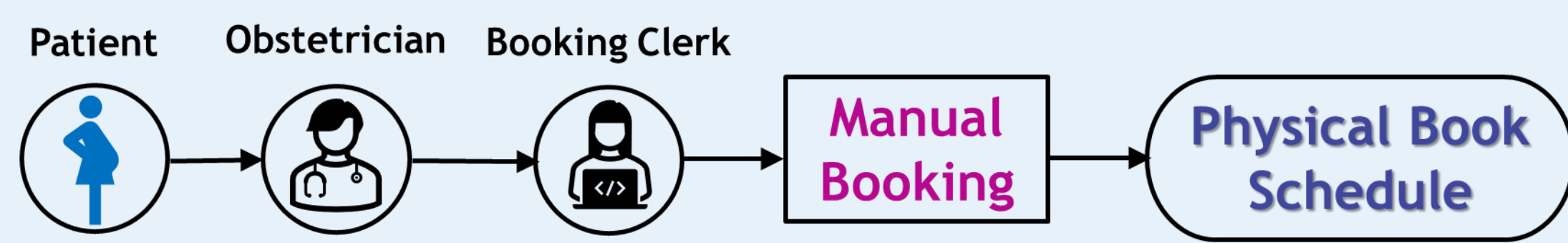


BACKGROUND

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.

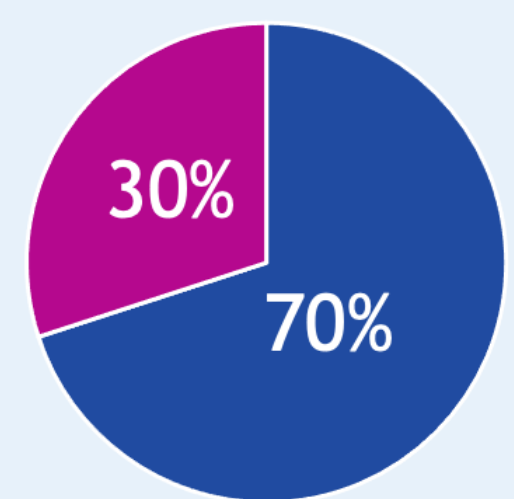
CURRENT PROCESS



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

CURRENT STATE

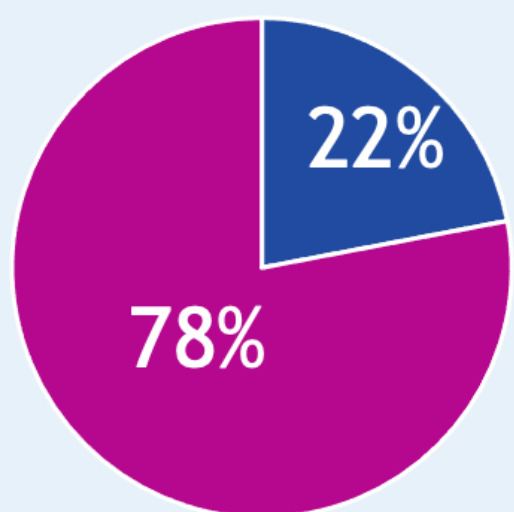
ELCS Duration Accuracy



- Cases go over time which creates schedule delays

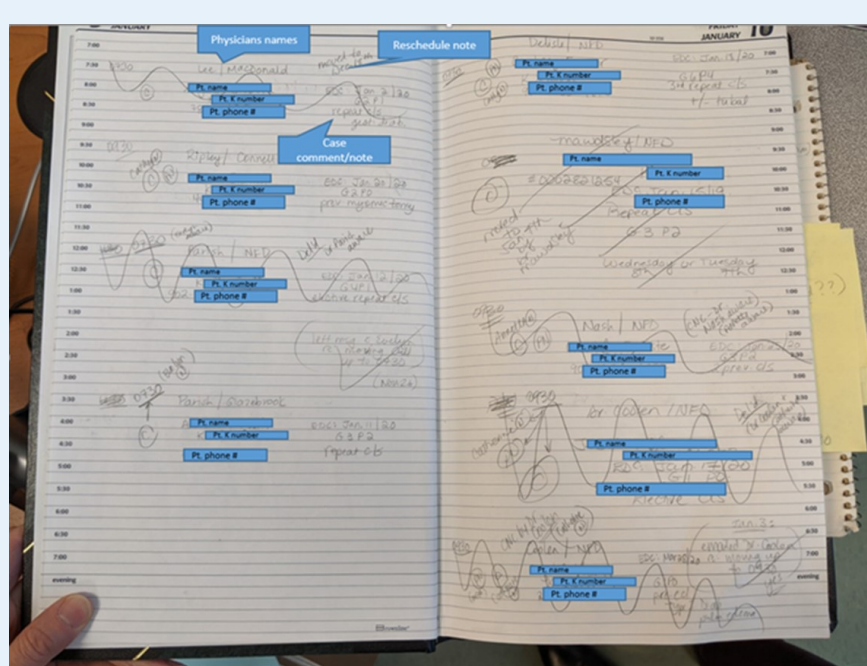
■ Overtime ■ Undertime/Ontime

ELCS Patientlist Status



- Overbooked weeks require extensive waitlist planning

■ OverBooked ■ UnderBooked/Optimal



- The manual planner has limited access and functionality

SOLUTION ELEMENTS

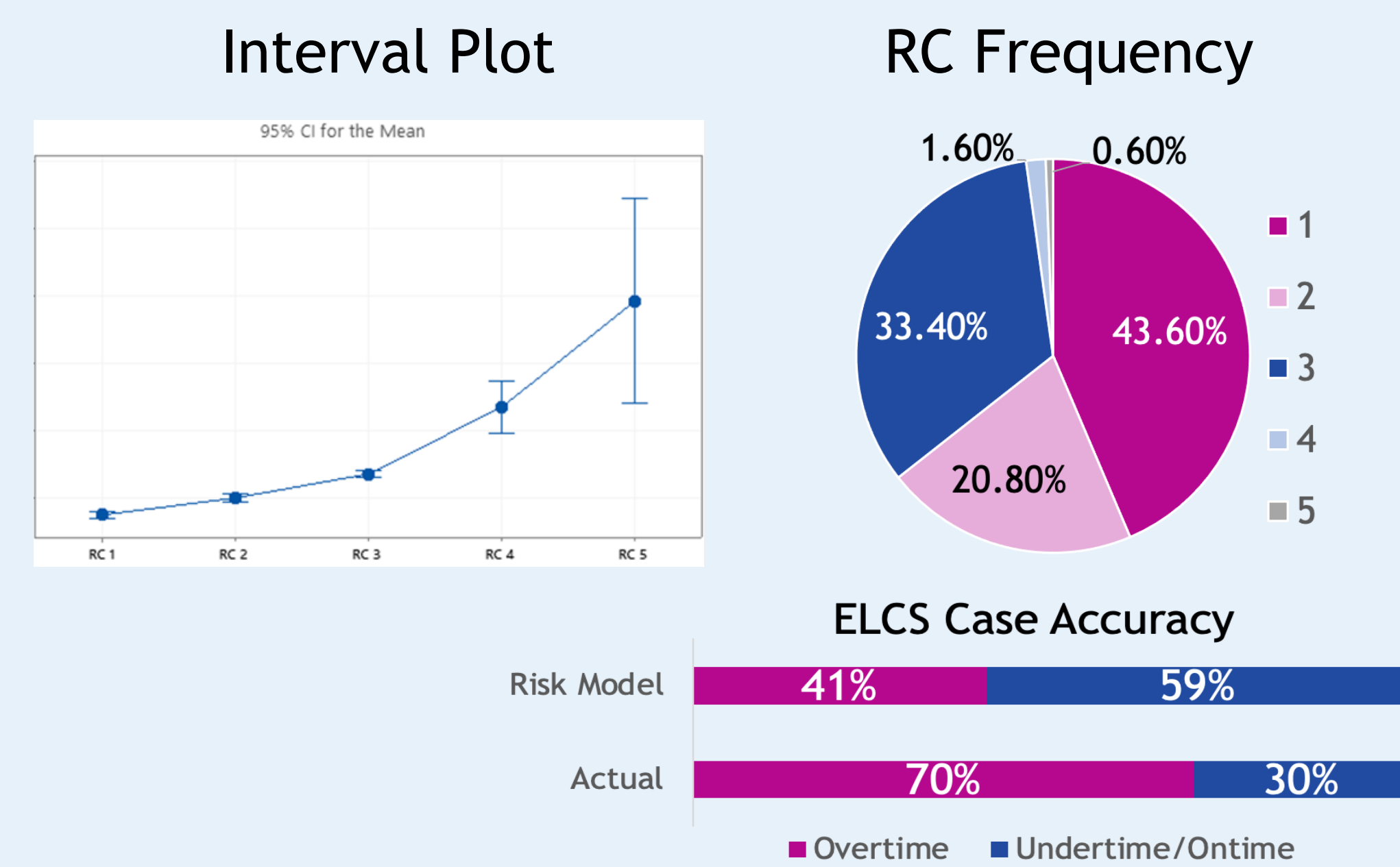
1 ASSIGNING *the duration*

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%



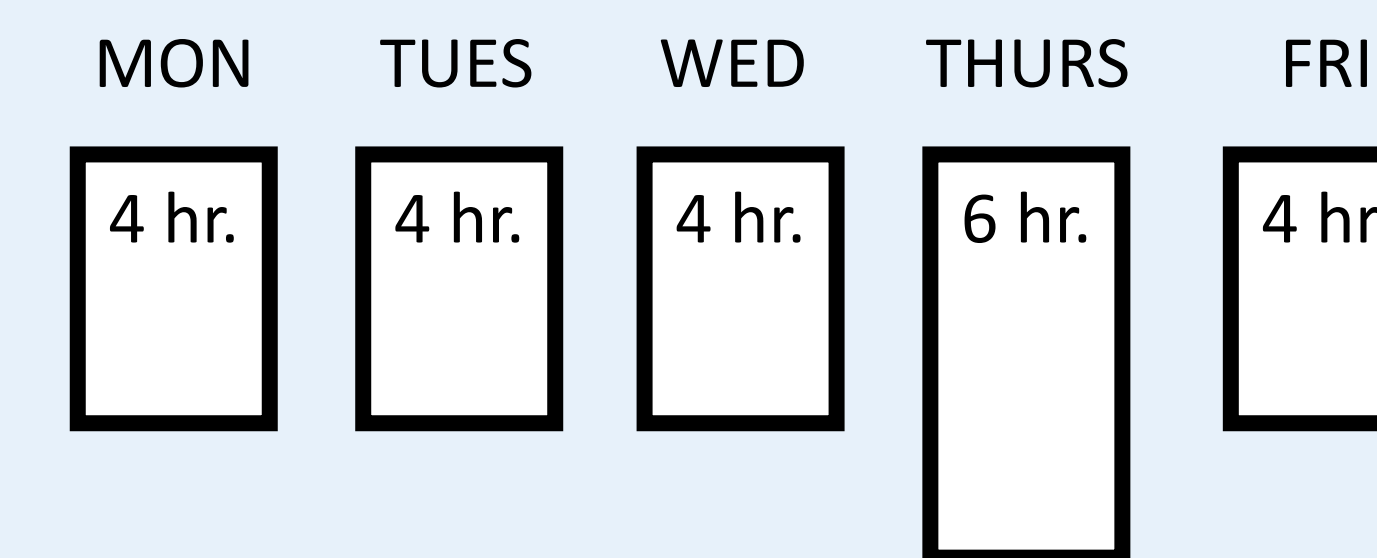
IN PRACTICE

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

2 OPTIMIZING *the schedule*

AVAILABILITY

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.



MILP

Minimize: $Z = c_{ij} * x_{ij}$
 c_{ij} cost of booking a patient i on waitlist/day j
 $x_{ij} \begin{cases} 1 & \text{if patient is scheduled for waitlist/day } j \\ 0 & \text{otherwise} \end{cases}$
 Subject to:
 $\sum_{i=1}^n x_{ij} - \sum_{i=1}^n x_{ji} \begin{cases} = -1 & \text{if patient } i \text{ exists} \\ \geq 0 & \text{for weekdays and waitlist } i \\ = 0 & \text{otherwise} \end{cases}$
 $\sum_{i=1}^n d_i * x_{ij} \leq a_j \forall j = 1 \dots n$
 d_i - duration for patient i
 a_j - availability for day j

Goals: Maximize the number of cases scheduled by minimizing the total cost of scheduling cases.

Constraint 1: Each case cannot be scheduled more than once.

Constraint 2: Cannot schedule more cases than time available

IN PRACTICE

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

3 DIGITIZING *the booking*

PHYSICAL BOOKING

- Prone to error
- Difficult to read
- Slow info retrieval
- Difficult to change
- Limited access
- Limited information

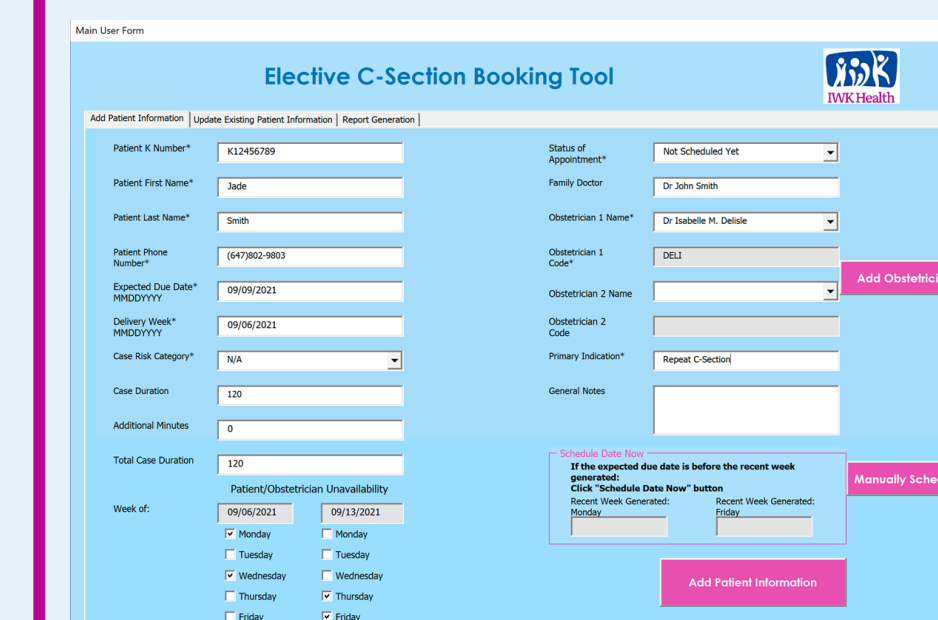
DIGITAL BOOKING



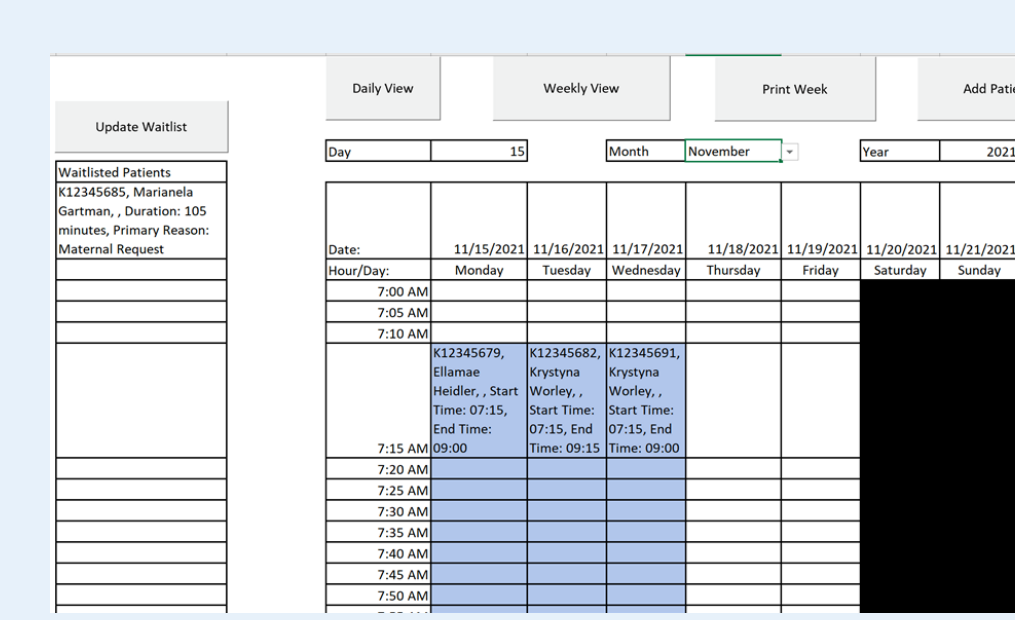
Booking: Multi-tab user form for adding and updating cases

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

Main User Form



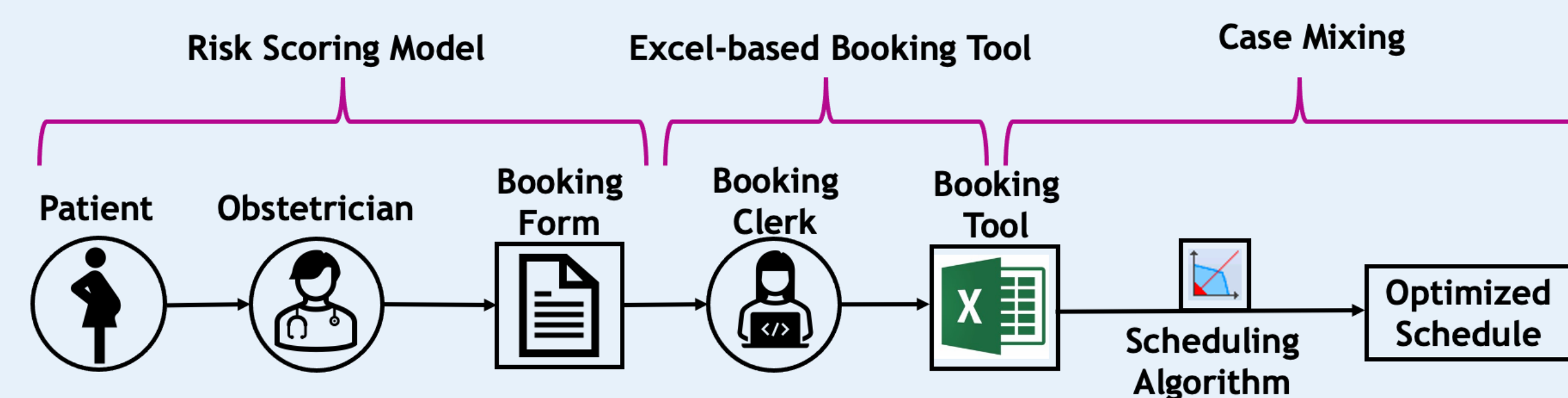
Calendar View



IN PRACTICE

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

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

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.