

# Minute-by-Minute Anesthesia Activity, Capacity, Utilization

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## Background

- Optimum staffing is unknown, difficult to determine
- OB activity/staffing are especially heterogeneous
  - Im et al (2022) estimated 33% utilization
  - “how busy we are” vs “how we are busy”

## Methods

COMIRB exempt #23-0077

1. Extract one year L&D patient EHR data
2. Identify activity: med admin, intra-op events for OR care, non-OR care (mostly neuraxial)
3. De-duplicate per patient
4. Aggregate *Minimum Engaged Activity* (MEA)
5. Repeat 1-4 for staff schedule, determine capacity
6. MEA / capacity → *Minimum Engaged Activity Index* (MEAI)

## Results/Discussion

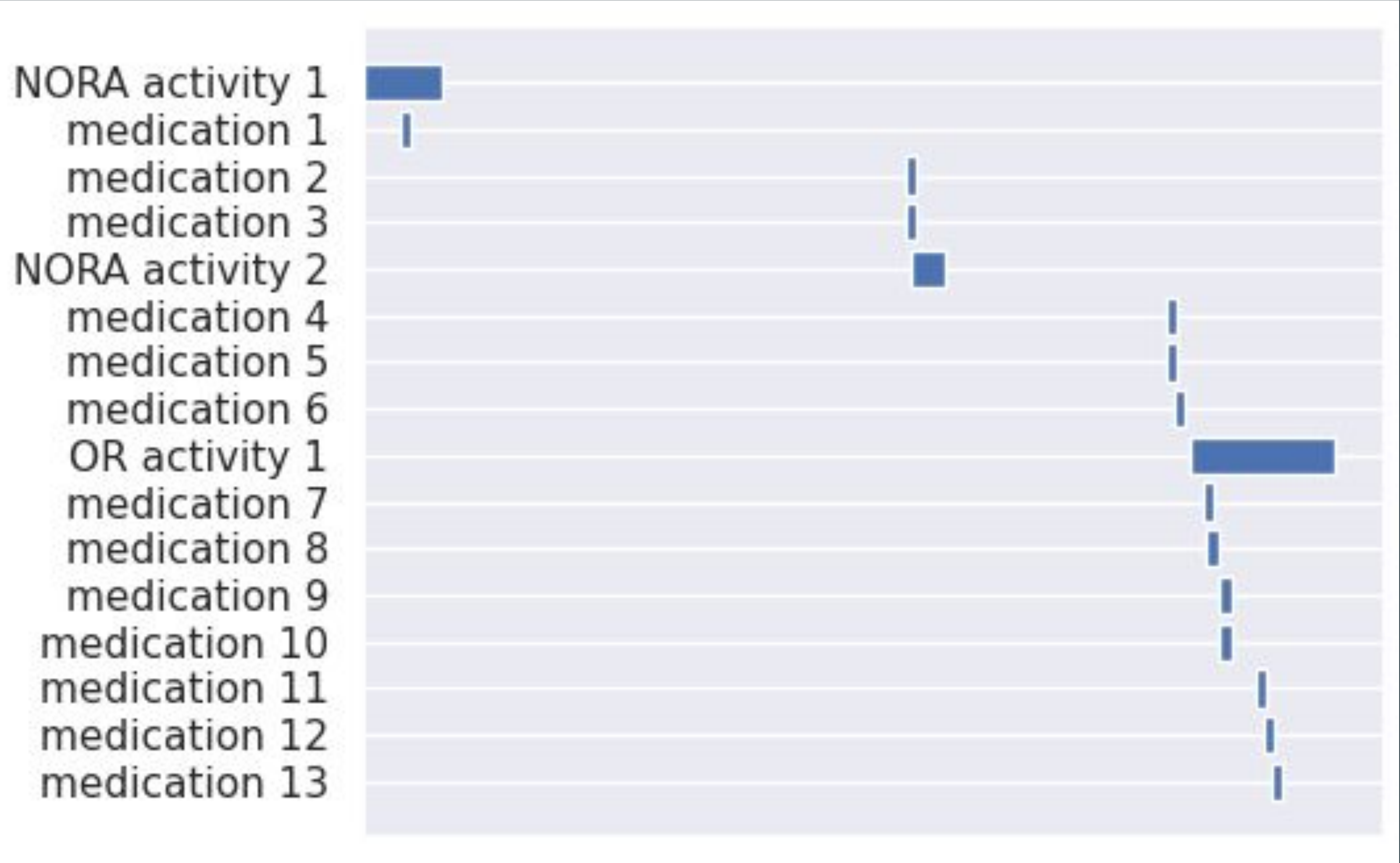
Patient data: 3,219 admissions + 54,722 intra-op events + 28,163 meds → extracted 32,029 activities

*Fig. 1: Extracted activities*

| Activity      | Count  | Duration (hh:mm) |        |        |
|---------------|--------|------------------|--------|--------|
|               |        | 25%ile           | 50%ile | 75%ile |
| OR activity   | 1,243  | 00:41            | 01:11  | 01:35  |
| NORA activity | 2,623  | 00:19            | 00:32  | 00:44  |
| Medication    | 28,163 | 00:05            | 00:05  | 00:05  |

Staffing data: 73,202 assignments → extracted 1,154 resident and APP assignments at study site

Fig. 2: Activity de-duplication per patient (sample)



✨data processing✨

↓

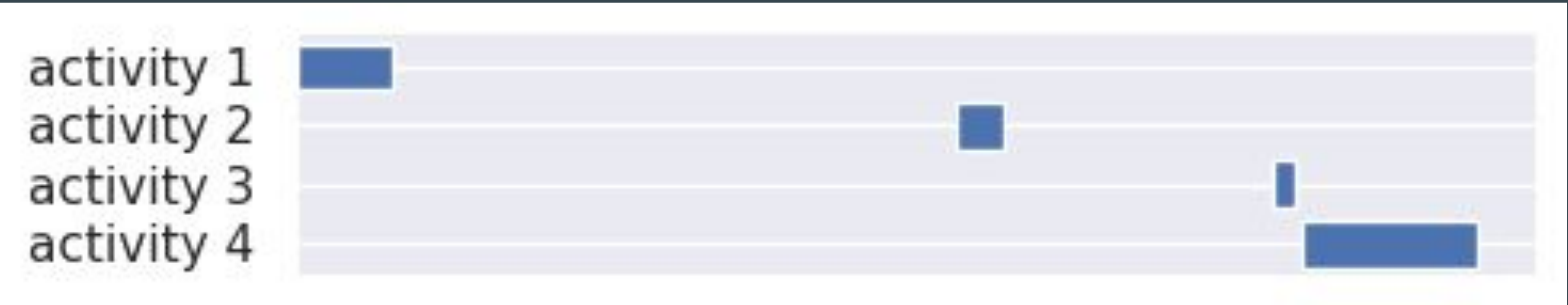


Fig. 3: Sample MEA, capacity, MEA Index and summary statistics

| Timestamp | MEA      | Capacity | MEA Index (MEA/capacity) |
|-----------|----------|----------|--------------------------|
| ...       | ...      | ...      | ...                      |
| 17:18:00  | 1        | 2        | 0.50                     |
| 17:19:00  | 1        | 2        | 0.50                     |
| 17:20:00  | 2        | 2        | 1.00                     |
| ...       | ...      | ...      | ...                      |
| Average   | 0.402411 | 1.935046 | 0.225498                 |

Fig. 4: Cumulative time by MEA Index level

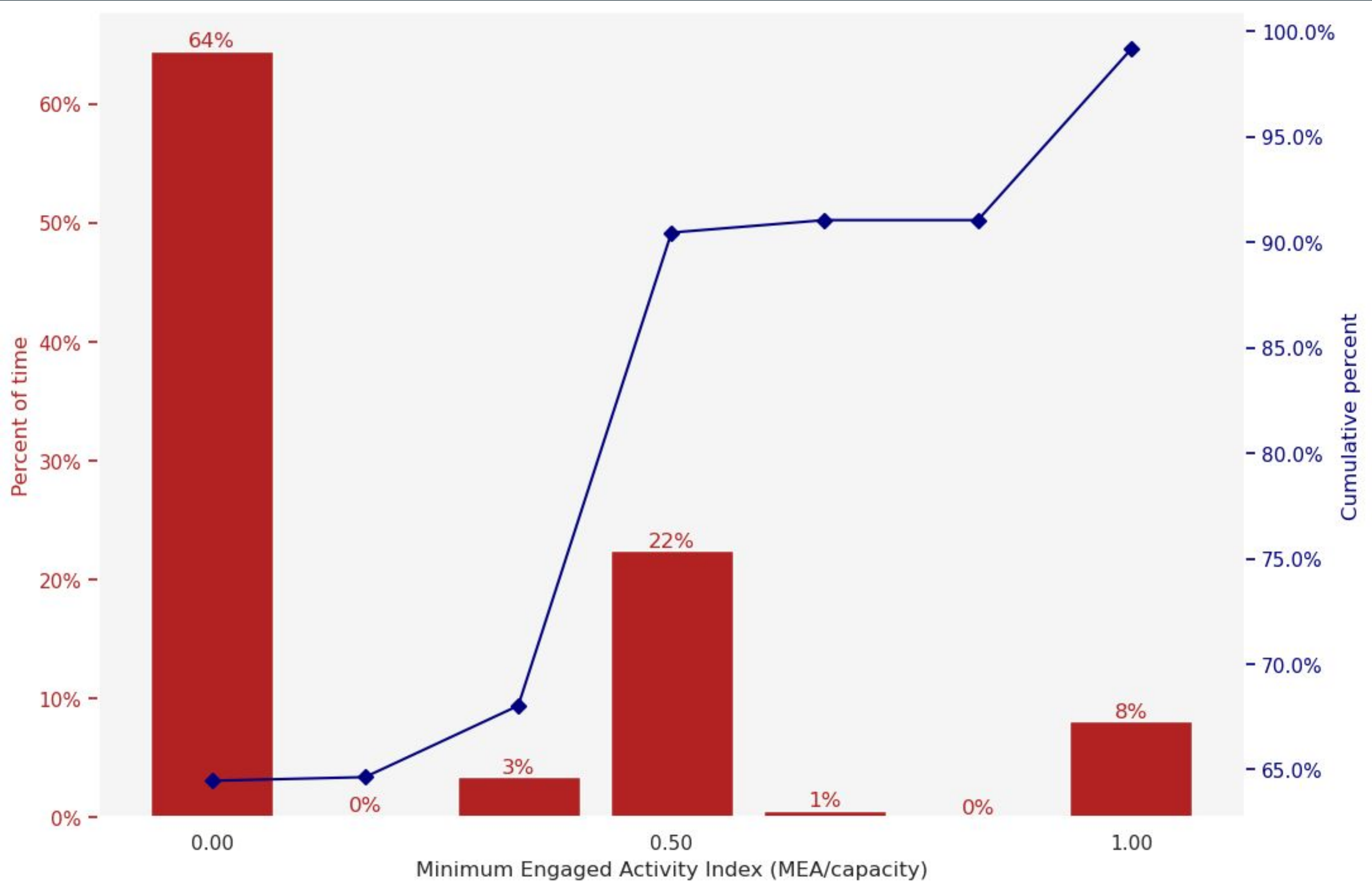
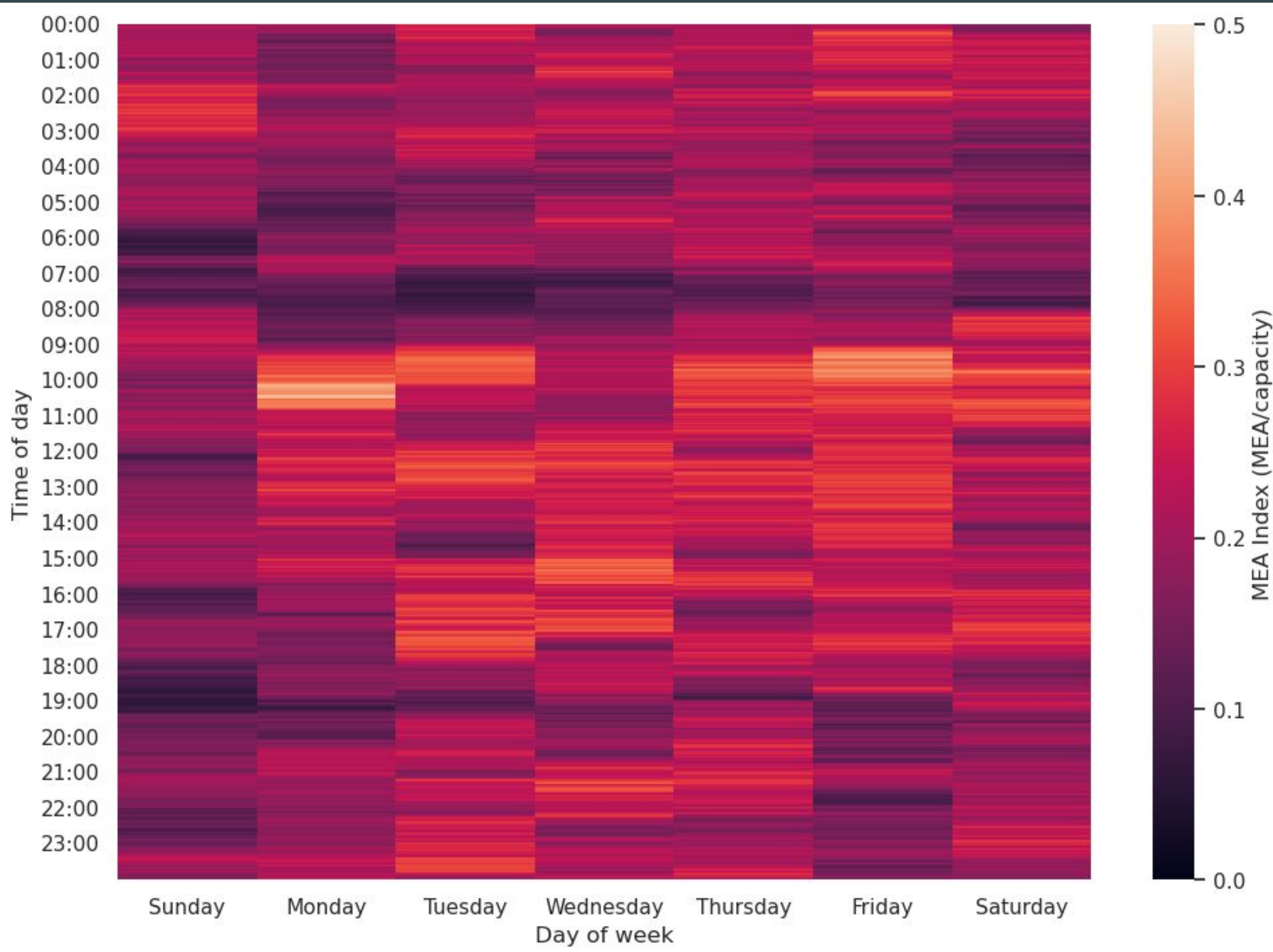


*Fig. 5: Heat map of MEA Index by time of day and day of week*



### Limitations

- Charting/data quality
- Omits unstructured activity (pre-/post-op evals, OR/procedure setup, coordination, consults, IV starts, transport, etc.)

### Conclusions

Anesthesia intraoperative records and staffing data can be used to determine minute-by-minute activity, capacity, and utilization.

### Future Work

- Toolkit: *Python Tools for Investigating and Visualizing Activity* (PyTIVA GitHub.com)
- Scale to more time, other anesthetizing sites
- Stress analysis: how often exceeding  $n\%$  utilization, how often less than  $x$  minutes between activities, etc.
- Stratify by day/night/weekend coverage, total minutes by activity in each stratum

<https://github.com/tjbiel85/pytiva>