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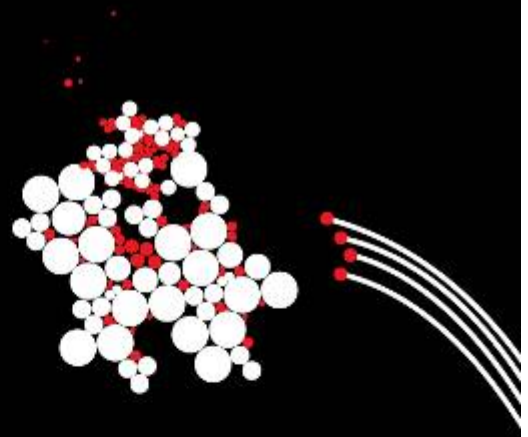

Planbare spoed is (zelden) goed?

Maartje Zonderland

CHOIR, Universiteit Twente
Leids Universitair Medisch Centrum

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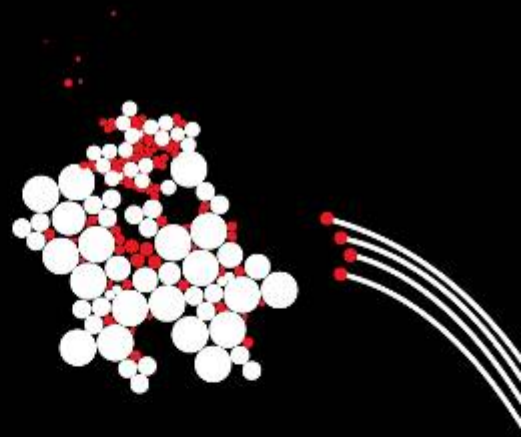
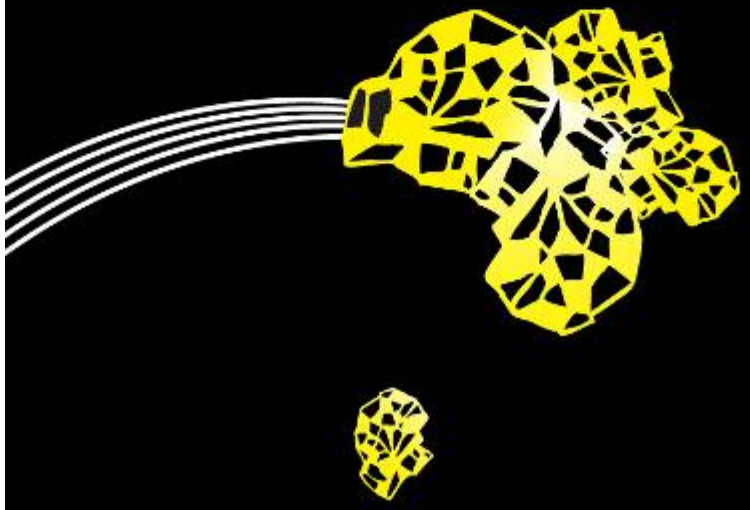


Plannen van spoedopnames met behulp van de AOA



‘Overbevolking’ op de Eerste Hulp

- Veel in het nieuws: lange wachttijden op de Eerste Hulp
- Ook in het LUMC regelmatig aan de orde
- Niet alleen een landelijk probleem
- Misschien valt het in NL nog wel mee..
- Ziekenhuizen zoeken naar manieren om wachttijden terug te dringen

‘Overbevolking’ op de Eerste Hulp

NEWS | SEPTEMBER 23, 2008 | 0 COMMENTS

Man dies during 34-hour wait in ER

SOURCE: http://www.cbc.ca/health/story/2008/09/23/er-wait.html

Health officials say a man who died in the waiting area of a major Winnipeg hospital's emergency department may have been dead "for some time" before medical staff was alerted — 34 hours after he arrived.

The 45-year-old arrived by taxi at the Health Sciences Centre around 3 p.m. Friday

‘Overbevolking’ op de Eerste Hulp

Recente BMJ studie van Guttmann et al[1]:

“Death and admission rates are higher when length of stay is longer”

Waarom is de verblijftijd zo lang?

[1]BMJ 2011;342:d2983

Redenen voor Lange Verblijftijd

- Vergrijzing
- Gestegen vraag naar acute zorg
- Patiënten zijn moeilijk over te plaatsen naar de kliniek

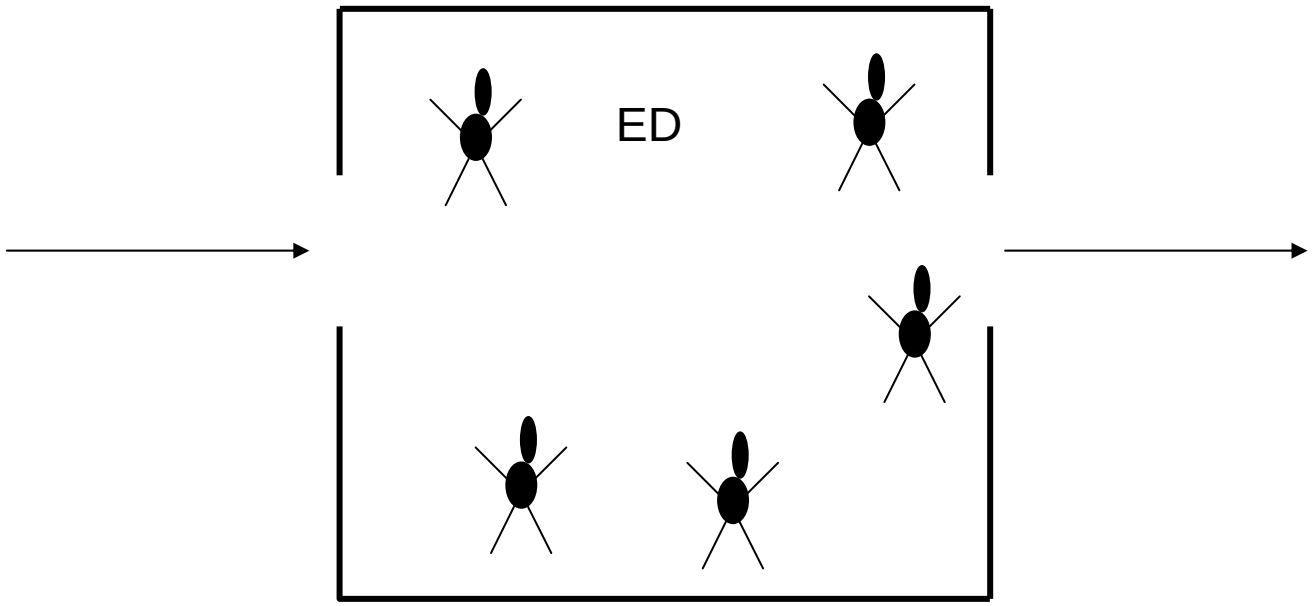
- “Hospital restructuring leading to fewer inpatient beds, more ambulatory care and closure of hospitals and/or ED’s”[2]

[2]Schull et al. (2001) AEMJ 8(11):1037-43

Maatregelen om Verblijftijd te Verkorten

- Triage systeem
  - Vermijden dat patiënten wachten zonder dat ze eerst zijn gezien

Maatregelen om Verblijftijd te Verkorten



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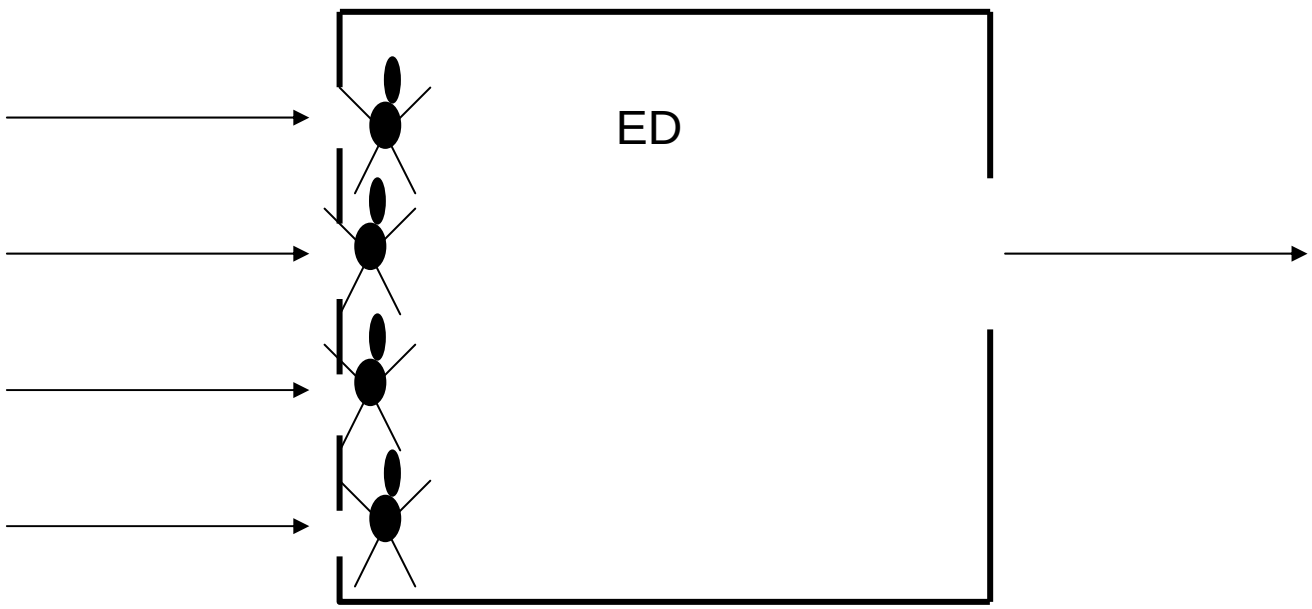

Maatregelen om Verblijftijd te Verkorten

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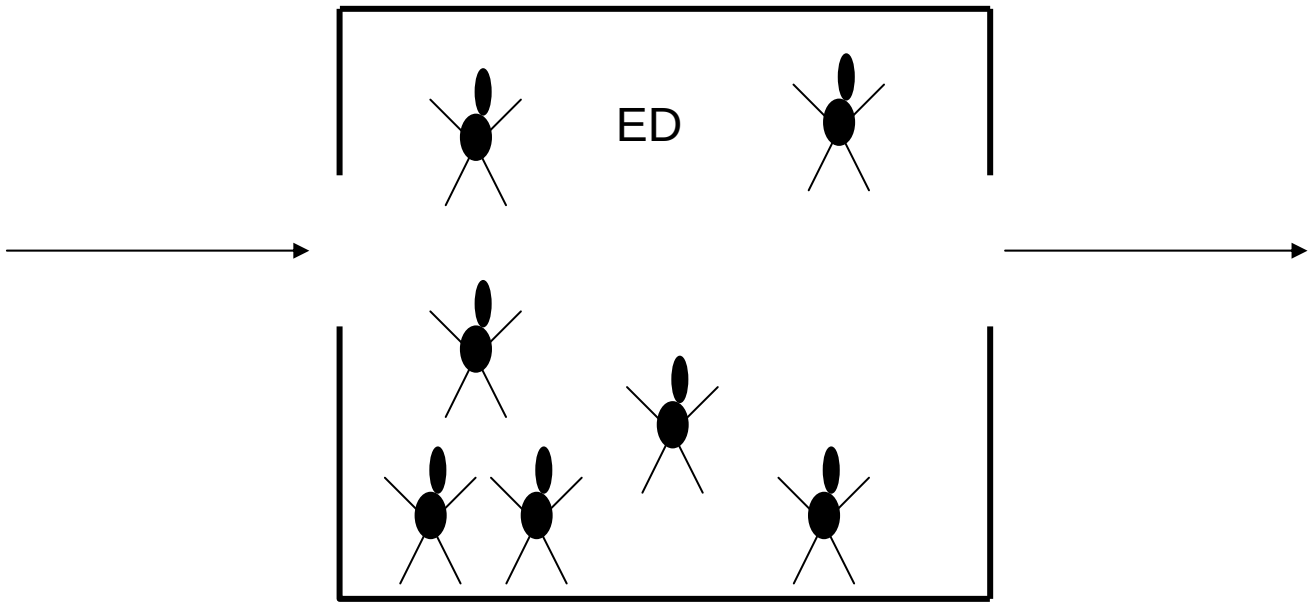

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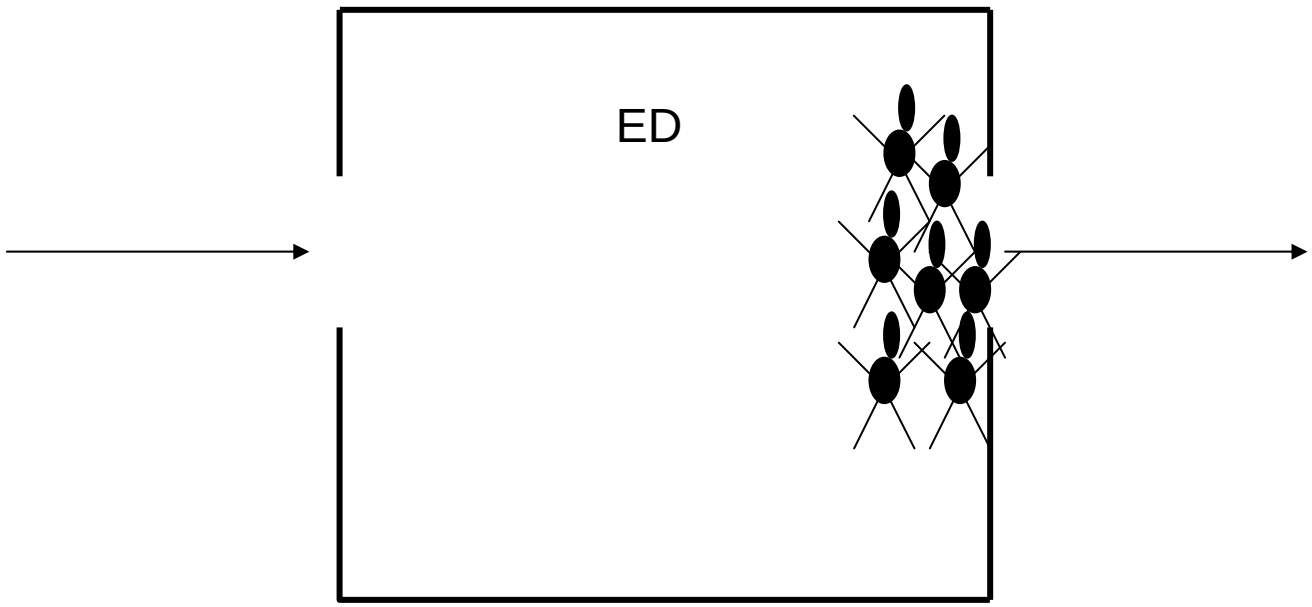

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- Fast track voor patiënten met ‘geen eerste hulp’ klachten (alternative level of care) - Huisartsenpost

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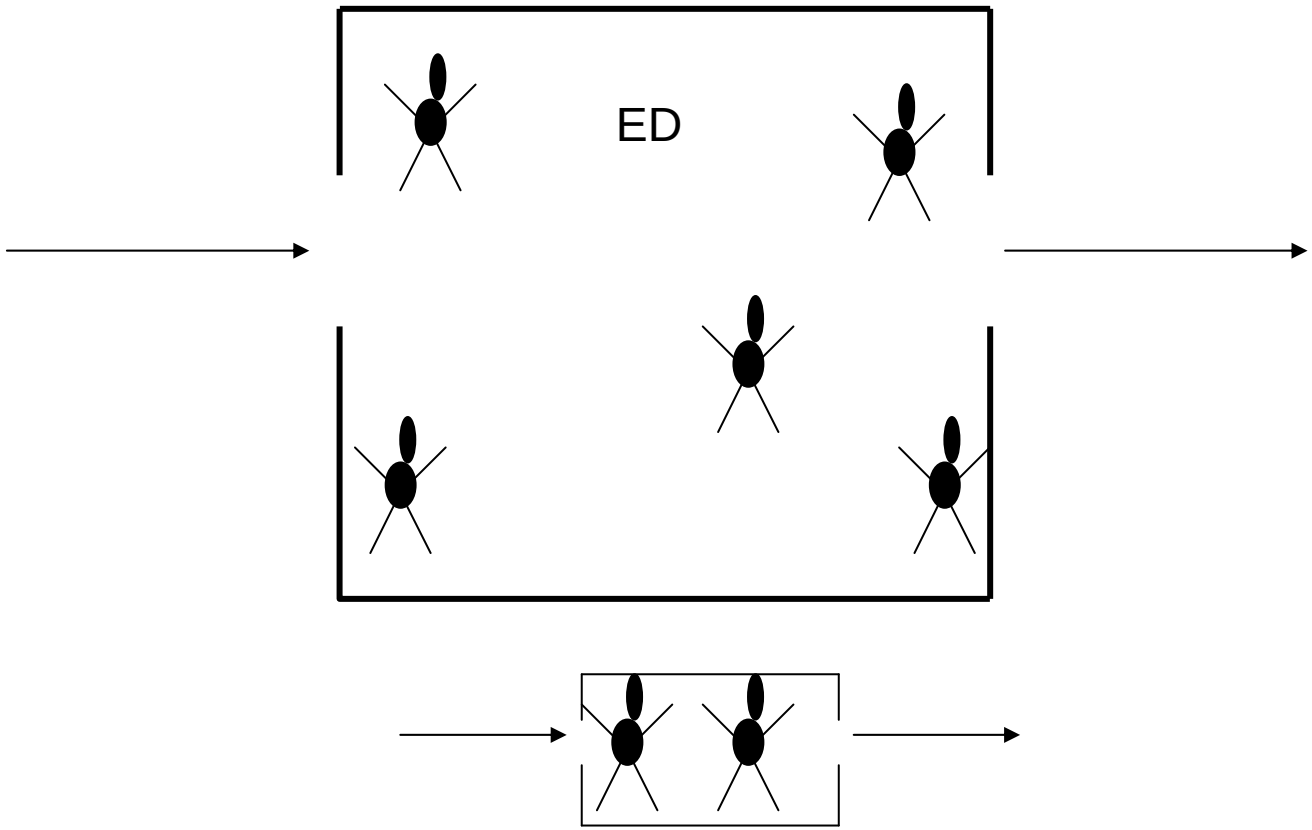

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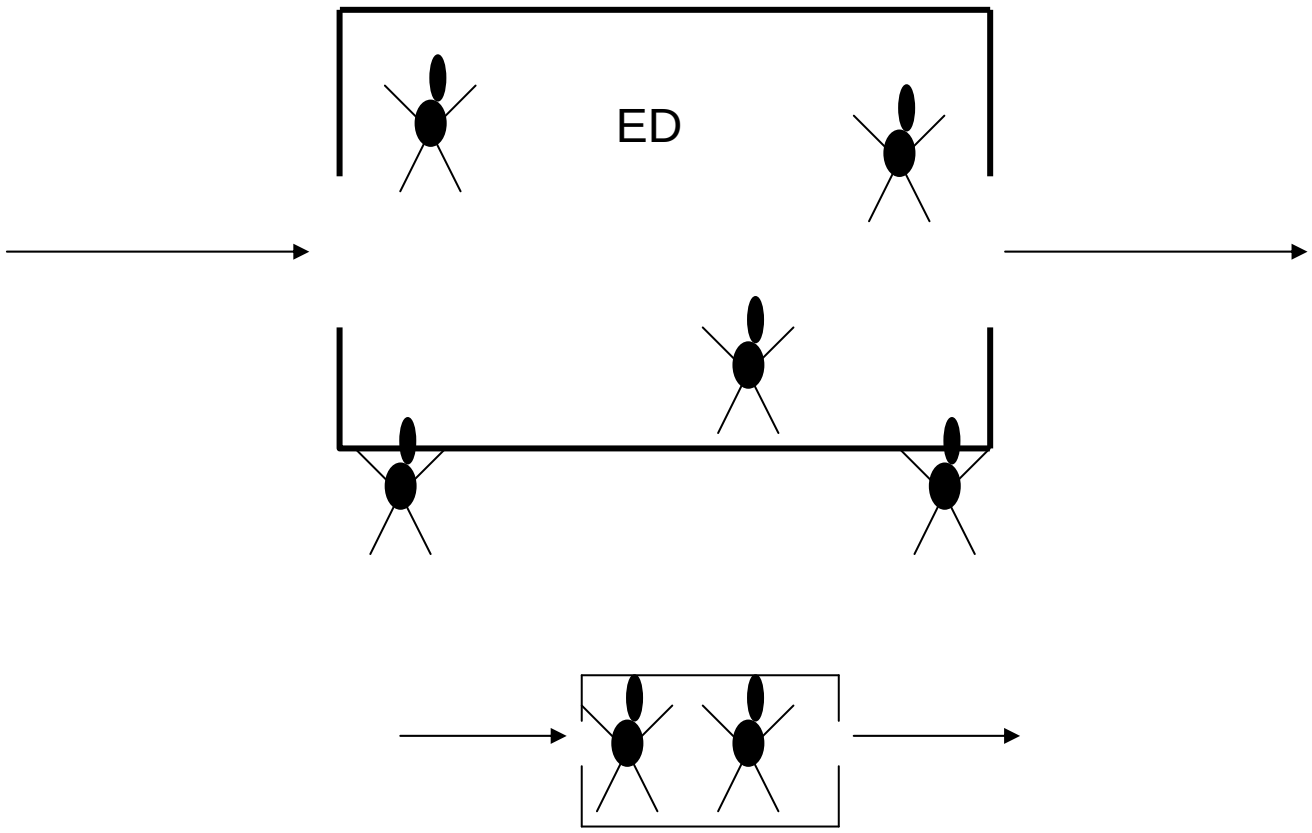

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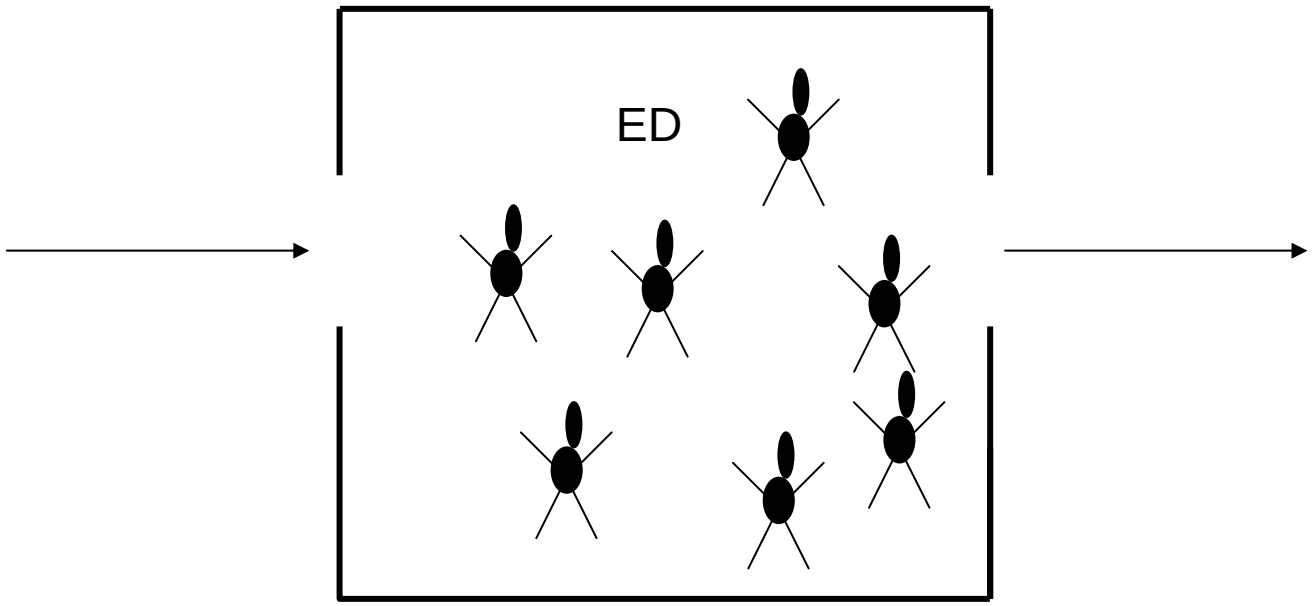
- Acute Opname Afdeling

Maatregelen om Verblijftijd te Verkorten



Wat is een Acute Opname Afdeling?

- Oerwoud van termen: Medical Admission Unit, Acute Medical Unit, Clinical Decision Unit, Emergency Admission Unit, etc..
- Met name in de UK wordt veel gebruik gemaakt van AMU’s
- Van afdeling op papier tot volledig ingerichte afdeling met >30 bedden
- We onderzoeken tastbare organisatievormen
- Get their butt of the ED bed!

Maar…

- Geen eenduidige organisatievorm
  - Wat is een AOA nu precies?
- Met name kwalitatieve resultaten
  - Weinig kwantitatieve onderbouwing
- Onduidelijkheid over het effect op de rest van het ziekenhuis
  - Wat is het totaaleffect?
- Berichtgeving is niet altijd neutraal

Waaraan voldoet een goed functionerende AOA?

- Uit de literatuur:
  - Well-defined chain of command
  - Clear agreements upon transfers to inpatient wards
  - Access to specialist consultation

- Welke patiënttypes?
- Wat voor zorg?
- Hoeveel bedden?
- Kosten?

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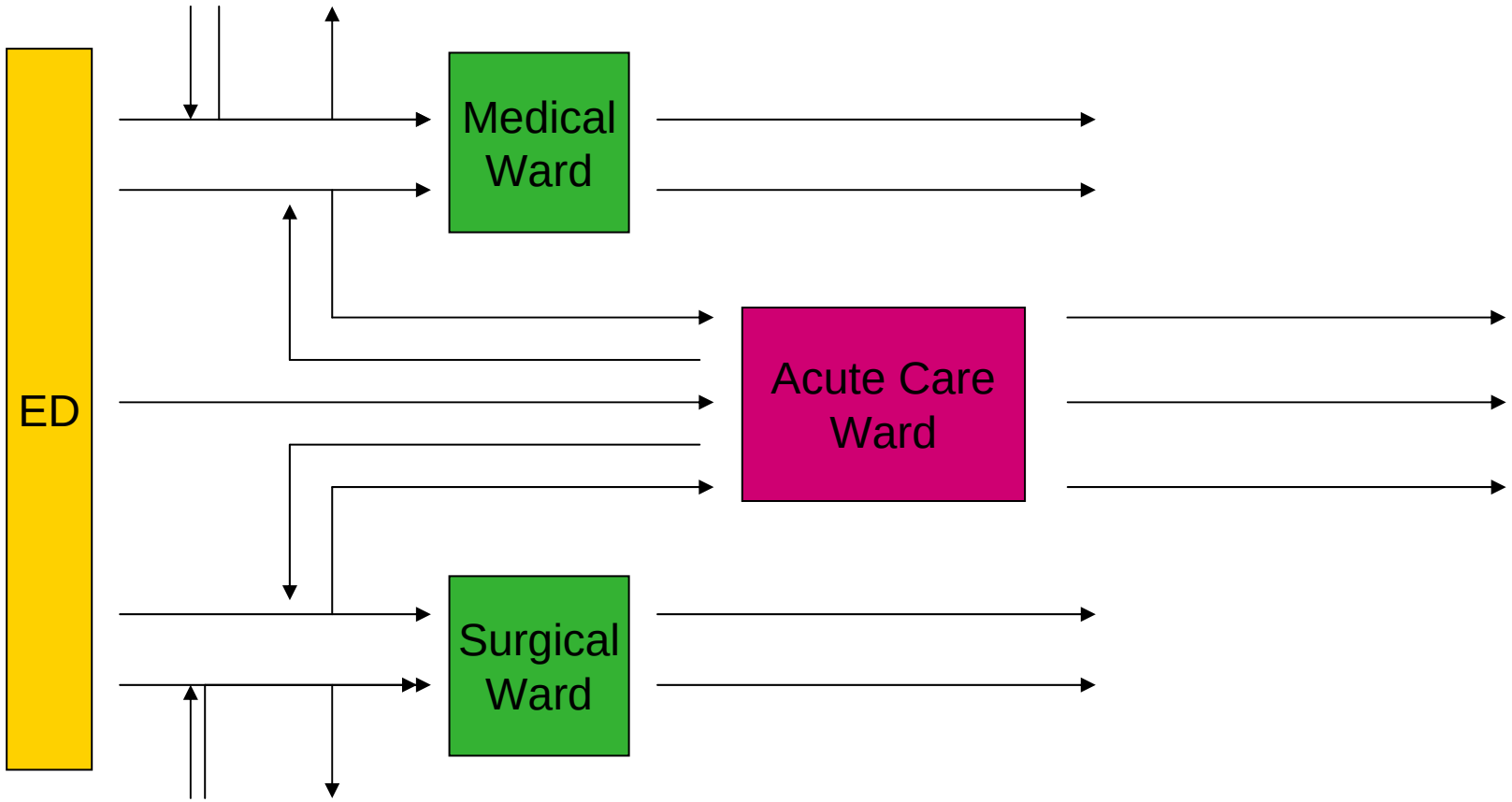
- Wat voor zorg?
- Hoeveel bedden?
- Kosten?

- Verschillend voor elk ziekenhuis → Wiskundig model

Waarom een Kwantitatief Model?

- Op AOA vaak hogere bezetting per bed → Kost geld
- Mogelijk om aantal bedden op verpleegafdelingen te verminderen??
  → Met hoeveel? Levert dit voldoende op?
- Wat is een redelijke wachttijd op de Eerste Hulp?
  → Is het wel mogelijk om dit te bereiken?
- Niet het ene probleem voor het andere inruilen
- Bewustwording van gevolgen van beslissingen!

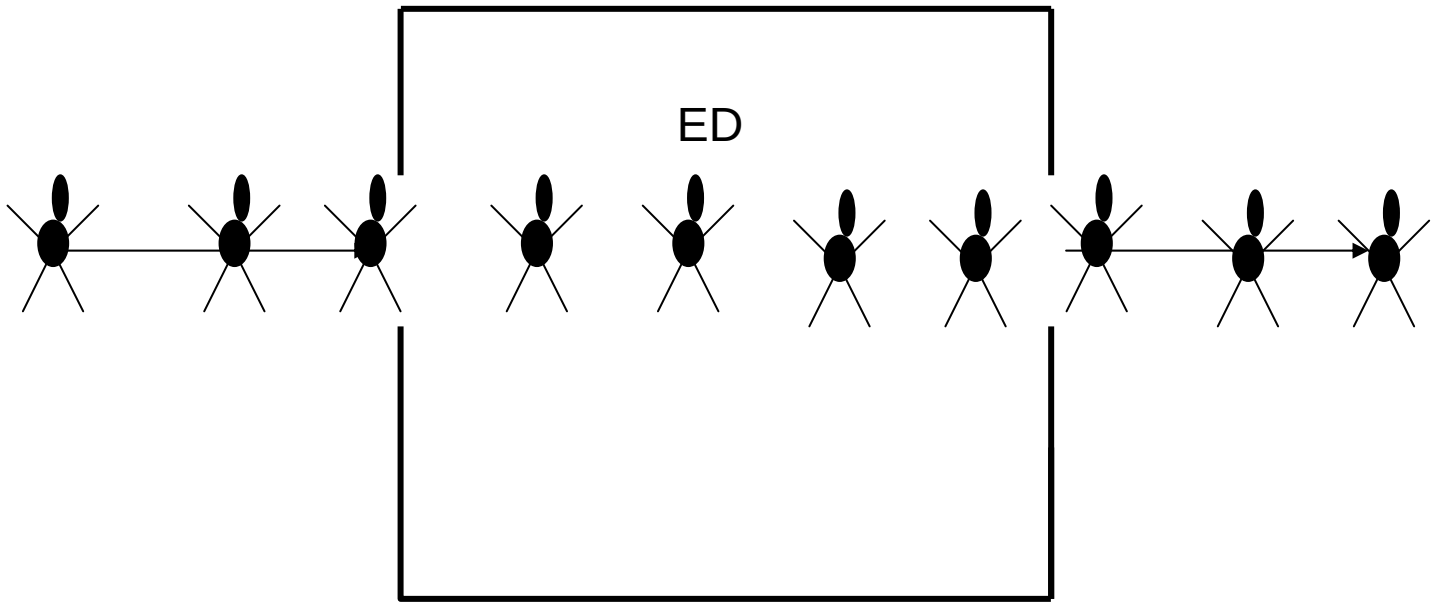
Patient Flow Diagram



Kwantitatieve Effecten

- Aantal opgenomen spoedpatiënten neemt toe
- Minder ruimte voor electieve patiënten
- Verdringing!
- Naast de (extra) bedden op de AOA, ook extra bedden op de verpleegafdeling nodig!
- Dan: meer ruimte voor opnames op verpleegafdeling

‘Everything is Connected…’



Planning and Scheduling of Semi-Urgent Surgeries: Implementation Study in Neurosurgery

Maartje E. Zonderland[1,2]
Richard J. Boucherie[1]
Nelly Litvak[1]
Carmen L.A.M. Vleggeert-Lankamp[3]
[1]Stochastic Operations Research, University of Twente
[2]Division I, Leiden University Medical Center
[3]Department of Neurosurgery, Leiden University Medical Center

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LUMC
LEIDEN UNIVERSITY MEDICAL CENTER

Background

- Surgical department

- Three surgery types:
  - Elective (planned in advance)
  - Urgent (within 24 hours)
  - Semi-urgent (within 1 or 2 weeks)

- Consider regularly scheduled hours

Motivation

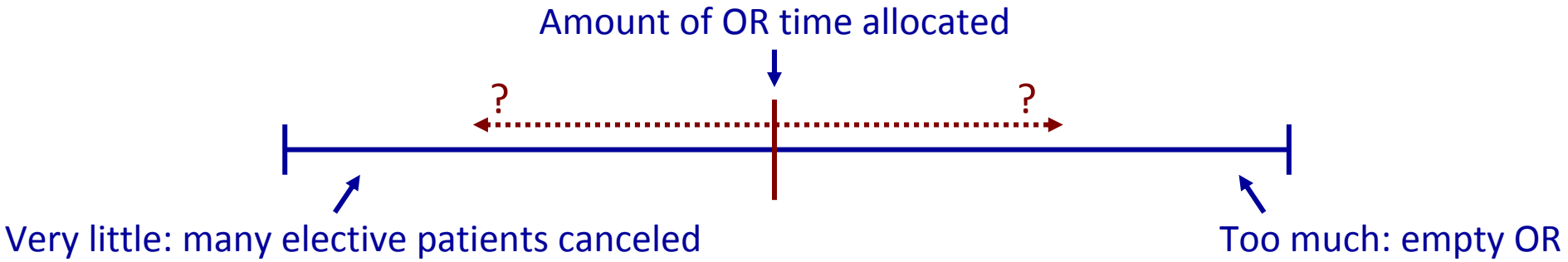
- (Semi-)Urgent surgeries pose uncertain demand on resources

- Urgent surgeries usually performed in overtime or at separate OR

  → Not taken into account

- Semi-urgent surgeries may not be performed in overtime

  → Allocate part of regular OR hours to these surgeries



Set-up of Study

- Consider Neurosurgery department at LUMC

- Determine optimal amount of OR time to allocate to semi-urgent surgeries
  → Queuing model

- Use model results and allocate part of OR time to semi-urgent surgeries

- Study implementation process and effect of allocating OR time

Queuing Model

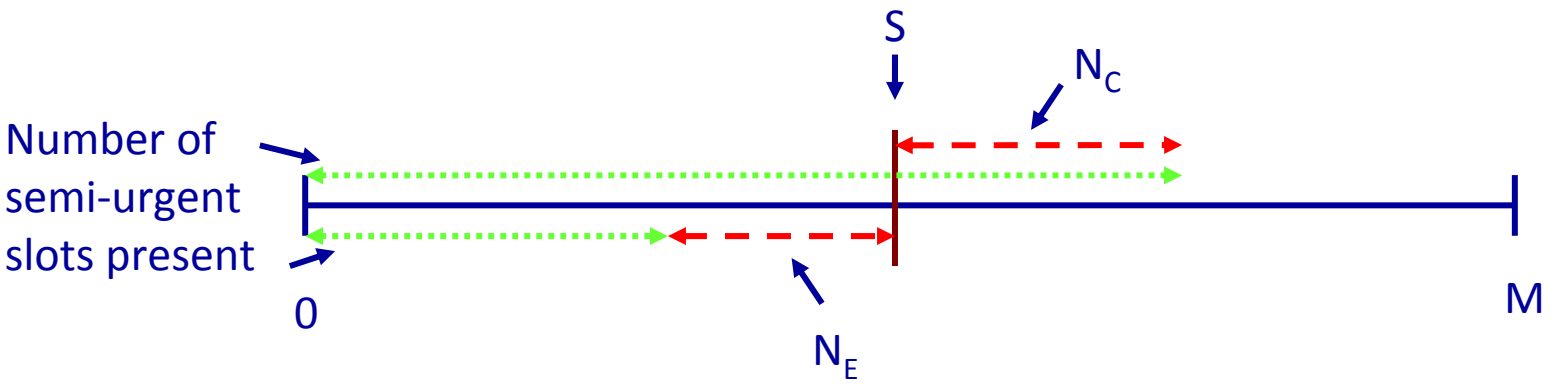
- Determine optimal amount of OR time to allocate to semi-urgent surgeries
- Each semi-urgent surgery has estimated duration 1,2,..,K slots
- Model semi-urgent slot arrivals as a compound Poisson process
- Each OR session has duration K slots
- Total number of slots available (M) = # OR sessions * K

Queuing Model

- Total number of slots available (M) = # OR sessions * K
- Allocate fraction (S) of M to semi-urgent slots
- Slotted queuing model in discrete time

Queuing Model

- Note that
  - → # of canceled elective slots (N_C) depends on S
  - → # of empty OR slots (N_E) depends on S



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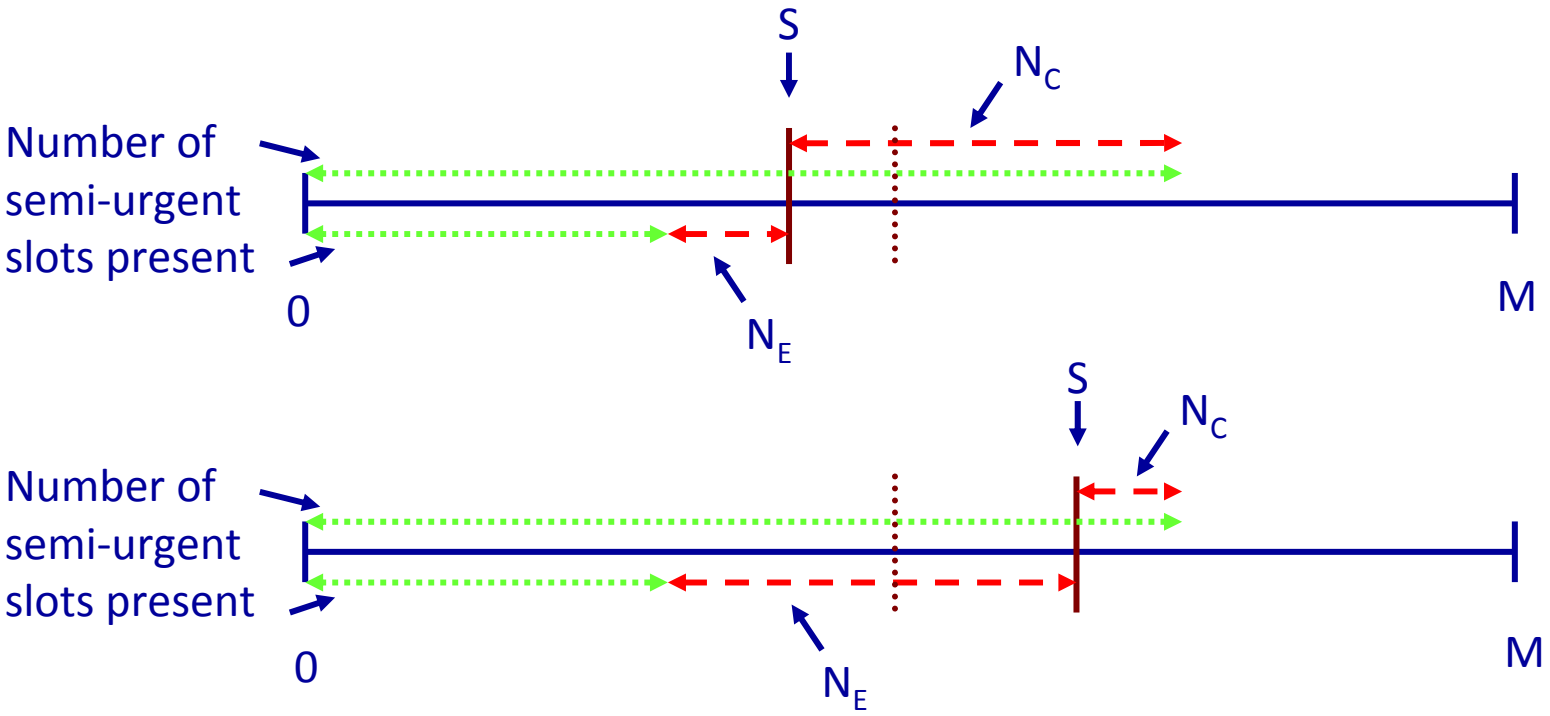


Queuing Model

- Use queuing model to determine $E[N_C]$ and $E[N_E]$ for each S
- Assign cost C_C to canceled elective slot
- Assign cost C_E to empty OR slot
- Find S* that miminizes expected total cost:

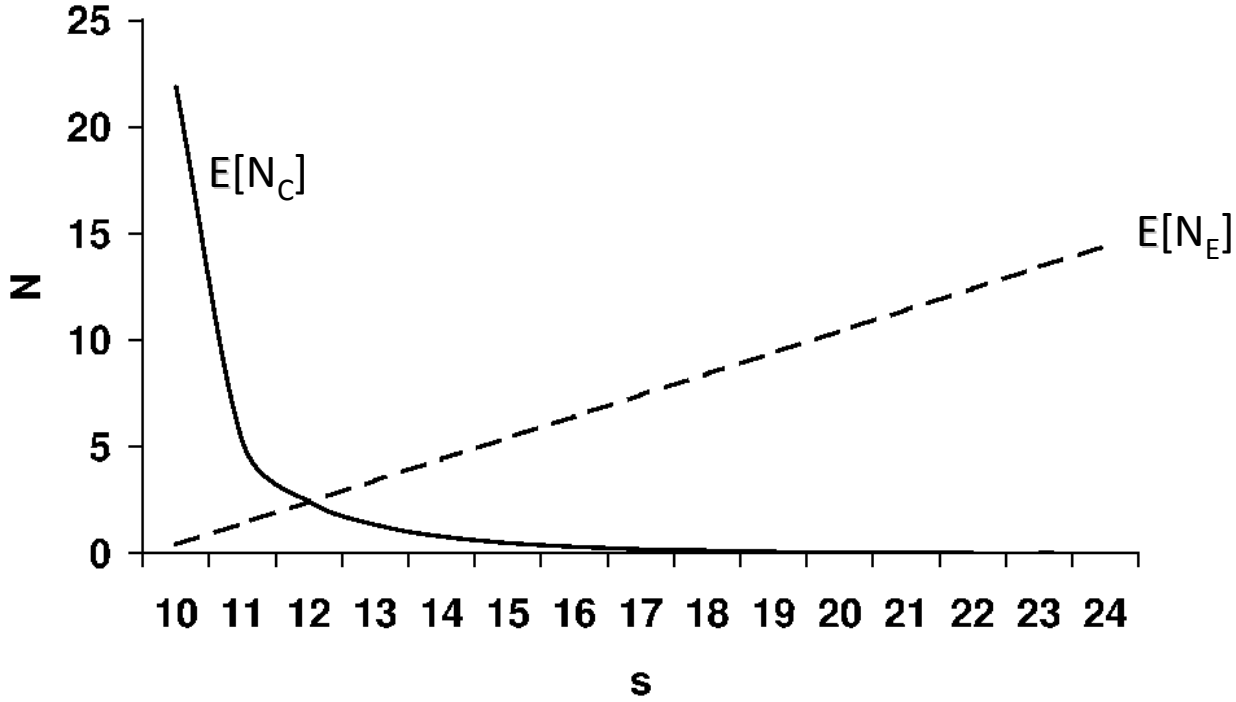
  $$E[C_T] = E[N_C]*C_C + E[N_E]*C_E$$

- S* is the optimal number of slots to allocate to semi-urgent surgeries, *given C_C and C_E*

Neurosurgery Department of LUMC

- 8 OR sessions per week consisting of 3 slots
- 40% of all incoming surgeries is classified semi-urgent
- Total number of slots available (M) = 8*3 = 24
- On average 5.5 semi-urgent surgeries arrive per week
- P(1 slot surgery) = 0.53, P(2 slot surgery) = 0.20,
  P(3 slot surgery) = 0.27
- Smin = expected number of semi-urgent slot arrivals = 9.6
  → Allocate at least 10 slots to obtain a stable system

Canceled vs. Empty Slots



Canceled vs. Empty Slots

- Optimal value of S* depends on choice of C_C and C_E

- If (C_C , C_E) = (1, 1)
  → S* = 13 (E[C_T] = 4.77)

- If (C_C , C_E) = (1, 10)
  → S* = 11 (E[C_T] = 19.42)

- If (C_C , C_E) = (10, 1)
  → S* = 17 (E[CT] = 9.45)

- Note that S* > S_{min} in all cases!

Implementation

- In 2010 the Neurosurgery department started with allocating OR slots to semi-urgent surgeries
- Time allocated: initially 9 slots (3 days)
- Difficult to start
- Availability of OR time fluctuated
- Allocated OR time fluctuated as well

Planning Process

- Fill semi-urgent slots of week n+1 and n+2 during week n
- Temporary planning
- Planning of week n finalized in week n-1
- Patient received notice of surgery ~1 week in advance

Additional Measures

- Part of OR time was dedicated to specific types of surgeries
- Semi-urgent surgeries of this type also had to be performed in this OR time
- Data manager hired for planning, supervised by neurosurgeon
- Collaborations with other hospitals
- Effort made to shorten waiting list

Data Collection

- Planning process was monitored for 25 weeks (May – Oct 2011)

- Information recorded for elective and semi-urgent surgeries:
  - Name and hospital ID of patient
  - Date of surgery
  - Operating room surgery was performed
  - Access time (time spend on waiting list)
  - Duration of surgery
  - Elective or semi-urgent status of patient
  - Number of cancellations before admission
  - Number of cancellations after admission

Results: Patient Level

- 265 elective and semi-urgent surgeries performed
- 98 semi-urgent (37%), 167 elective (63%)
- 161 OR days (on average 6.44 days per week, SD:1.29)
- During summer holidays on average 6.11 days per week, outside summer holidays 6.63 days per week
- No significant difference!

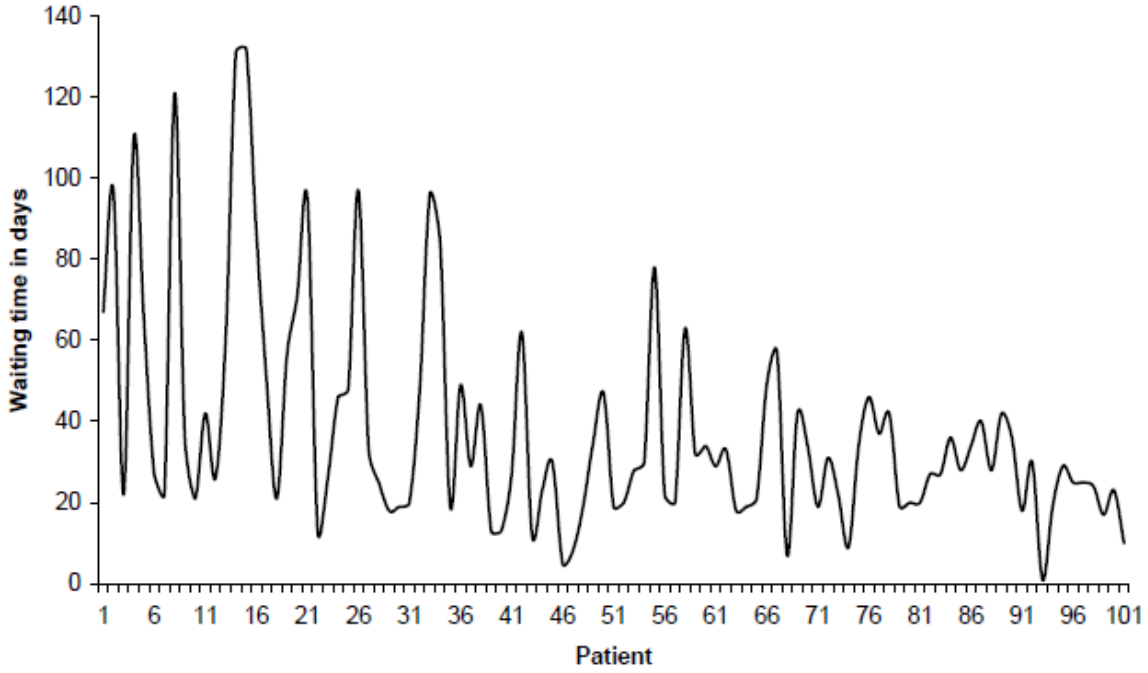
Results: Cancellations on a Patient Level

- 31 (19%) elective patients were canceled at least once
- Rescheduling on average within 12.29 days (SD:13.71)
- Hospital has another definition of cancellation

Cancellation mode	Number of patients	Percentage
Before admission, single cancellation	9	29.03%
Before admission, multiple cancellations	2	6.45%
After admission, single cancellation	9	29.03%
Combinations		
Before admission, single cancellation & After admission, single cancellation	5	16.13%
Before admission, multiple cancellations & After admission, single cancellation	1	3.23%
Unknown	5	16.13%

Results: Access Time

- Mean access time 8.5 weeks (SD: 7.5 weeks) for elective patients
- Mean access time 1 week (SD: 1 week) for semi-urgent patients
- Focus on waiting list had effect for new patients



Results on a Slot Level

Week	OR capacity	Completed elective	Completed semi-urgent	Completed urgent	Overtime	Canceled elective	Unused OR capacity
1	27	24	5	0	2	0	0
2	18	13	6	0	1	11	0
3	21	11	13	0	3	3	0
4	18	12	9	0	3	7	0
5	27	23	9	2	7	0	0
6	15	12	3	3	3	0	0
7	24	16	10	0	2	0	1
8	15	10	8	0	3	1	0
9	15	6	10	0	1	3	0
10	21	12	12	0	3	2	1
11	21	13*	11	0	3	0	1
12	18	16	9	0	7	1	0
13	18*	11	11	0	4	0	1
14	18	11	8	0	1	2	0
15	18	14	10	2	8	6	1
16	15	10	6	3	4	7	0
17	21	14	10	0	3	4	0
18	15	14	5	0	4	3	0
19	18	15	4	0	1	2	0
20	24	9*	13	3	1	0	0
21	24*	25*	7	0	8	2	0
22	12	6	9	0	3	0	0
23	21	21	4	0	4	3	0
24	18*	18*	4	0	4	2	0
25	24*	23*	8	0	7	0	1
Total	486	359	204	13	90	59	6
Mean	19.44	14.36	8.16	0.52	3.60	2.36	0.24
SD	3.98	5.32	2.91	1.08	2.20	2.81	0.44

General Observations

- Patients who are on the waiting list for >1 year were difficult to plan
- Patients have a lot of influence on the date of their surgery
- Late notice of surgery date gives planner a lot of flexibility
- Preparation time for patient is sometimes too short
- Trade-off: short preparation time or higher probability of cancellation
- Continuous devotion to planning is required

Conclusion

- OR capacity was less than expected
- Cancellations and empty OR slots were minimal
- Partly realized at the cost of overtime (and with smart planning)
- Neurosurgery department succeeded in implementation

Discussion

- Implementation of results is challenging
- Additional measures (flexible temporary OR schedule, smart planning) may help in implementation
- Shortening of waiting list made planning more involved → yet another trade-off
- There is no such thing as a normal period for a measurement

Vragen?

m.e.zonderland@utwente.nl

Seminar ‘Curing the Queue’

Vrijdag 27 januari 10:30

Ravelijn 1501

Inschrijven: www.utwente.nl/choir

Openbare Verdediging

Vrijdag 27 januari 14:45

G.J. Berkhoffzaal, de Waaier

ORAHS 2012 ~ 15 – 20 juli 2012

Universiteit Twente

Enschede

www.utwente.nl/choir/orahs2012/

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