Anesthesiologists allocation optimization

Opmed Home Assignment – Hannah Ram

Background and Business Context

Problem:

- The hospital must staff anesthesiologists and assign operating rooms to cover **every scheduled surgery.**
- Poor assignments increase staffing spend through **under used shifts** and **overtime**.

Business Impact:

- **Direct labor cost:** overtime and inefficient shift utilization increase daily staffing spend.
- **Scalability:** a repeatable optimization process supports consistent decisions as schedules change.

What "good" looks like:

All surgeries are covered with:

- **Lowest possible staffing cost**
- **Minimal overtime hours**
- **Efficient use of anesthesiologists and rooms** (20 ORs available)

Solution: Create a daily OR schedule that covers every surgery while keeping staffing costs as low as possible

What we did

- **Step 1: Assign surgeries to operating rooms** so no room is double-booked.
- **Step 2: Step 3: Assign surgeries to anesthesiologists** so no clinician is double-booked.
- **Step 3: Minimize cost** by reusing anesthesiologists when possible and avoiding long shifts that trigger overtime.

Why this approach works for you

- Produces a valid schedule **quickly** (usable for daily operations).
- Follows actual constraints: no overlaps, limited rooms, and overtime costs.
- Easy to rerun when schedule changes (new cases, cancellations, delays).

Output

A clear schedule showing, for every surgery: **assigned room + assigned anesthesiologist**.

Key Results

Metric	Current scheduling	Optimized schedule	Improvement
Total anesthetist cost (units)	235.0	**205.12**	**−29.88 (−12.7%)**
# anesthesiologists used	28	**24**	**−4 (−14.3%)**
Average shift duration (hours)	7.4	**6.60**	**−0.8 hours**
Total overtime hours	40.0	**27.25**	**−12.75 (−31.9%)**

For the same set of surgeries, the optimized schedule reduces staffing cost and overtime while using fewer anesthesiologists.

If we assume this is a **typical daily schedule** repeated ~260 days per year, then the optimizer saves 29.88 paid hours per day, for a total of **about 7,769 hours per year** (29.88 × 260)

If we assume an anesthesiologist hourly rate is $250, then annual savings are about 7,769 hours × $250/hr = **~$1.94M per year**

Cost Saving Opportunities

Room efficiency

Our optimized schedule successfully covers the day's surgeries while only requiring **15 operating rooms** at peak (even though 20 rooms are available).

Immediate opportunity

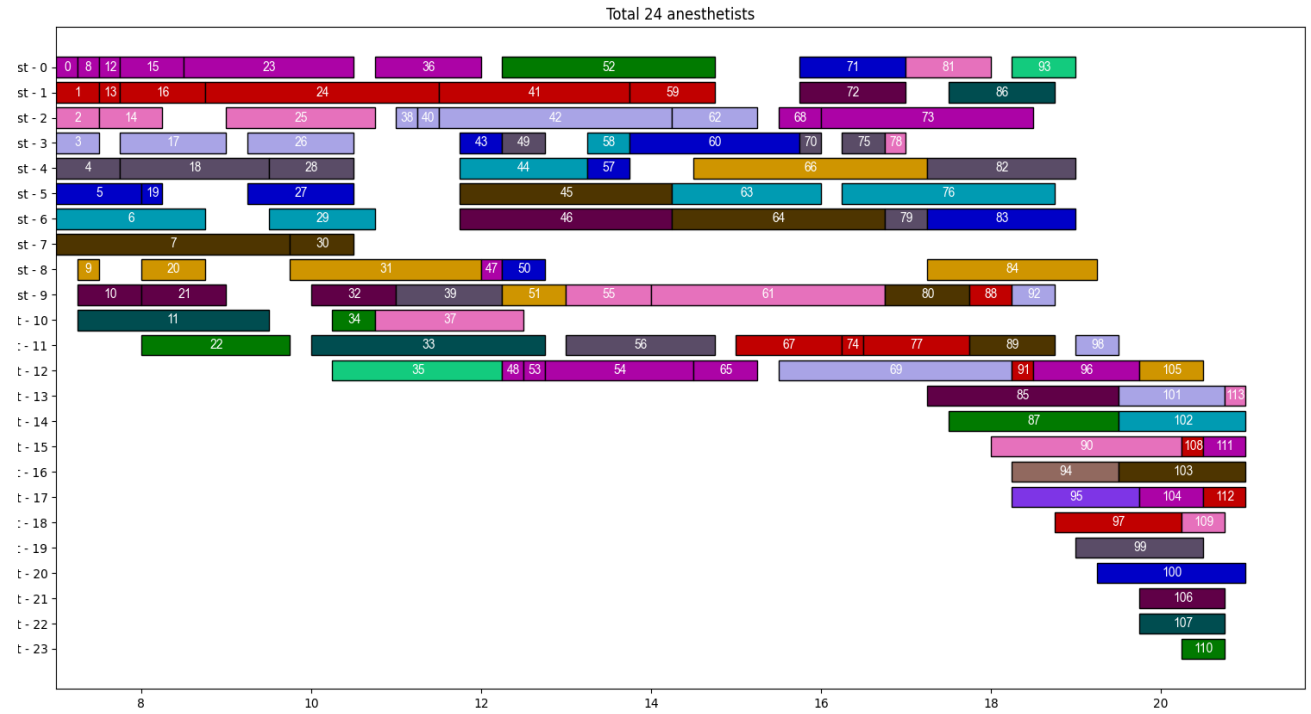
This creates 5-room capacity headroom that the hospital can use to:

1. Add more surgeries during peak overlap periods without needing additional rooms, and/or
2. Reduce the number of rooms opened on days with similar demand, lowering room-related operating costs (staffing, turnover, supplies, utilities).

Better use of paid staffing

Because anesthesiologist shifts have a minimum paid time (5 hours), adding surgeries into unused gaps can increase utilization of already-paid hours (filling "under-minimum" shifts) rather than adding new staff.

Recommendations and next steps



Recommendations

1. **Move a small number of flexible cases earlier** (when possible)
- Shift a portion of late-day cases into earlier open slots to smooth demand.
- **Benefit**: fewer simultaneous overlaps = **less need for extra anesthesiologists** and fewer short/underutilized shifts.

2. **Protect a late-day buffer for true add-ons only**
- Reserve the last part of the day for urgent or unpredictable cases instead of planned electives.
- **Benefit**: reduces late finishes and overtime risk.

Next Steps

1. **Validate on more days:** Run the optimizer across several weeks/months of schedules to confirm the savings are consistent (not just one day).

2. **Create a true baseline comparison:** Compare results to the hospital's current scheduling approach using the same days (cost, overtime hours, # anesthesiologist , room utilization).

3. **POC UI for decision makers:** We created a UI where you can upload a surgery list, run the optimizer, and instantly see the recommended schedule visually. This enables a quick pilot to gather feedback and compare outcomes against the current scheduling process.

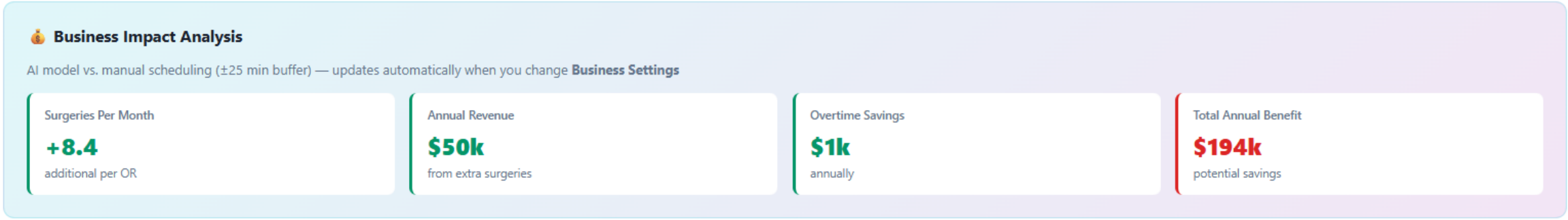
ROI potential – Surgery Duration Prediction

Before:

- **Baseline (manual scheduling):** assumes a **±25 min buffer per case** to manage uncertainty in surgeon estimates.
- This buffer creates **unused OR time** (gaps between cases) and still leads to **overtime risk** when cases run long.

After:

- **With our AI predictions:** the buffer is reduced by **40%** (25 min to 15 min) because duration estimates are more accurate, which frees up OR time and reduces avoidable overtime.



Total ROI:

$1.94M/year (schedule optimizer staffing savings)

$194K/year (duration prediction business impact)

minus $80K/year (annual service cost)

$2.054M net annual savings