.41	2.71
Std. Error of Kurtosis	0.17	0.37	0.35	0.48	0.58	0.40	0.14	0.28	0.29	0.62
Range	45	40	37	45	41	35	45	37	40	28
Minimum	0	0	0	0	0	0	0	0	0	0
Maximum	45	40	37	45	41	35	45	37	40	28
Percentiles 25	3	4	4	3	3	2	1	3	4	3
50	5	8	7	5	6	4	4	4	6	6
75	7	13	11	6	13	8	7	6	10	10

Table N-5 shows a summary of the descriptive statistics for the changeover times in Oldenzaal. Again, the table shows positively skewed distributions for all specialties, indicating that the distribution is asymmetrical. Furthermore, the values for the standard deviation are close to the values of the mean (coefficient of variation ≈ 1). Again, Ophthalmology shows a mode of zero, which is equal to the minimum value.

Histograms**Enschede****Figure N-7 Histogram of distribution of changeover times for General Surgery in Enschede (Data: ORsuite, 2009)****Figure N-8 Histogram of distribution of changeover times for Gynecology in Enschede (Data: ORsuite, 2009)**

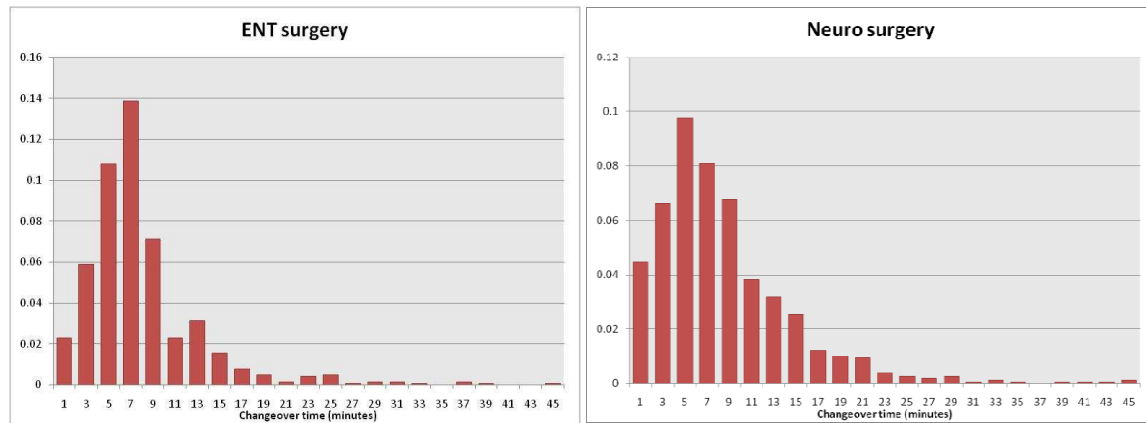


Figure N-9 Histogram of distribution of changeover times for Ear-Nose-Throat Surgery in Enschede (*Data: ORsuite, 2009*)

Figure N-10 Histogram of distribution of changeover times for Neurosurgery in Enschede (*Data: ORsuite, 2009*)

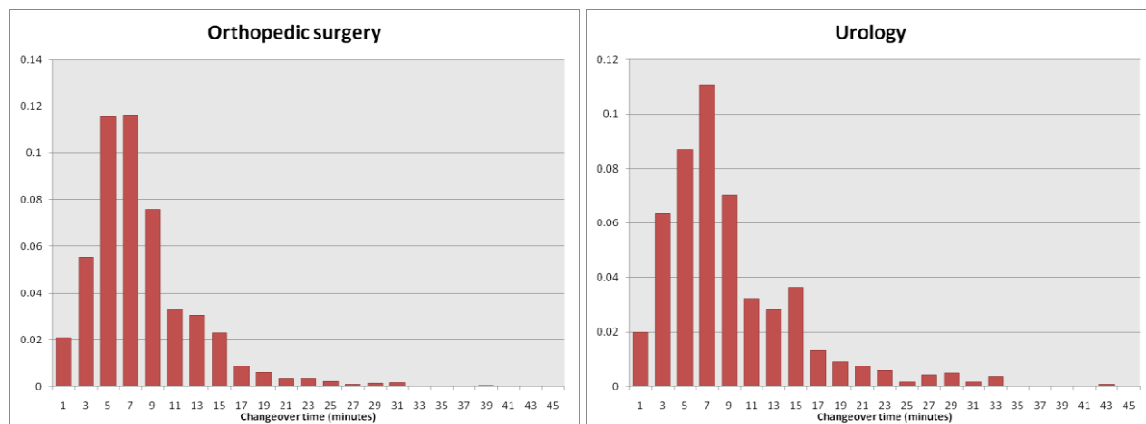


Figure N-11 Histogram of distribution of changeover times for Orthopedic Surgery in Enschede (*Data: ORsuite, 2009*)

Figure N-12 Histogram of distribution of changeover times for Urology in Enschede (*Data: ORsuite, 2009*)

Figure N-7 - Figure N-12 show histograms of the distribution of changeover times in 2009 for the six most frequent users of OR capacity in Enschede. The histograms affirm that the distribution of changeover times is asymmetrical, with a tail to the right. The shape of the distributions seems similar for all specialties.

Oldenzaal

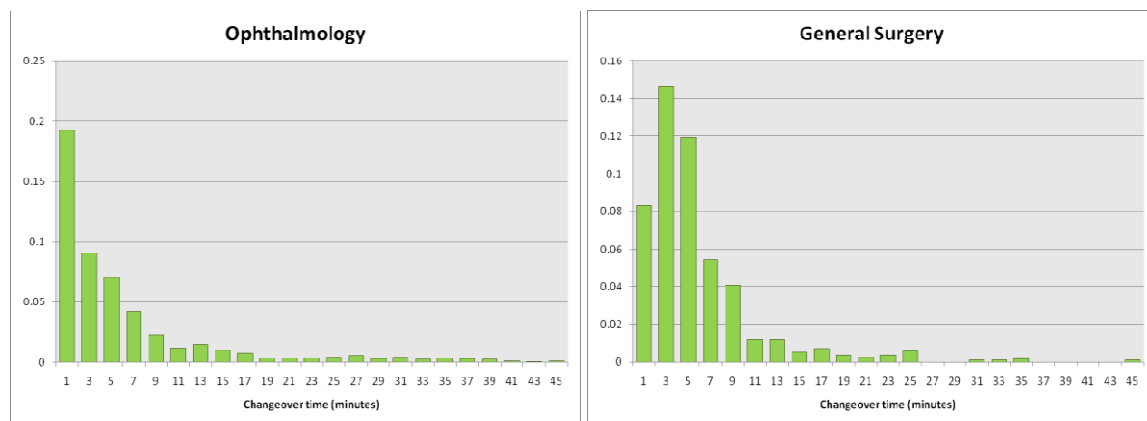


Figure N-13 Histogram of distribution of changeover times for Ophthalmology in Oldenzaal (*Data: ORsuite, 2009*)

Figure N-14 Histogram of distribution of changeover times for General Surgery in Oldenzaal (*Data: ORsuite, 2009*)

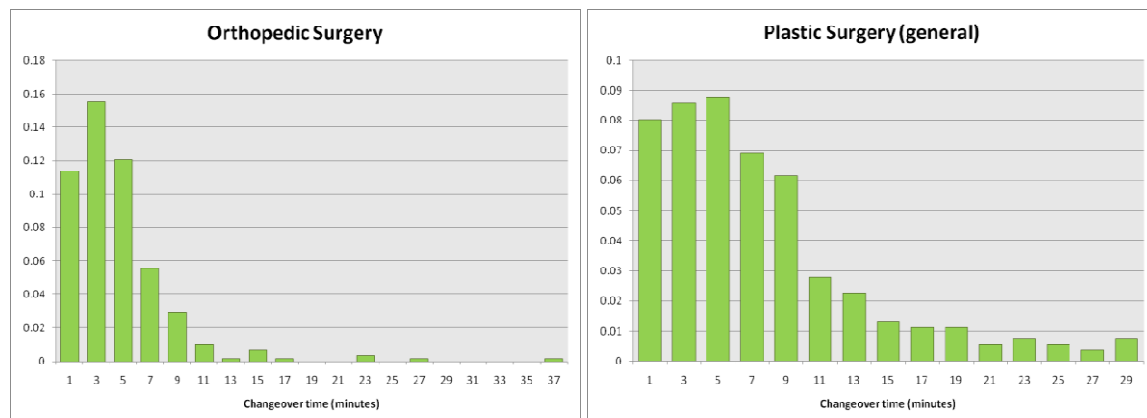


Figure N-15 Histogram of distribution of changeover times for Orthopedic Surgery in Oldenzaal (*Data: ORsuite, 2009*)

Figure N-16 Histogram of distribution of changeover times for Plastic Surgery (general) (*Data: ORsuite, 2009*)

Figure N-13 - Figure N-16 show histograms of the distribution of changeover times in 2009 for the four most frequent users of OR capacity in Oldenzaal. The histograms show that all distributions have a tail to the right of the median. Unlike the distributions for changeover times in Enschede, not all distributions seem to have the same shape. Especially the distribution of Ophthalmology (Figure N-13) differs from the other distributions. This can be explained by the fact that Ophthalmologic surgeries generally do not involve anesthetics.

Box plots

Enschede

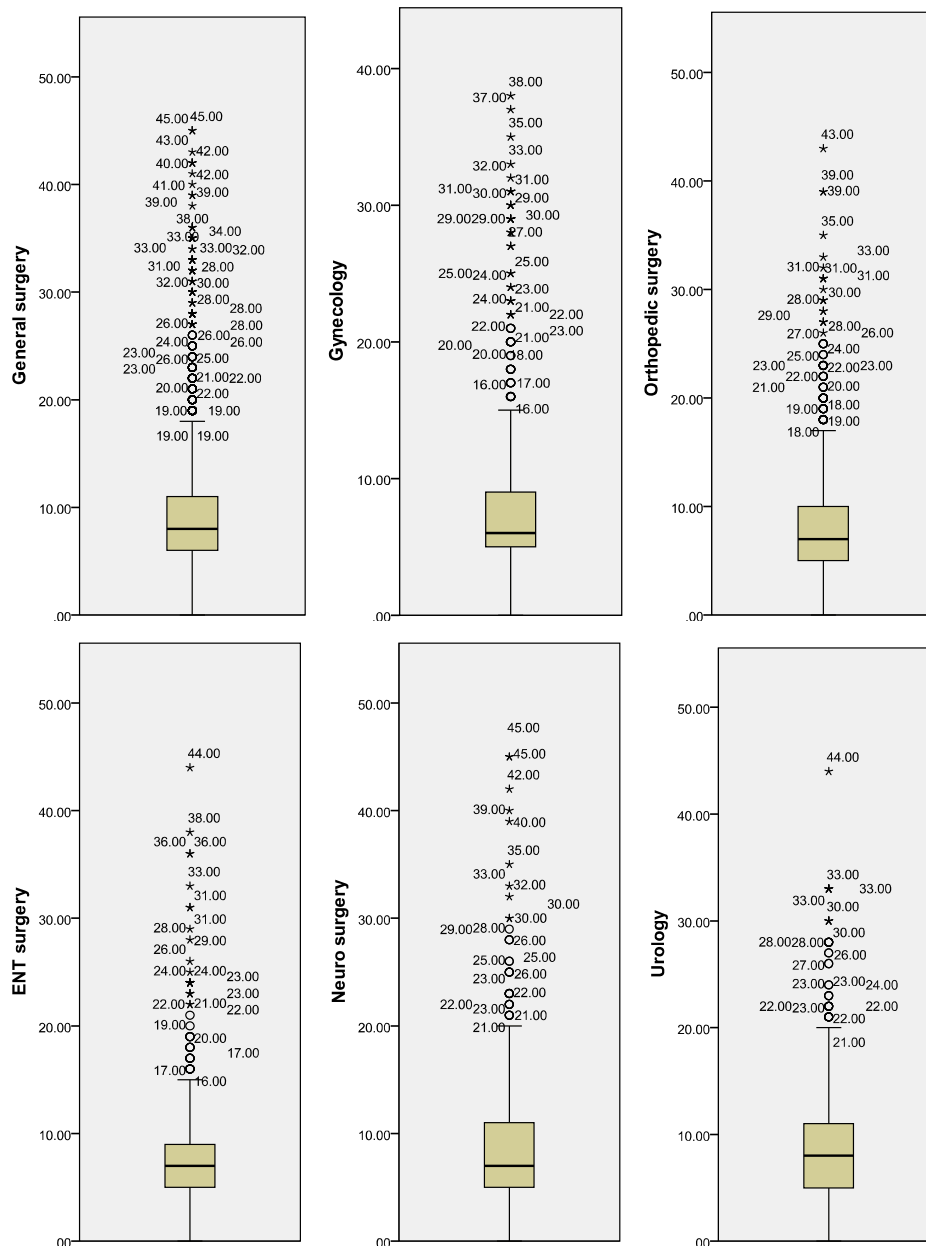


Figure N-17 Box plots of changeover times (in minutes) for six most frequent specialties in Enschede (*Data: ORSuite, 2009*)

Figure N-17 affirms that the distributions are right tailed. Additionally, the box plots show the outliers for each distribution. The figures show a high concentration of comparable changeover times on a relatively small range. This can also be seen by the large kurtosis values in the descriptive summary.

Oldenzaal

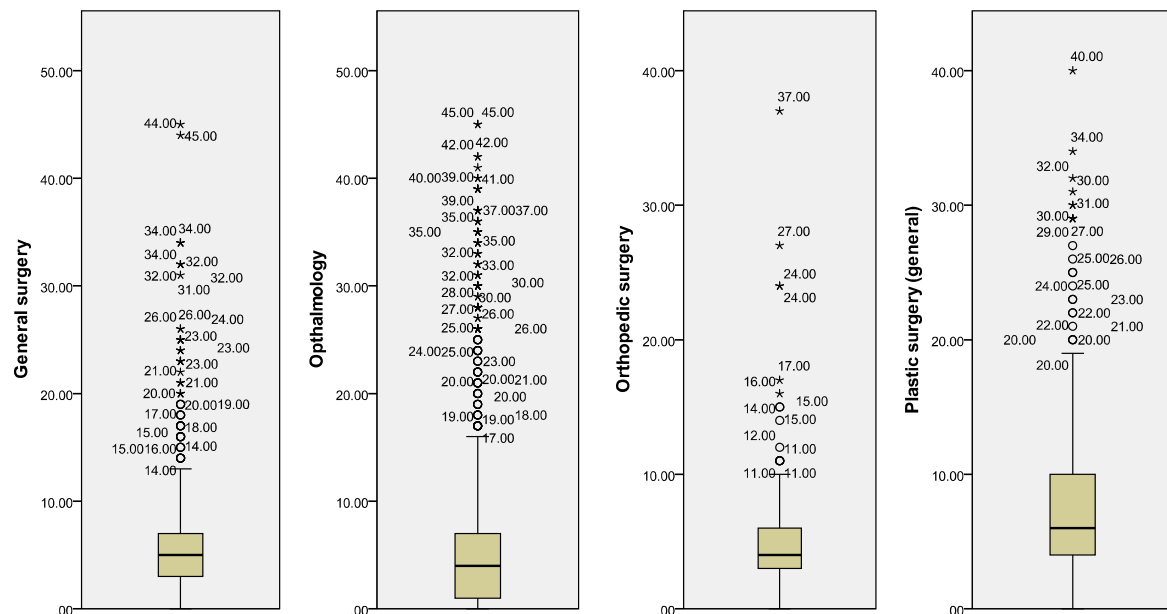


Figure N-18 Box plots of changeover times (in minutes) of four most frequent specialties in Oldenzaal (Data: *ORSuite, 2009*)

Figure N-18 shows the box plots for the four most frequent specialties in Oldenzaal. Again, we see the distribution of Ophthalmology differs from the other distributions. The first quartile of the distribution is close to the minimum value.

Parameter estimation

In a real world situation, changeover times are continuously distributed. We therefore suggest a continuous distribution for the input distribution of changeover times in the simulation model. The distribution is asymmetrical, and changeover values cannot be negative.

Based on the analysis of the statistical summary, the histograms, and the box plots, it is possible that ophthalmology requires another distribution than the other specialties. This can be justified by the changeover process. In general, Ophthalmologic patients only require local anesthetics. This means that patients generally do not enter the OR in a bed, but are able to walk in prior to the surgery, and walk out afterwards (or leave the OR on a mobile chair).

Goodness of fit

Since the distribution should be asymmetrical and have a tail to the right, one of the possible distributions is the lognormal distribution, which is a common distribution to describe time intervals of surgery durations (e.g. Dexter et al., 1998; May et al., 2000; Van Oostrum et al., 2008).

Lognormal distribution

Table N-6 shows the estimated parameters for the lognormal distribution of the six most frequently scheduled specialties in Enschede. Figure N-19 shows the Q-Q plots for the lognormal distribution. We see that the lognormal distribution seems a good fit for the distributions of changeover times of General surgery, Orthopedic surgery, Neurosurgery, and Urology. Gynecology and ENT surgery deviate more from the lognormal distribution, especially for large changeover times.

Table N-6 Estimated Distribution parameters changeover times of six most frequently operating specialties in Enschede

		Estimated Distribution Parameters					
		General Surgery	Gynecology	Orthopedic surgery	Ear-Nose-Throat Surgery	Neurosurgery	Urology
Lognormal Distribution	Scale	9.099	7.671	8.218	8.100	7.971	8.747
	Shape	.544	.498	.489	.479	.616	.555
	Shift	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000

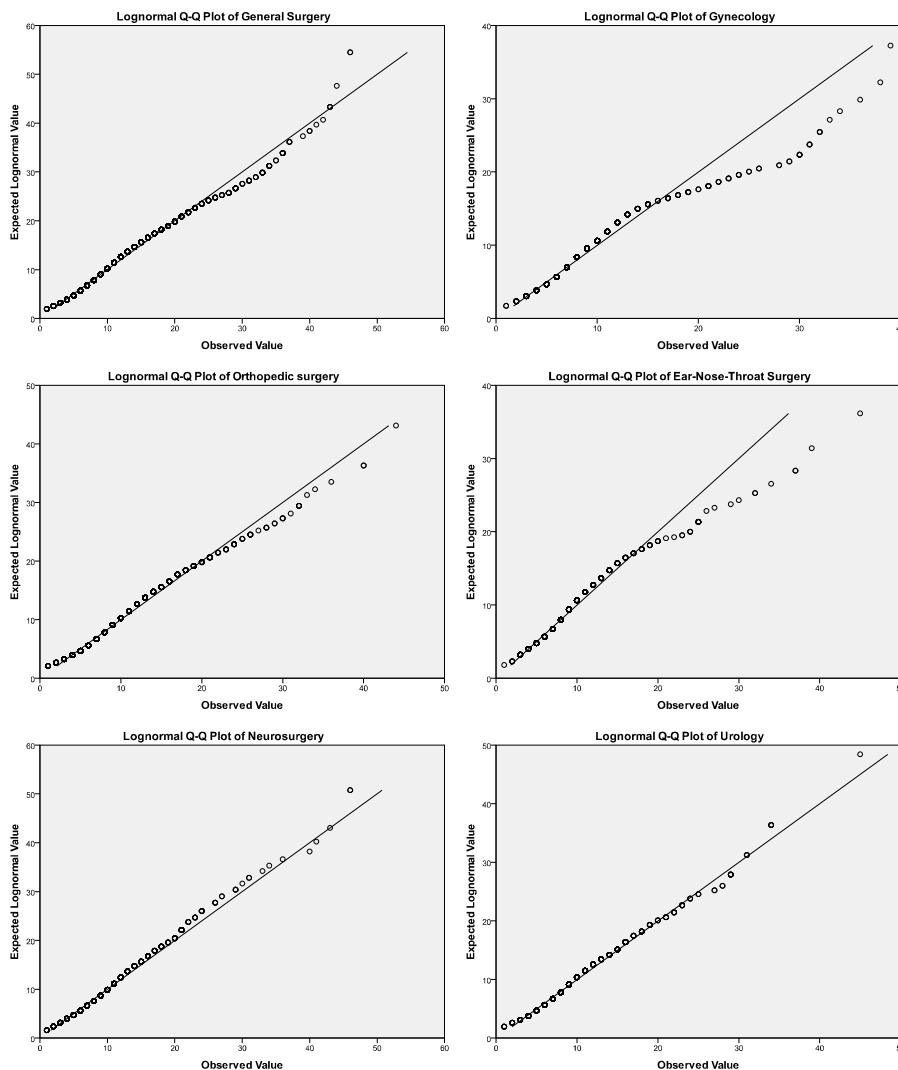


Figure N-19 Q-Q Plots for lognormal distribution for six most frequently operating specialties in Enschede

Statistical test

Changeover times are measured in minutes. The range of changeover times is relatively small compared to the measurement unit. Changeover times that have the same measurement value (in minutes) can have values that differ up to 60 seconds. This brings up a problem when using statistical tests to compare observed values expected values of continuous distributions. If we choose the ranges too small, the number of observations (and thereby degrees of freedom) is too small assign a distribution. If we choose smaller ranges, we create test ranges that are between subsequent integer values (e.g. 2.2 minutes – 2.8 minutes). These ranges do not contain any observed value, which prevents us from assigning a distribution to the observed values. Therefore, we are not able to use the Chi-square test. Instead we use a the Kolmogorov Smirnov test for normality on the natural logarithm of the changeover time (with shift=-1).

- Changeover times $X_1, \dots, X_n$ are independent random samples with distribution F.
- If G = cumulative distribution function of $\ln(X_i + 1)$ and $\mathfrak{N}$ is the class of all normal cumulative distribution function,

$$H_0: G \in \mathfrak{N}$$

$$H_1: G \notin \mathfrak{N}$$
- Test values:

Tests of Normality

Location	Specialty	Kolmogorov-Smirnova		
		Statistic	df	Sig.
Enschede	General Surgery	.078	2251	.000
	Gynecology	.104	823	.000
	Ear-Nose-Throat Surgery	.099	703	.000
	Neurosurgery	.095	841	.000
	Orthopedic surgery	.102	1790	.000
	Urology	.078	605	.000
Oldenzaal	Ophthalmology	.106	1282	.000
	General Surgery	.107	801	.000
	Orthopedic surgery	.120	291	.000
	Plastic surgery (general)	.093	274	.000

- We see that all Significance levels are less than $\alpha = 0.10$ therefore we have to reject H_0 for all specialties
- There is statistical evidence that changeover times are not lognormal distributed.

Besides the lognormal distribution, we also tested other (continuous and discrete) distribution, such as: Gamma, Beta, Geometric and Poisson). Neither distribution can be used as input distribution.

Conclusion

Since, we are not able to fit a distribution to the observed changeover times in 2009, we use an empirical distribution as input parameter in the simulation model.

Appendix O. Restrictions and assumptions of simulation model

O.1 Oldenzaal

- Waiting list replenishment: After a patient is scheduled from the waiting list a new patient is generated using the case mix distribution of 2008.
- Regular OR opening hours are from 8:00 to 16:00. Overtime is allowed during execution of the program, not during offline scheduling.
- Elective Surgeries are only scheduled, if the expected end of the surgery does not exceed regular opening hours, except when the patient is scheduled at an empty ORday.
- ORs that were closed in the tactical block schedule cannot be used during the execution of the program. In reality no staff is available.
- No emergency surgeries.
- If no surgery is scheduled at a specific OR, the OR is closed.
- The ORs are closed during weekends.
- Wards do not close. In reality the wards in Oldenzaal are closed every Sunday. The number of patients that are at this ward every Sunday are considered being transported to Enschede (and therefore removed from the system).
- Wards are assumed to have unlimited capacity (although, it is registered if the maximum capacity is exceeded). During the generation of the Master surgical schedule, resource conflicts are prohibited unless no other solution is available.
- Job selection rule: Random due date. In reality surgeries are scheduled on a first come, first served rule. Therefore, we have to make sure that the order in which patients arrive is random. During the creation of the master surgical schedule, we choose longest surgery duration first, in order to improve OR utilization.
- OR selection rule: Best fit. When scheduling the last surgery in an OR, generally the planner chooses the surgery that fits best.
- Close empty ORs after planning
- Outpatient surgeries may be performed on any type of OR
- Do not consider lunch breaks
- Surgeries with an MSS slot may generally may only be performed in that MSS slot, except when no slot is available in time.
- All patients are available at the start of the day
- An elective surgery may start before its planned starting time
- Start all elective surgeries, even if they are entirely outside of general working hours
- Consider only the emergency surgeries that arrive during regular opening hours.

- We use the average changeover times of 2008 in creating an operational offline OR plan.
- Surgeries may not move between ORs: In reality only a limited number of OR staff and surgeons are available in Oldenzaal, which prohibits the use of additional unplanned OR capacity.

O.2 Enschede

- Waiting list replenishment: After a patient is scheduled from the waiting list a new patient is generated using the case mix distribution of 2008.
- Regular OR opening hours are from 8:00 to 16:00. Overtime is allowed during execution of the program, not during offline scheduling.
- Elective Surgeries are only scheduled, if the expected end of the surgery does not exceed regular opening hours, except when the patient is scheduled at an empty ORday.
- ORs that were closed in the tactical block schedule cannot be used during the execution of the program. In reality no staff is available.
- Emergency surgeries are scheduled in the emergency OR if possible. If there is no emergency OR available, emergency surgeries may break in on elective programs.
- If no surgery is scheduled at a specific OR, the OR is closed.
- The ORs are closed during weekends.
- Wards are not taken into account in the simulation model..
- Job selection rule: Random due date
- OR selection rule: First fit
- Close empty ORs after planning
- Outpatient surgeries may be performed on any type of OR
- Do not consider lunch breaks
- All patients are available at the start of the day
- An elective surgery may start before its planned starting time
- Start all elective surgeries, even if they are entirely outside of general working hours
- Consider only the emergency surgeries that arrive during regular opening hours.
- Delayed surgeries may move between ORs.

Appendix P. Tactical block plan Enschede (Simulation)

Tactical block plan for location Enschede, as used during simulation and as input for the analytical model, based on data 2008.

- 4 weeks of 7 days (0-27)
- 10 ORs (0-9)

Day	<u>OR</u>									
	0	1	2	3	4	5	6	7	8	9
0	CH	CH	CH	CH	GY	KA	NE	NE	OR	PL
1	CH	CH	CH	CH	CH	GY	KN	NE	OR	UR
2	CH	CH	CH	GY	KN	NE	OR	OR	PL	UR
3	CH	CH	CH	CH	GY	NE	NE	OR	PL	UR
4	CH	CH	CH	CH	GY	KN	OR	OR	PL	UR
5										
6										
7	CH	CH	CH	CH	GY	KA	KN	NE	OR	OR
8	CH	CH	CH	CH	BT	GY	KN	NE	OR	PL
9	CH	CH	CH	CH	GY	NE	NE	OR	PL	UR
10	CH	CH	CH	CH	GY	NE	NE	OR	OR	UR
11	CH	CH	CH	CH	KA	NE	OR	OR	PL	UR
12										
13										
14	CH	CH	CH	CH	GY	KA	KN	NE	OR	OR
15	CH	CH	CH	CH	GY	KN	NE	OR	OR	UR
16	CH	CH	CH	GY	KN	NE	OR	OR	PL	UR
17	CH	CH	CH	CH	GY	NE	NE	OR	PL	UR
18	CH	CH	CH	CH	GY	KN	NE	OR	OR	PL
19										
20										
21	CH	CH	CH	CH	GY	KA	NE	OR	OR	PL
22	CH	CH	CH	CH	GY	KN	NE	OR	PL	UR
23	CH	CH	CH	CH	KN	NE	OR	OR	PL	UR
24	CH	CH	CH	CH	GY	NE	OR	OR	UR	OO
25	CH	CH	CH	CH	GY	IN	NE	OR	OR	UR
26										
27										

Figure P-1 Tactical block plan for location Enschede

Appendix Q. Simulation results bed occupancy

Table Q-1 Performance measures of simulated configurations for inpatient bed utilization for location Oldenzaal. (All days of the week are included, average seem low because of empty beds during weekends).

	Configuration	Average Inpatient Bed occupation	Standard deviation of inpatient Bed occupation	Maximum bed occupancy	Coefficient of variability
0.	Old_Block_Q(50)	1.72	2.40	12	1.40
1.	Old_Block_Q(60)	1.68	2.46	14	1.46
2.	Old_Block_Q(67) (Null configuration)	1.63	2.31	12	1.42
3.	Old_Block_Q(70)	1.62	2.44	14	1.51
4.	Old_Block_Q(80)	1.55	2.17	11	1.40
5.	Old_Block_PS(0.2)	1.72	2.43	15	1.41
6.	Old_Block_PS(0.5)	1.72	2.44	14	1.42
7.	Old_Block_PS(1.0)	1.59	2.28	11	1.43
8.	Old_Block_PS(1.5)	1.58	2.39	14	1.51
9.	Old_Block_PS(2)	1.53	2.21	15	1.44
10.	Old_cBlock_PS(0.5)	1.76	1.88	9	1.07
11.	Old_cMSS_PS(0.5)	1.77	2.05	11	1.16

Appendix R. References

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