

DTU



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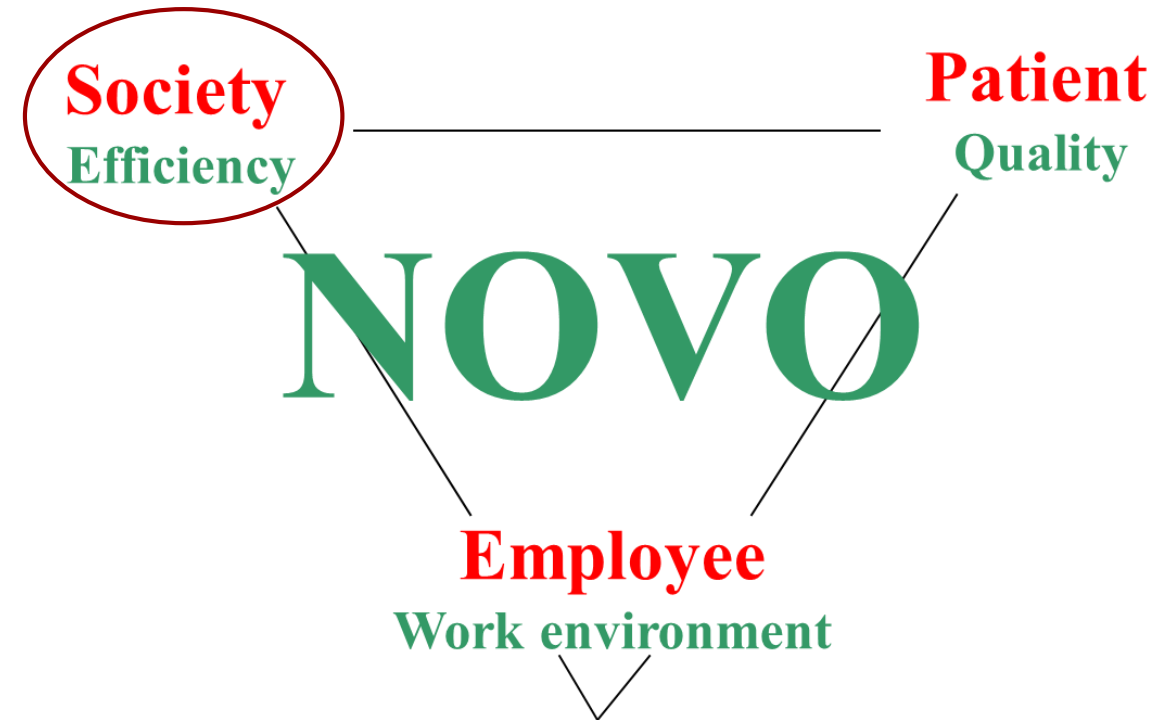
Creating better patient schedules by gaining an understanding of the work of the employees

Outline

- Introduction to Operations Research
- Get up to speed on the case
- Creating value for the patient through optimization algorithms
- How we used insight from the employees to create a novel solution
- Results and conclusion

Operations Research

- Operations Research (OR) is the science of making better decisions
- Planning is a series of decisions on how to manage resources efficiently
- We treat all problem as the same to reuse good algorithms for solving large problems
 - truck ~ ship ~ patient

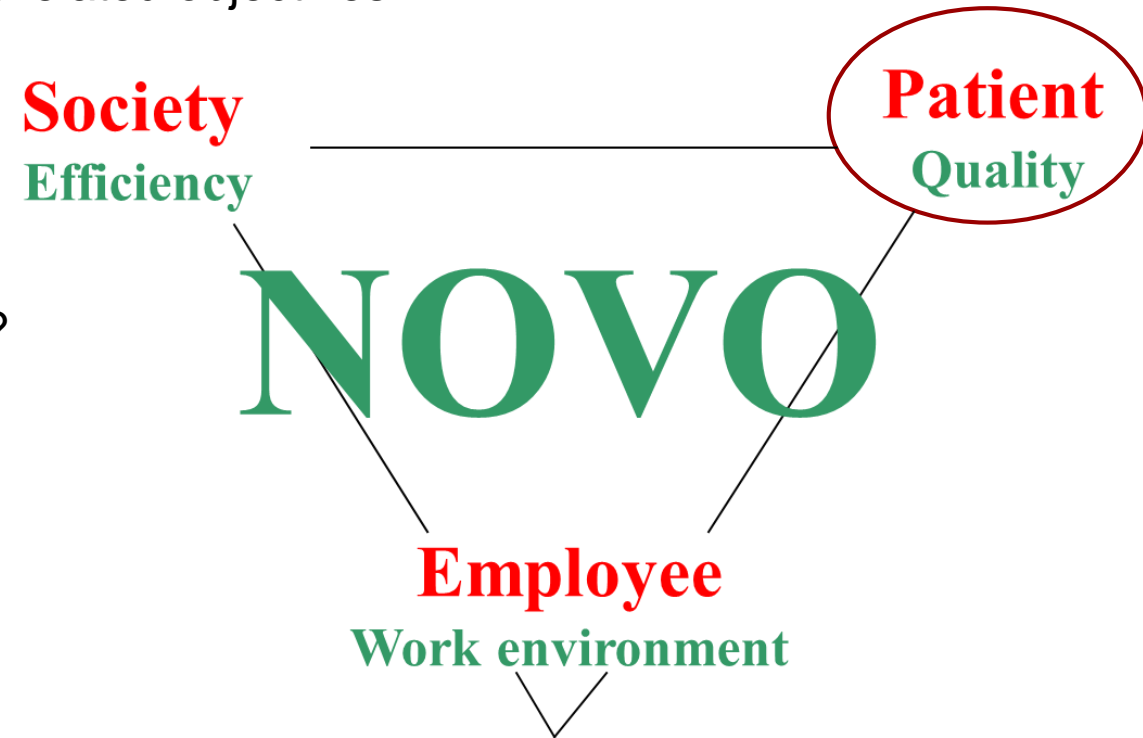


Case: Outpatient clinic for Grown Ups with Congenital Heart-disease

- GUCH patients have their health and heart closely watched:
 - Yearly check-ups may include: MRI, EKG, TTE, Holter monitor, VO_2 -max test and consultations
- The outpatient clinic service >1600 GUCH patients
- The clinic shares resources with the rest of the department
 - Check-ups are now planned a year in advance due to lack of available resources

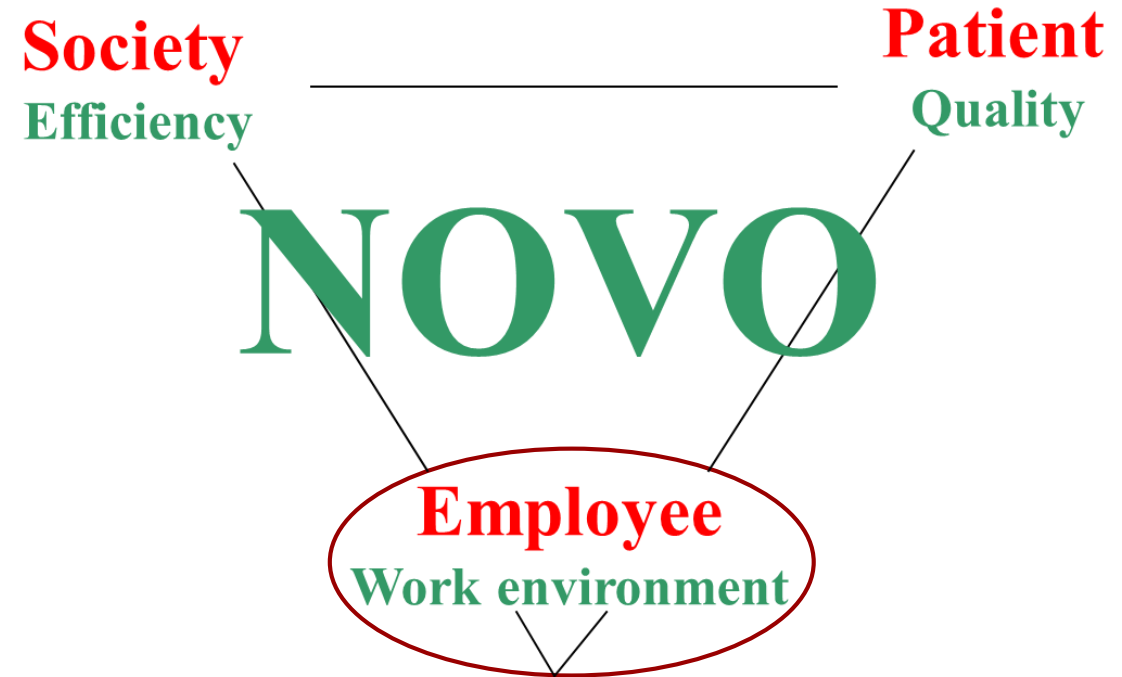
Creating value for the patient

- The project has roots in Value based health care
- We therefore looked at the literature for patient related objectives:
 - Minimize access time
 - Maximize satisfaction
 - Minimize time to complete all tasks
- Is this really what creates value for the patient?



What do we do differently and why

- The project is carried as a mixed methods study, where we include a solid qualitative investigation of the work in the outpatient clinic.
- Among other we interviewed medical secretaries on their approach to patient planning



Planning problems are defined very differently

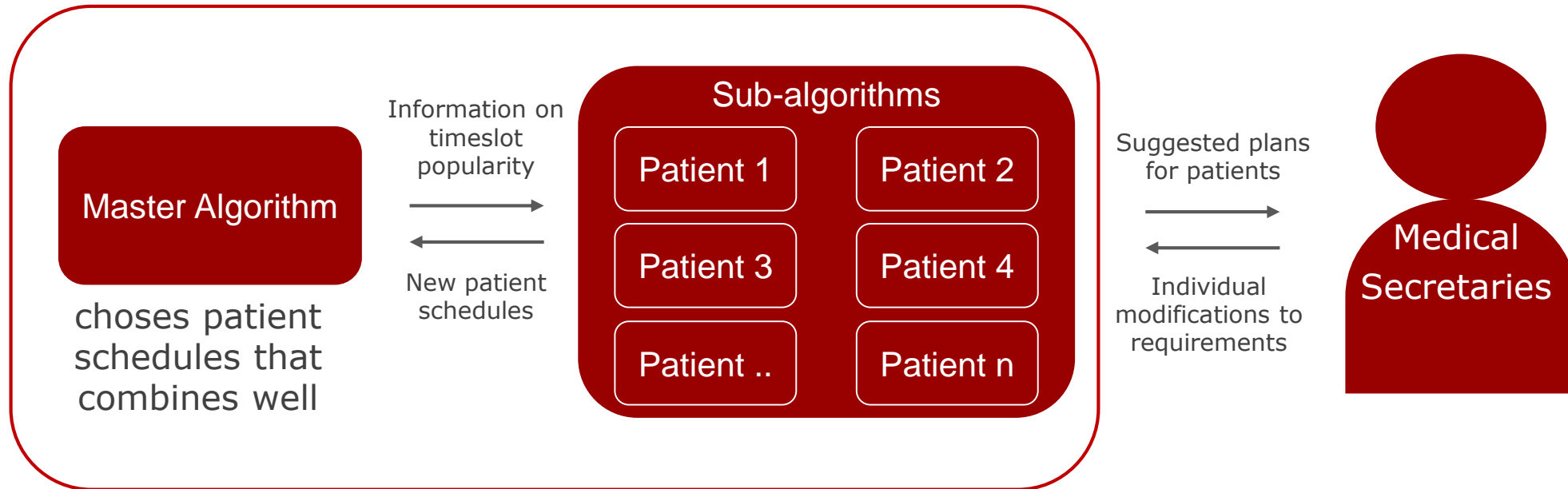
	Engineer	Medical Secretary
Objective	Minimize the number of show-ups $\min \sum_{\substack{p \in \mathcal{P} \\ j \in \mathcal{J}}} y_{pj}$	“Living with the condition should be as easy as possible”
Constraints	<ul style="list-style-type: none"> Doctors can only attend one patient at a time Patients can only attend visit at a time A visit must end before a new one begins $\sum_{\substack{i \in \mathcal{I} \\ a \in \mathcal{A}}} x_{ijpa} \leq M \cdot y_{jp} \quad \forall j \in \mathcal{J}, p \in \mathcal{P}$ $\sum_{\substack{i \in \mathcal{I} \\ j \in \mathcal{J}}} x_{ijpa} = 1 \quad \forall a \in \mathcal{A}_p, p \in \mathcal{P}$ $\sum_{\substack{i \in \mathcal{I} \\ j \in \mathcal{J}}} T_{ij}^s x_{ijpa_2} - \sum_{\substack{i \in \mathcal{I} \\ j \in \mathcal{J}}} T_{ij}^e x_{ijpa_1} \geq T_{a_1, a_2}^{\Delta} \quad \forall a_1 \in \mathcal{A}_p, a_2 \in \mathcal{A}_p, p \in \mathcal{P}$ $x_{ijpa} \in \{0, 1\} \quad \forall i \in \mathcal{I}, j \in \mathcal{J}, p \in \mathcal{P}, a \in \mathcal{A}$ $y_{jp} \in \{0, 1\} \quad \forall j \in \mathcal{J}, p \in \mathcal{P}$	<ul style="list-style-type: none"> “If it is a 40-year old we can book Echo and V02 max before the MRI, but lying in an MRI can be tough so sometimes we leave it by itself” “Then we have those from Bornholm they can come in at around 10am” “We know that a 75-year old should not be scheduled at 9am – But it is always a consideration”

What do we do differently and why

- The work is carried as a mixed methods study, where we include a solid qualitative investigation of the work in the outpatient clinic.
- Among other we interviewed medical secretaries on their approach patient planning
- “The caring approach to planning”
 - Many consideration
 - Age
 - Diagnosis
 - Condition
 - Geography
 - Special wishes
 - No governing logic



Results & Conclusion



- The planning algorithm can plan patients 400 visits in ~10 minutes
- But more importantly each patients plan can be customized to fit their individual needs.