



BACKGROUND

The IWK is a women's and children's hospital in Halifax, Nova Scotia. Out of the 4,500 births that annually take place at the IWK, 11% are elective caesarian sections (ELCS). An ELCS is a prescheduled c-section and there are 11 timeslots per week available for these surgeries.

CURRENT PROCESS



- 1. 2-hour flat time slots regardless of complexity
- 2. Cases booked over the phone or email on a first come first serve basis
- 3. Manual Planner used for booking and scheduling

CURRENT STATE

ELCS Duration Accuracy



1. Cases go over time which creates schedule delays

ELCS Patientlist Status

Overtime Undertime/Ontime



2. Overbooked weeks require extensive waitlist planning

OverBooked UnderBooked/Optimal



3. The manual planner has limited access and functionality

OPTIMAL BOOKING & SCHEDULING OF ELECTIVE CAESARIAN SECTION CASES

ASSIGNING

the duration

RESEARCH

Used a risk scoring method adapted from a peer reviewed article (ELECTIVIST) that estimates case duration based on medical risk factors

RESULTS

- Identified 5 risk categories (RC) with different complexity levels
- Model reduces the # of cases going over their scheduled time by 39%
- Model reduces the average overtime by 34% and reduces the average undertime by 30%



IN PRACTICE

A digital booking form has been created with a simple risk assessment for the obstetricians to determine the case risk score and associated duration.

FINAL PRODUCT



- **Risk Scoring Model:** Obstetrician will complete the booking form and submit to the booking clerk
- **Excel-based Booking Tool:** The booking clerk will add the patient to the tool to be scheduled
- **Case Mixing:** The booking clerk will use the excel booking tool to generate the optimal schedule for the week



With 22 hours available each week for ELCS, an algorithm was developed to optimize the schedule by maximizing the number of cases scheduled and minimizing the number of waitlisted cases.





$$\sum_{i=1}^n x_{ij} -$$

After a waiting period to collect cases, a schedule can be generated rapidly within the Excel booking tool.

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SOLUTION ELEMENTS



the schedule

Goals: Maximize the

scheduled by mini-

mizing the total cost

of scheduling cases.

Constraint 1: Each

Constraint 2: Can-

not schedule more

cases than time

case cannot be

than once.

available

scheduled more

number of cases

AVAILABILITY



Minimize: $Z = c_{ij} * x_{ij}$

c_{ij} cost of booking a patient i on waitlist/day j 1 if patient is scheduled for waitlist/day j 0 otherwise

> = -1 if patient i exists $-\sum_{i=1}^{n} x_{ji} \} \ge 0$ for weekdays and waitlist = 0 otherwise

 $\sum_{i=1}^n d_i * x_{ij} \le a_j \; \forall j = 1 \dots n$

 d_i – duration for patient i

a_j – availability for day j

IN PRACTICE





Main User Form

	Elective C-Section Booking Tool					IWK Health		Daily View		Weekly Vi	ew	Pri	nt Week		Ado
dd Patient Information Upr	late Existing Patient Inform	nation Report Generation	1				Update Waitlist								
Patient K Number*	K12456789		Status of Appointmen	. [Not Scheduled Yet	•		Day	15]	Month	November	¥	Year	2
Patient First Name*	Jade		Family Docto	· [Dr John Smith		Waitlisted Patients K12345685, Marianela								
Patient Last Name*	Smith		Obstetrician	Name*	Dr Isabelle M. Delisle	•	Gartman, , Duration: 105 minutes, Primary Reason:								
Patient Phone Number*	(647)802-9803		Obstetrician Code*	- I	DELI		Maternal Request	Date:		11/16/2021	11/17/2021		11/19/2021		
			Code-			Add Obstetrician		Hour/Day:	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Expected Due Date* MMDDYYYY	09/09/2021		Obstetrician	2 Name		<u>_</u>		7:00 AM							
Delivery Week* MMDDYYYY	09/06/2021		Obstetrician Code	2		_		7:05 AN 7:10 AN							
Case Risk Category*	N/A	•	Primary India	ation*	Repeat C-Section	_			K12345679,	K12345682,					
Case Duration			General Note	. r		_			Ellamae Heidler, , Start		Krystyna Worley, ,				
cuse buildon	120		ound in the	·						Start Time:					
Additional Minutes	0									07:15, End					
			- Schedule					7:15 AM		Time: 09:15					
Total Case Duration	120		If the	If the expected due date is before the recent week generated:				7:20 AM							
	Patient/Obstetric	ian Unavailability	Click "	Schedule Dat	te Now" button	Manually Schedule		7:25 AM							
Week of:	09/06/2021	09/13/2021	Recent Monday	Week Generat	ted: Recent Week Generated: Friday			7:30 AM							
	Monday	Monday						7:35 AM							
	Tuesday	Tuesday						7:40 AM							
	Vednesday	Wednesday			Add Patient Information			7:45 AN							
	Thursday	Thursday			Add Falleni miormalion			7:50 AM							
	Friday	Friday													

IN PRACTICE

This booking tool will replace the manual planner, and by extension, it will resolve the issues mentioned above.

IMPACT Improved Predictability

Case duration is more predictable and allocated on need basis. This predictability reduces percentage of cases exceeding the allocated time, and reduces average overtime and undertime. As a result, patients are less likely to experience stress-inducing delays. Improved Communication

The virtual booking tool allows for simultaneous remote viewing of the schedule while the booking form provides additional important case information to the medical team. Patients will also know the expected duration of the operation in advance. Improved Scheduling

The scheduling algorithm optimizes the utilization of the OR and prioritizes the scheduling of more complex cases to reduce intensive waitlist planning.

CONCLUSION

The objective of this project has been achieved. The client has been trained on all solution elements and a phased implementation will be completed soon.



PHYSICAL BOOKING

e to error
cult to read
info retrieval

- **4.** Difficult to change
- **5.** Limited access
- **6.** Limited information

DIGITAL BOOKING

Booking: Multi-tab user form for adding and updating cases

Functionality: Calendar view, report generation, built-in error handling

Calendar View