Academic Medical Centre, The Netherlands

Reduce throughput time radiotherapy department

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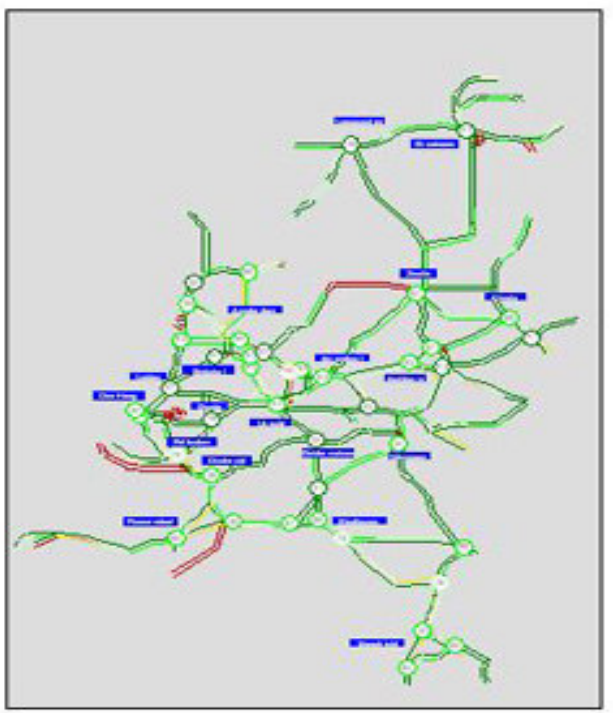
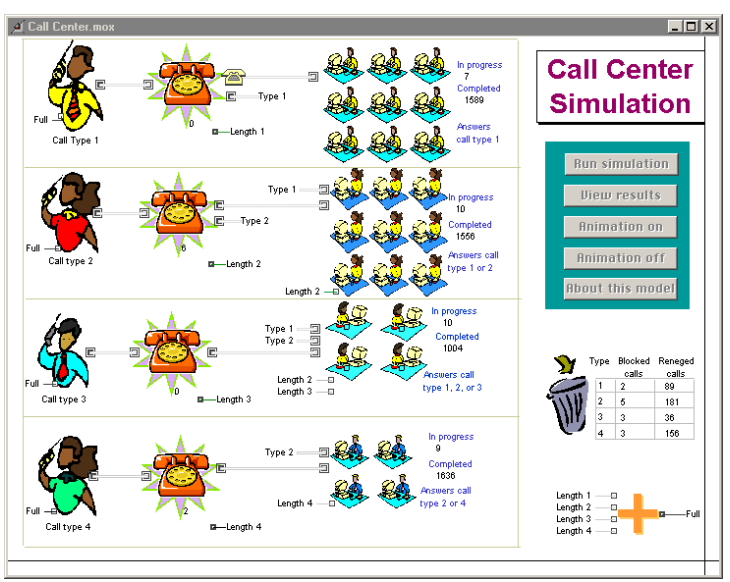
Team **I**nnovation & **P**rocess management

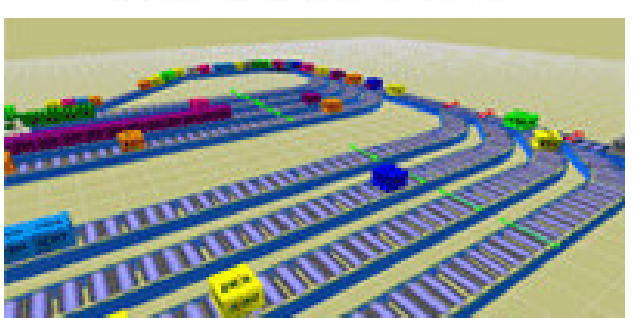
Persoonlijke achtergrond

- 1993 – 1998: Operational Research & Management, UvA
- 1998 – 2006: Simulatie consultant en projectleider Incontrol
- 2006 – heden: Senior projectleider AMC en promovendus bij UvA



3. Network graph showing the delay in the network





AMC

- Afdeling Kwaliteit & Proces Innovatie sinds 1 januari 2008
- Pijler Patiëntgeoriënteerde logistiek (15 personen), voormalig Team Innovatie & Procesmanagement
- Andere drie pijlers
  - Patiëntveiligheid
  - Patiëntgerichtheid
  - Evidence Based Practice
- Meer over AMC door Sylvia Elkhuizen op 28 april 2008

Promotie-onderzoek

Doelstelling

- AMC breed model met patiëntstromen om afdelingsoverschrijdende, strategische/tactische beslissingen tijdig en kwantitatief te ondersteunen.

(Wiskundige) methoden (uit Operations Research)

- Computer simulatie, gecombineerd met
  - Wachtrijtheorie en
  - Optimalisatiemethoden als lineair programmeren

Outline

- Introduction
- Methods
- Results
- Conclusions

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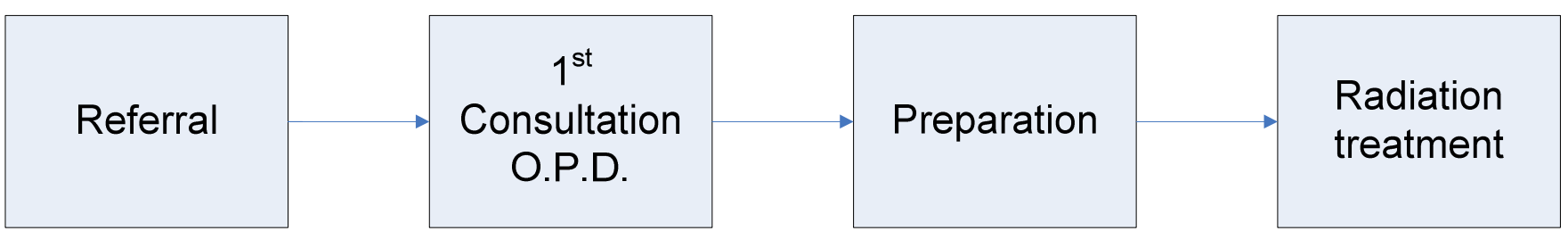
Introduction

Radiotherapy department of AMC

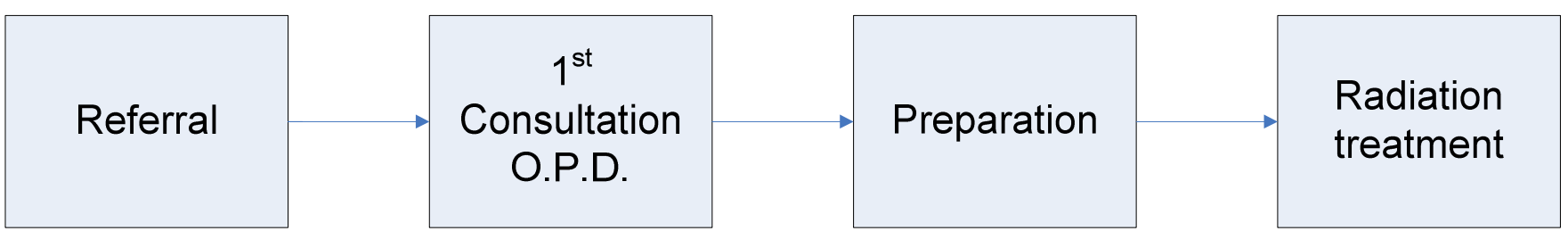
Goal: Reach SLA of throughput time from referral to start of actual treatment,

- 80% of palliative patients < 7 days
- 80% of curative patients < 21 days



Introduction

1. Scope: only new patients and follow-ups who need re-treatment
2. Two types of patients: palliative and curative
3. On average 32.5 new patients per week for 10 radiotherapists



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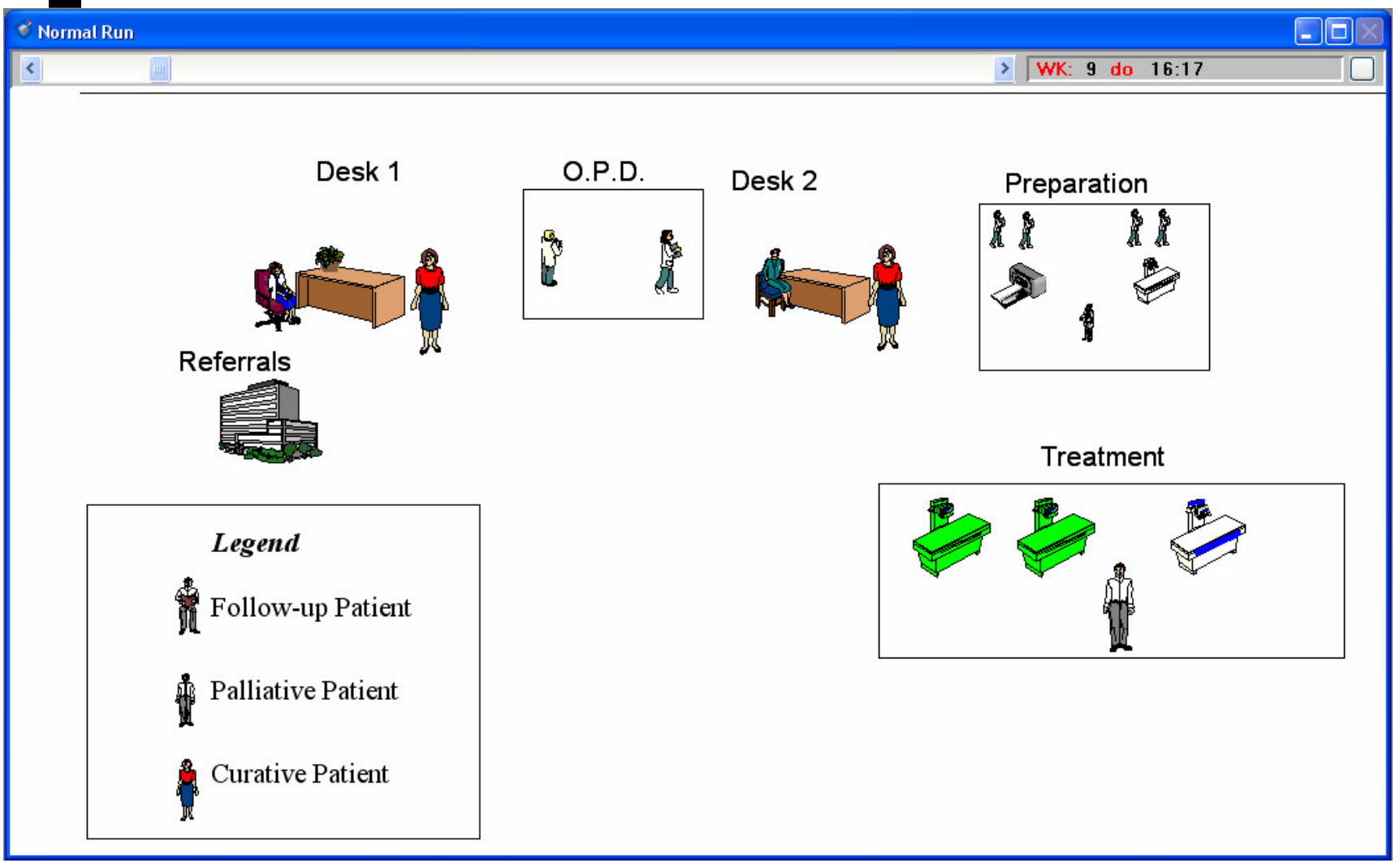
Methods

- Process mapping
- Data analysis
- Discrete event simulation
  - Number of referrals fits Poisson distribution
  - Fluctuating capacity at OPD (26-42 NP per week)
  - Preparation process modelled as black box (duration for curative patients lognormal fit)
  - Empirical distribution for number of fractions (1-35) and duration of treatment session (10, 20, 30 minutes)
  - Succesful validation (both access and throughput time within 10% of practice)

Methods


Normal Run
WK: 9 do 16:17
Desk 1
O.P.D.
Desk 2
Preparation
Referrals
Treatment
Legend
Follow-up Patient
Palliative Patient
Curative Patient

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Results

Different scenario's

1. Extra linear accelerator: SLA still not reached, extra capacity at OPD is necessary (35 in stead of 33.5 NP)

2. Fluctuations of capacity at outpatient department

Results

Capacity at outpatient department (OPD)

1. Fluctuates between 26 NP and 42 NP
2. Reason: bank holidays, doctor holiday, conferences, absence of assistant doctors
3. Reduction of fluctuations has two benefits
    1. Access time before OPD drops
    2. Waiting time before preparation and actual treatment (directly after the OPD) reduces

Results

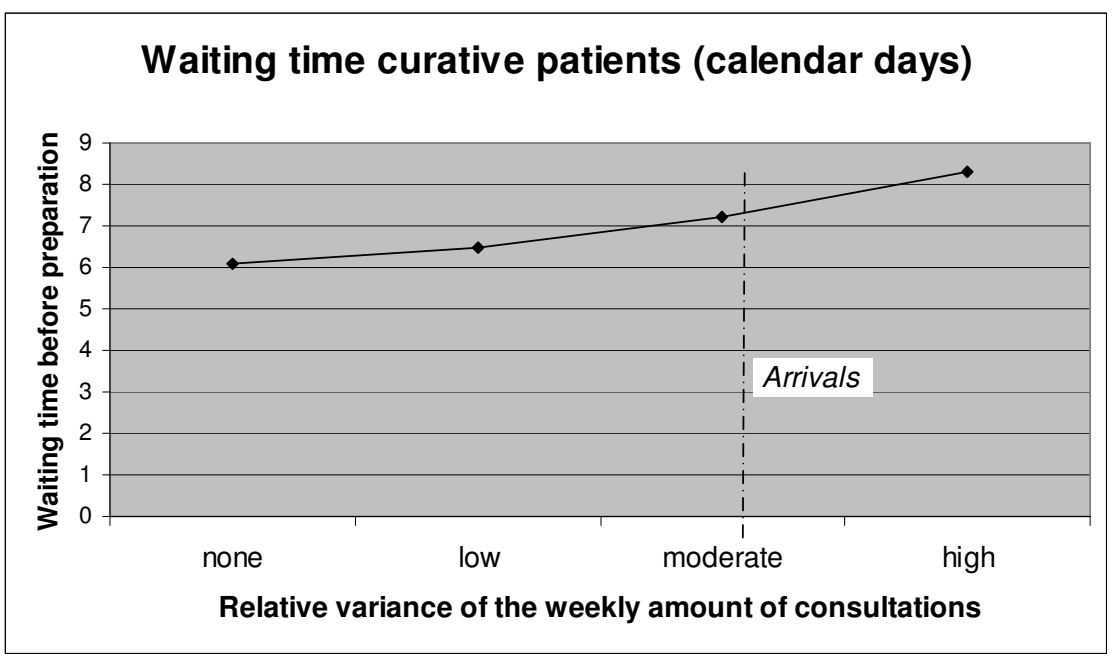
Why does access time before OPD drop?

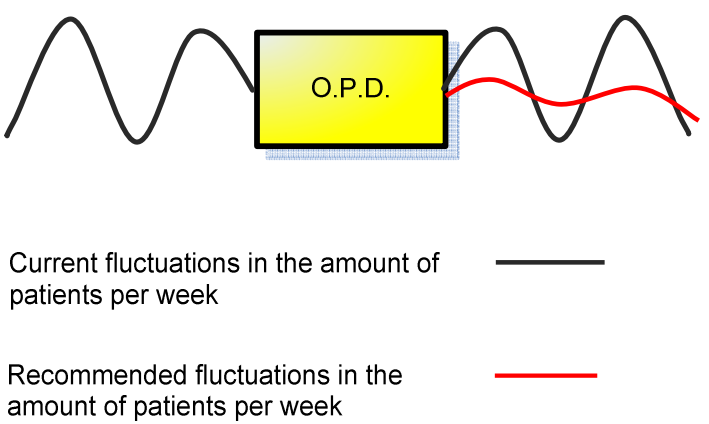
1. General queuing theory
   $W_{M|M|1} = 2 * W_{M|D|1}$
2. Pollaczek-Khintchine formula:
   $W_{M|G|1} = (1 + c_s^2) * W_{M|D|1}$ with c_s variation coefficient of service times (exponential times -> $c_s = 1$)
3. Kingman approximation
   $W_{G|G|1} \approx (c_a^2 + c_s^2) * W_{M|D|1}$ with c_a variation coefficient of interarrival times
4. Lower variance of capacity at OPD will reduce access time

Results

Why does waiting time before preparation drop?

- Coefficient of variation of # new patients is higher after OPD than before!
- More stable demand at preparation makes sure capacity is used more effectively





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Conclusions

1. Scheduled extra linear accelerator is not sufficient to reach SLA

2. 35 NP necessary at OPD with current, high variance of capacity

3. With halved variance 1 NP less needed at OPD to reach SLA (40% reduction of spare capacity)

Recommendations to department

1. Overview of bank- and doctor holidays to act pro-active
2. Introduction of spare capacity: one spare consultations per doctor per week
3. Follow-up patient not in week with bank holiday to save time for new patients
4. Spread doctors holiday more evenly

Afsluiting

- Bedankt voor de aandacht!
- Vragen of opmerkingen?
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