Improving Patient Wait Times at Outpatient Phlebotomy

SWIFT — DRAW

Overview

Goal

Reduce wait times and improve patient experience throughout outpatient blood draw at the three flagship hospitals for UW Medicine: Montlake, Northwest, & Harborview.
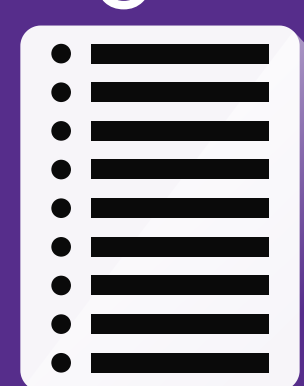
UWMed Outpatient Phlebotomy

- Patient walks in & out that day
- Timed VS normal draws
- Peak hours: morning
- No current wait estimation

Assumptions

- Fixed number of draw stations
- Draw time is constant
- Phlebotomists have equal skill
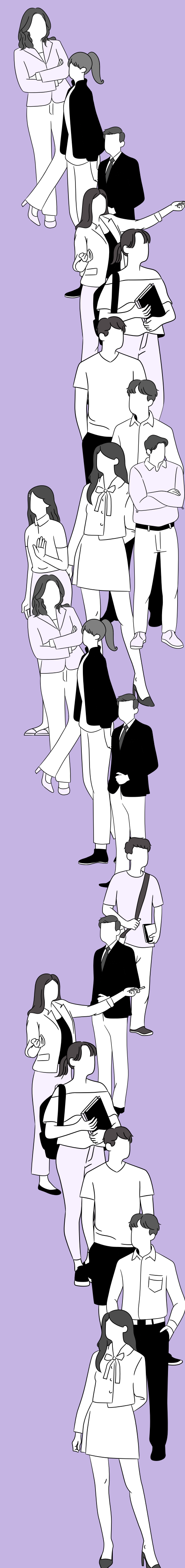- Historical data is representative

System Elements

- Registration
- Waiting Room
- Callback
- Blood Draw

Methodology

Solution Flow

ANALYZE SYSTEM → REQUEST & COLLECT DATA → CLEAN & PREPARE DATA → CREATE MODELS

Data Collection & Cleaning

- Time studies at all clinics
- Filter to four main clinics
- Remove outliers and negative values
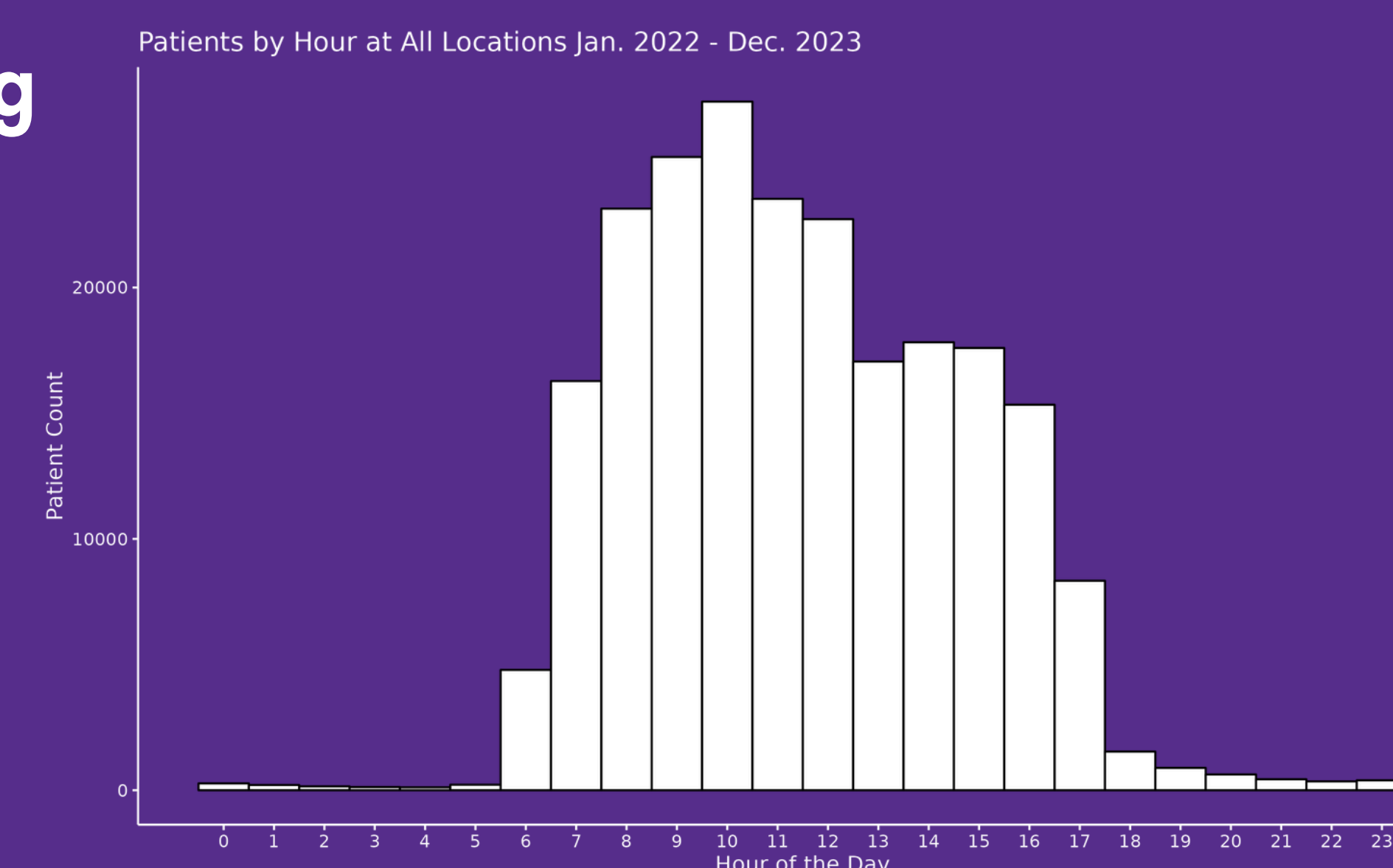- Calculate wait time
- Derive staffing levels

Figure 1. Patient Count by Hour

Variable Modeling

- Methods tried:
  - Linear Regression
  - Decision Tree
  - Multivariate Adaptive Regression Splines
  - Poisson Regression
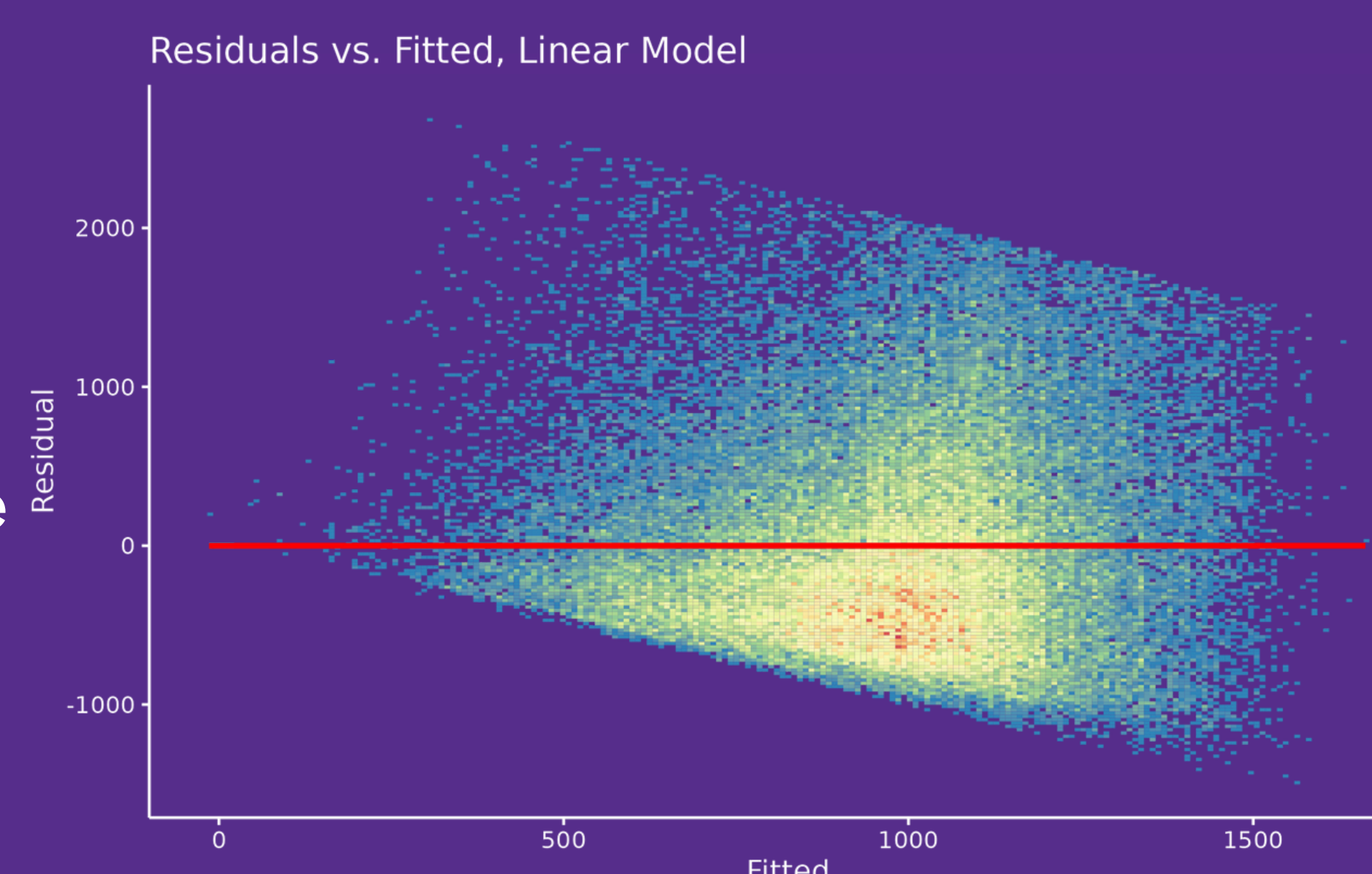- Low predictive power
- High variable output

Figure 2. Residuals vs Fitted For Linear Regression

Facebook Prophet Modeling

- Time-series forecasting tool with customizable seasonalities and regressors by hospital
- Incorporates historical staffing and patient demand data
- Predicts patient wait times with high accuracy
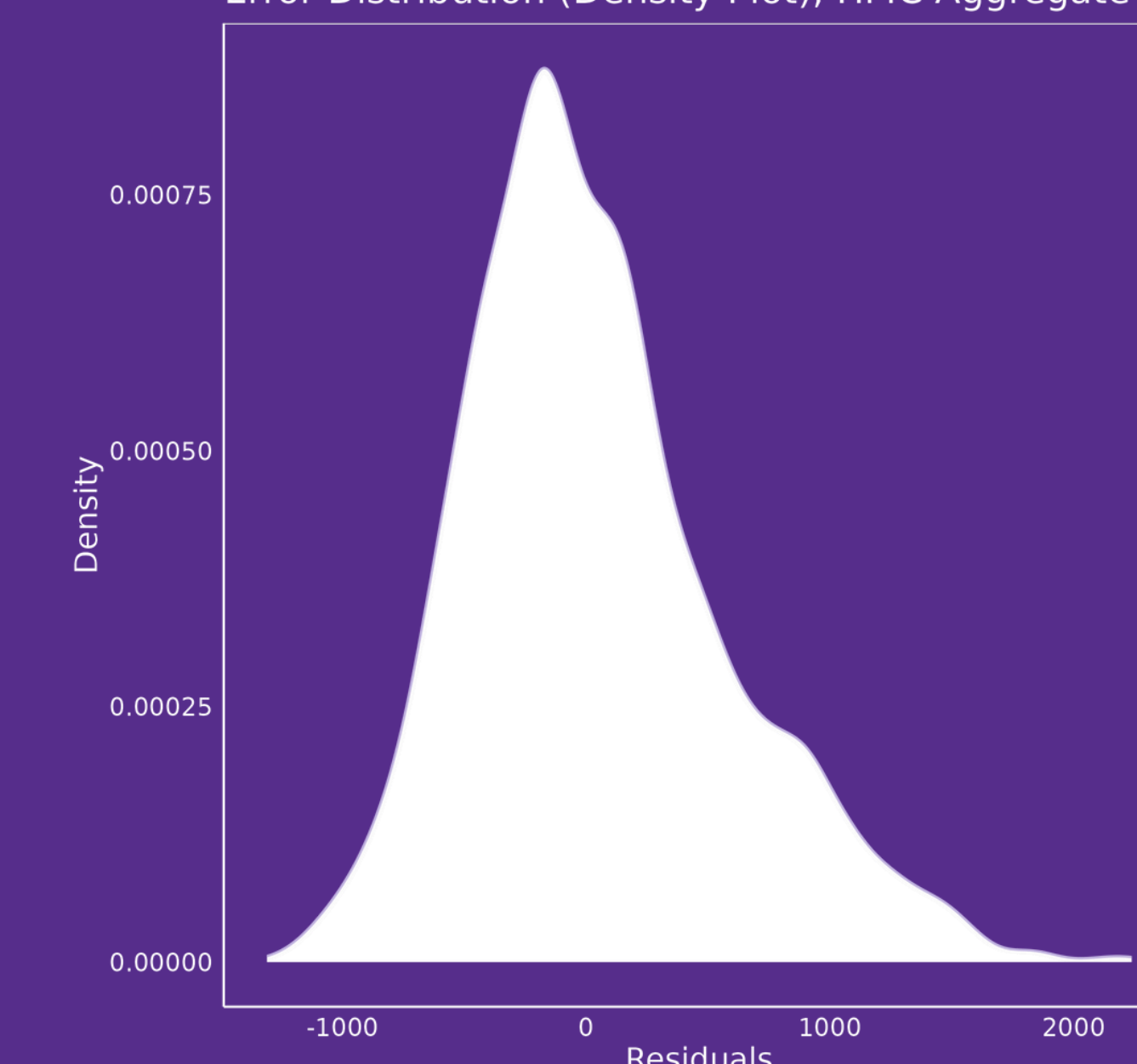

Figure 3. Error Residuals for Prophet Model

Recommendations

Model Implementation

- Targeted interventions within 48-72 hours
  - Additional staff called in
- Optimize and test staff schedules to minimize wait times
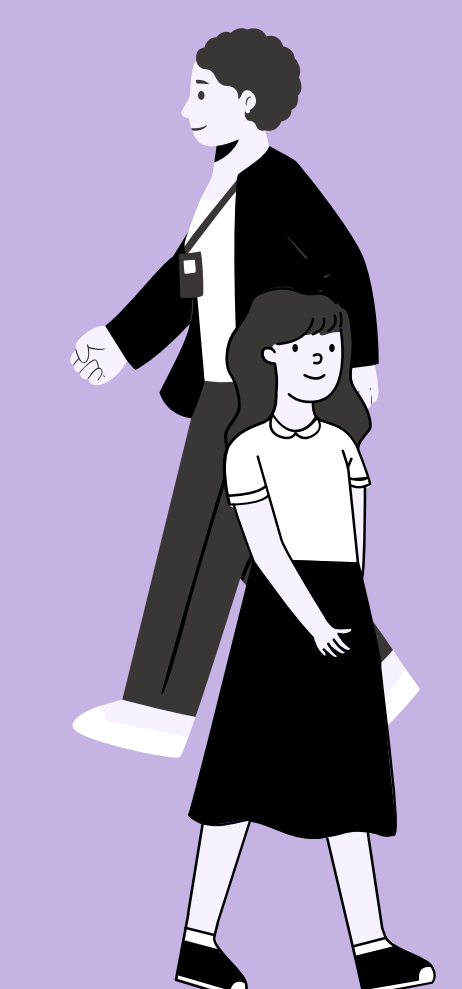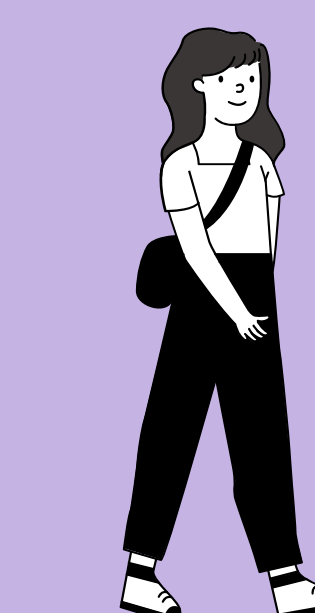- Improved data collection practices will lead to greater accuracy

5 minute average error

Process Improvements

- Reduction of single-resource consumption
  - Ex: Redistributing phone call duties
- Redirection of overflow patients from main Harborview to NJB
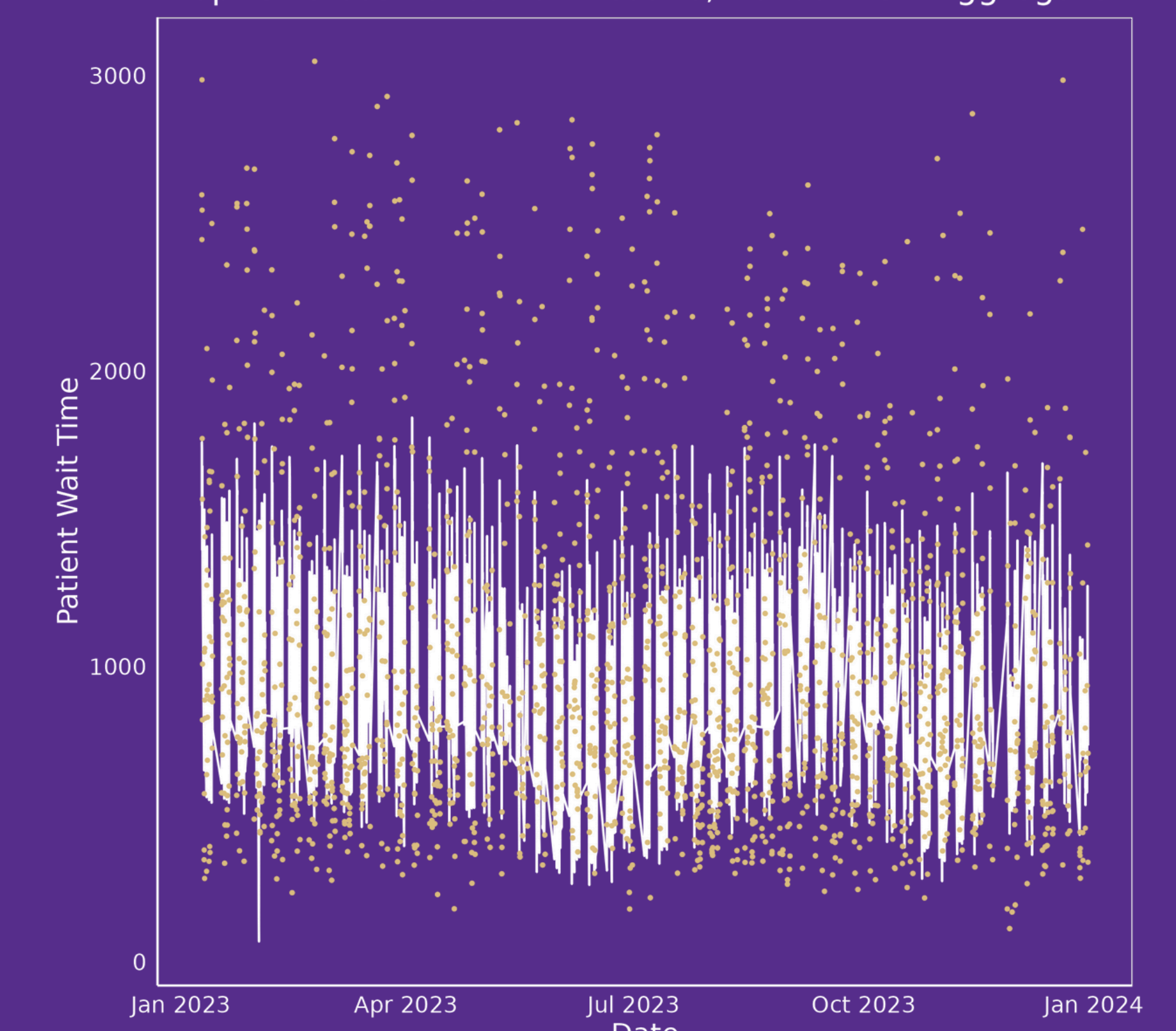
14+ day prediction power

67% efficiency increase

Figure 4. Prophet Model Cross-Validation