

Improving Patient Wait Times at Outpatient Phlebotomy

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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

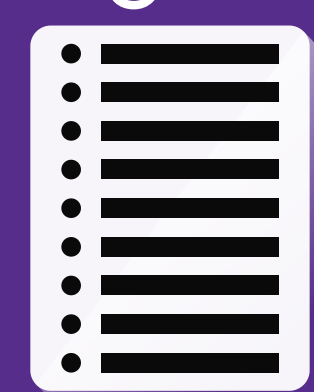
- Patient walks in & out that day
- Timed VS normal draws
- Peak hours: morning
- No current wait estimation

Assumptions

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

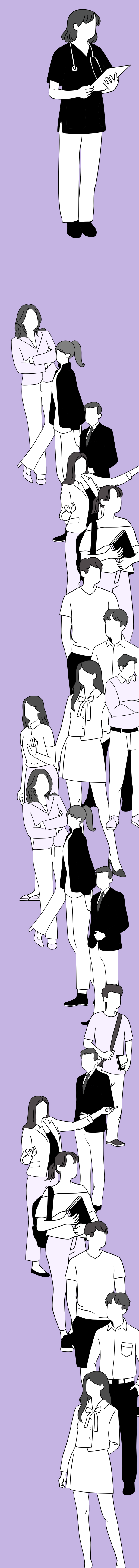
System Elements

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

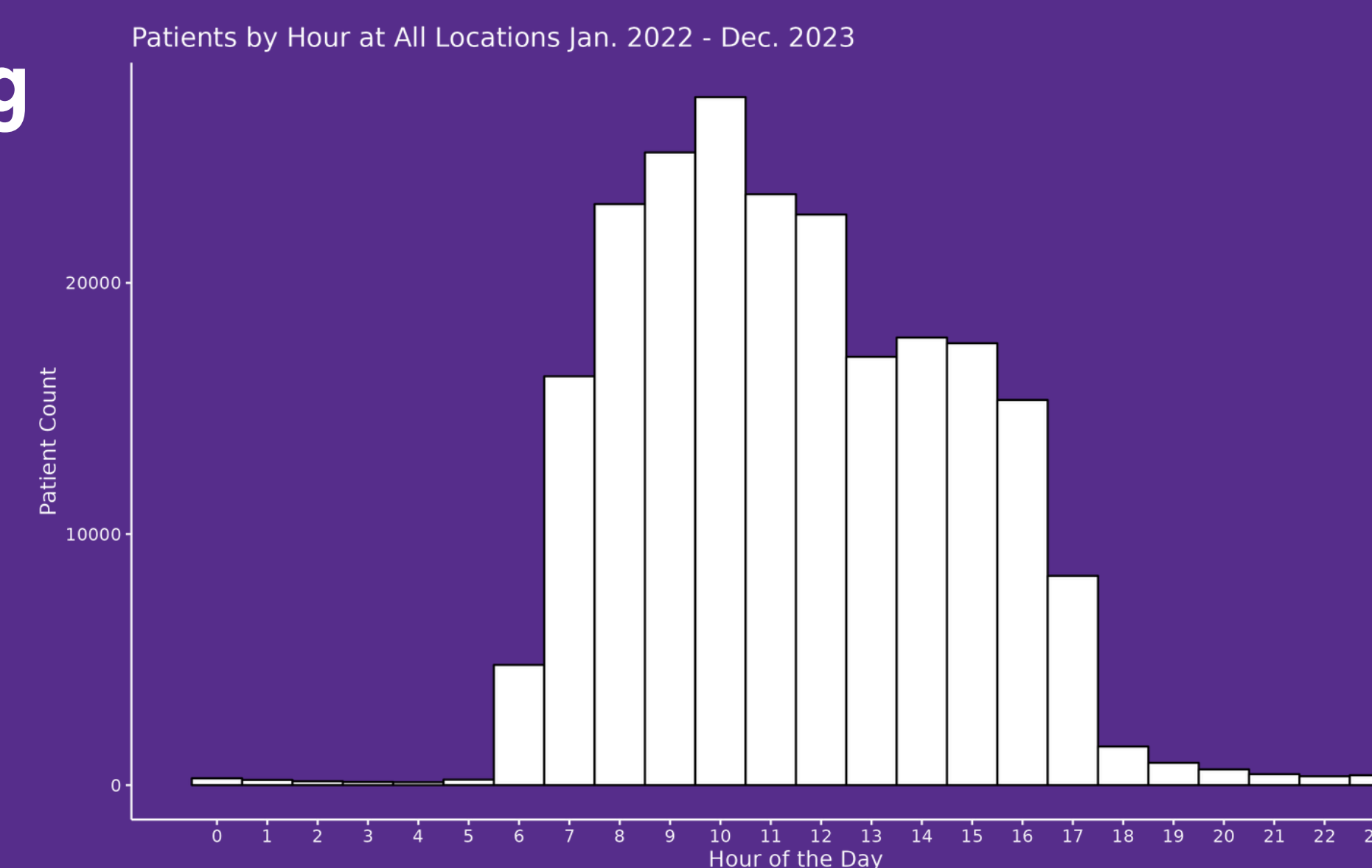


Figure 1. Patient Count by Hour

Variable Modeling

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

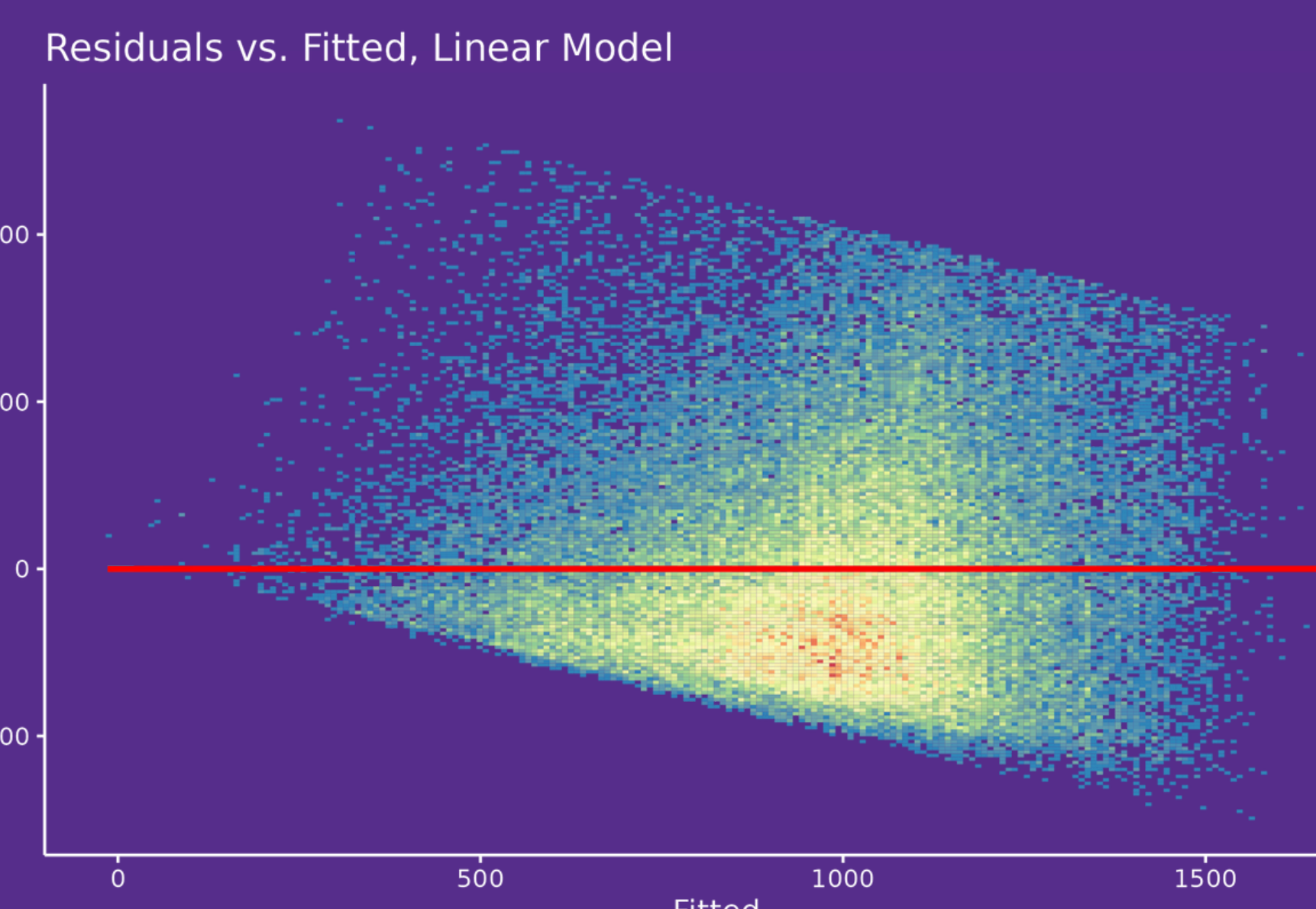


Figure 2. Residuals vs Fitted For Linear Regression

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

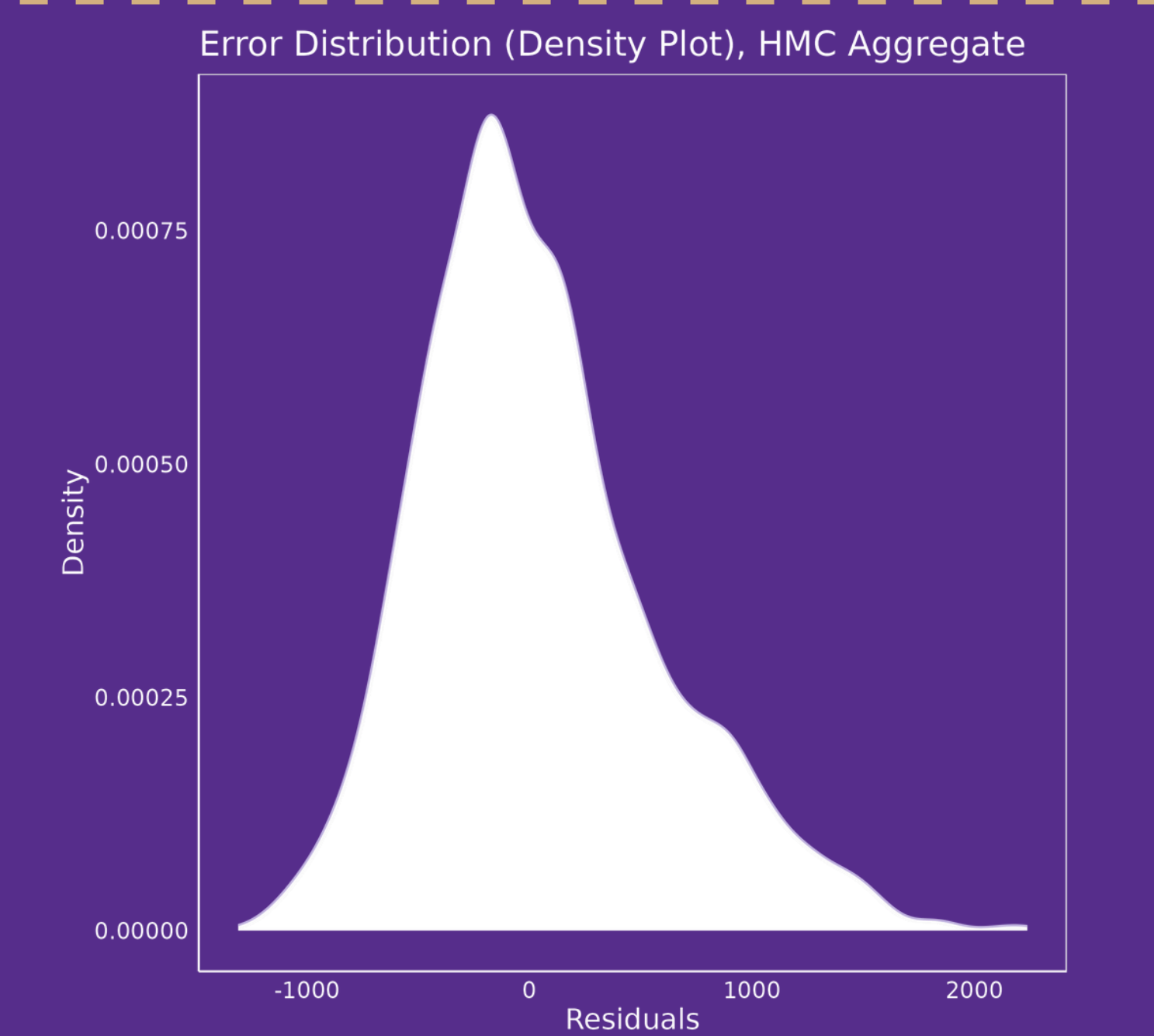


Figure 3. Error Residuals for Prophet Model

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

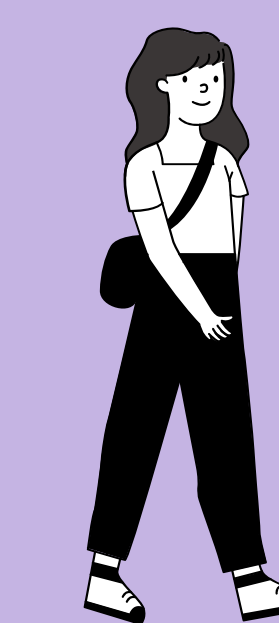
**5
minute
average
error**

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**



Prophet Cross-Validation Results, Harborview Aggregate

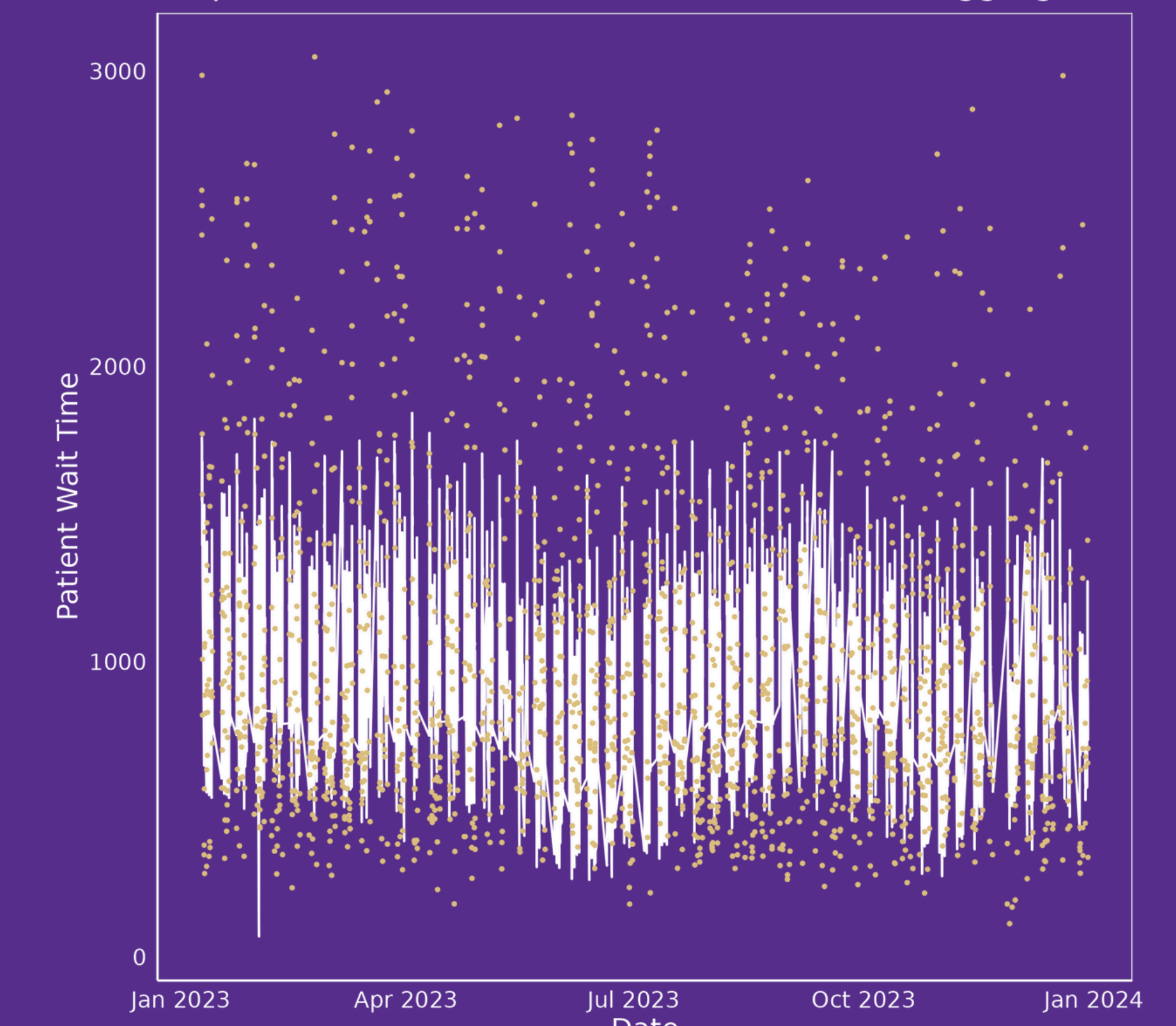


Figure 4. Prophet Model Cross-Validation