BDA 640:

Data driven decision making & optimization

OPERATIONAL EFFICIENCY IMPROVEMENT IN HOSPITAL OBSERVATION UNITS

- Aakanksha
- Joyce
- Srikar

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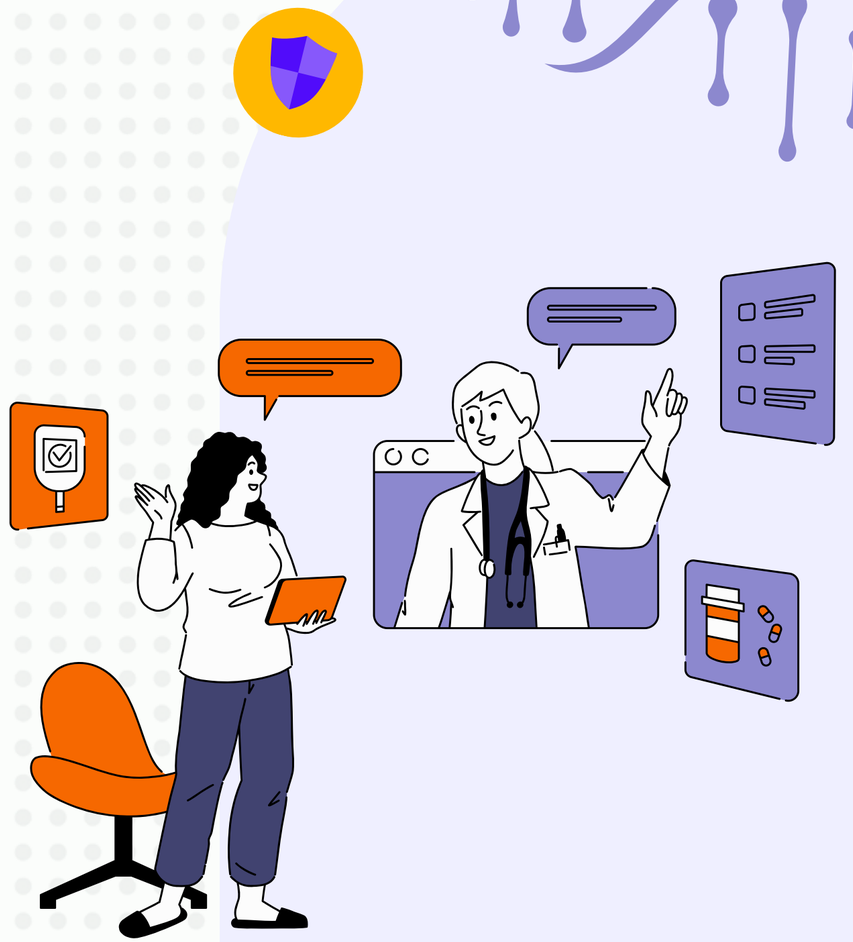
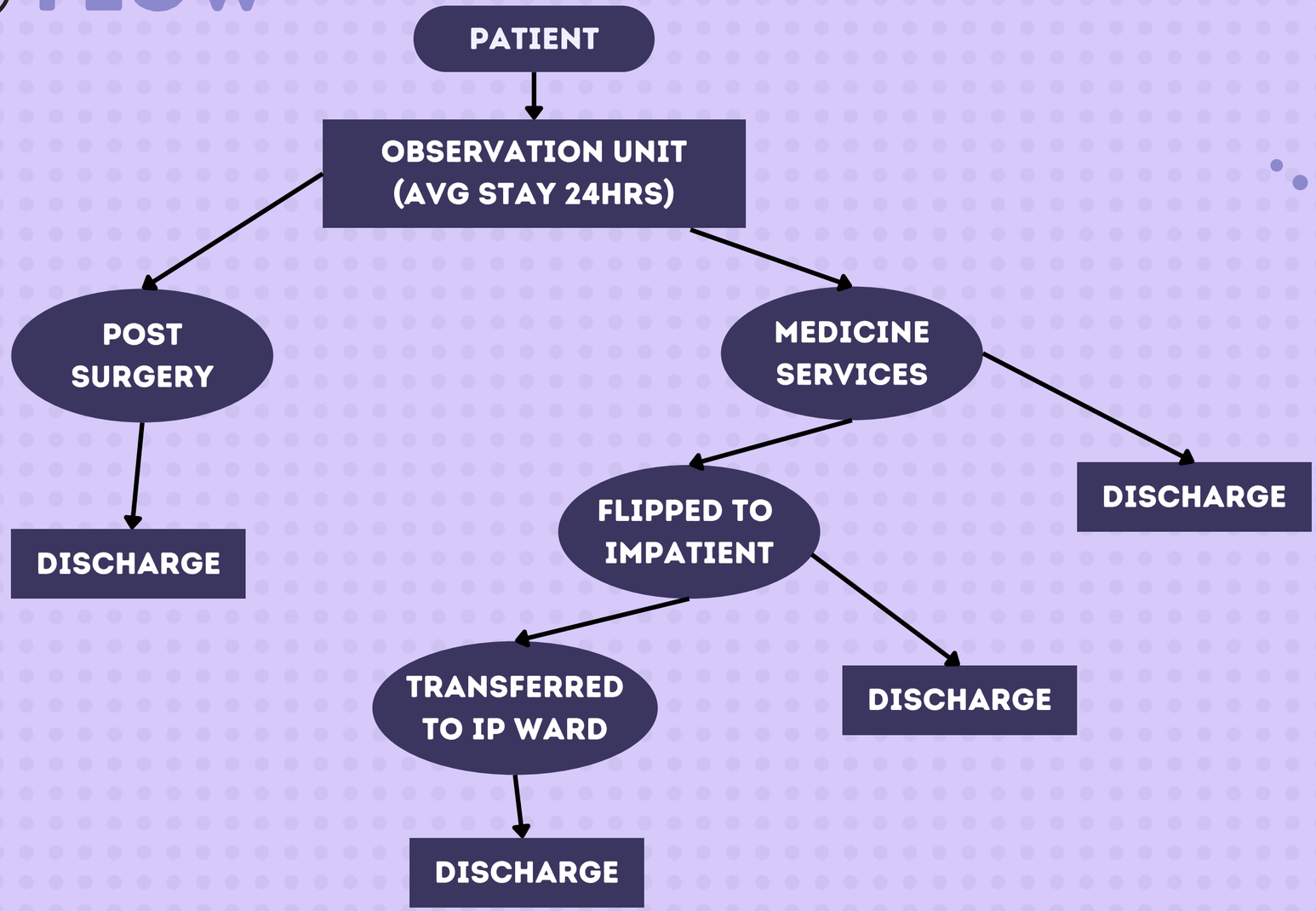
INTRODUCTION

- THE HOSPITAL IS LOCATED IN THE CITY OF MONTANARO.
- IT IS A 260-BED MEDICAL FACILITY, INCLUDING A SPECIALIZED 23-BED OBSERVATION UNIT (OU).
- UNDER THE LEADERSHIP OF DR. ERIN KELLY.
- THE OU PLAYS A KEY ROLE IN PATIENT CARE, DESIGNED TO MONITOR PATIENTS WITH COMPLEX, NON-CRITICAL SYMPTOMS.
- IT SERVES AS AN IMPORTANT INTERMEDIATE CARE OPTION BETWEEN THE EMERGENCY DEPARTMENT AND FULL INPATIENT ADMISSION, ENSURING EFFICIENT PATIENT MANAGEMENT.



PROCESS FLOW

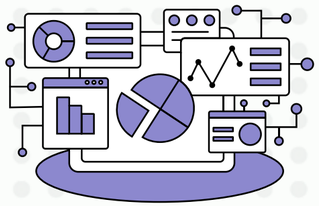


ISSUE OVERVIEW

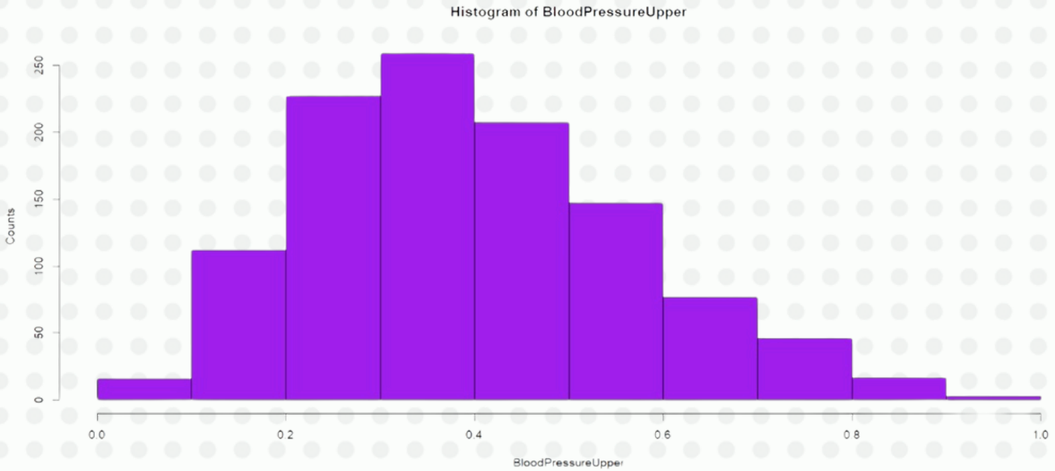
- Resource misallocation and extended stays
- Job dissatisfaction among Observation Unit (OU) nurses
- Overcrowding in the Emergency Department
- Limited exclusion list
- Low compensation by medical insurance provider

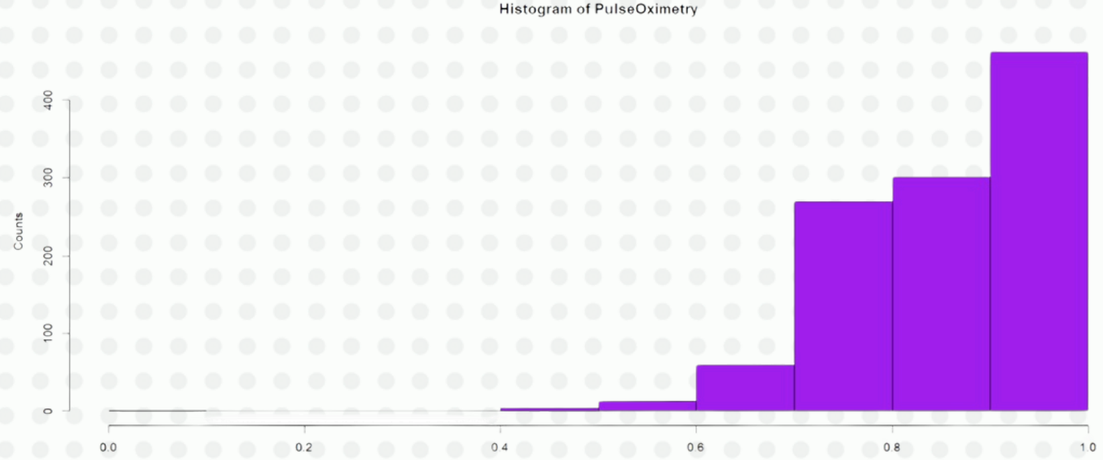
DATA DICTIONARY

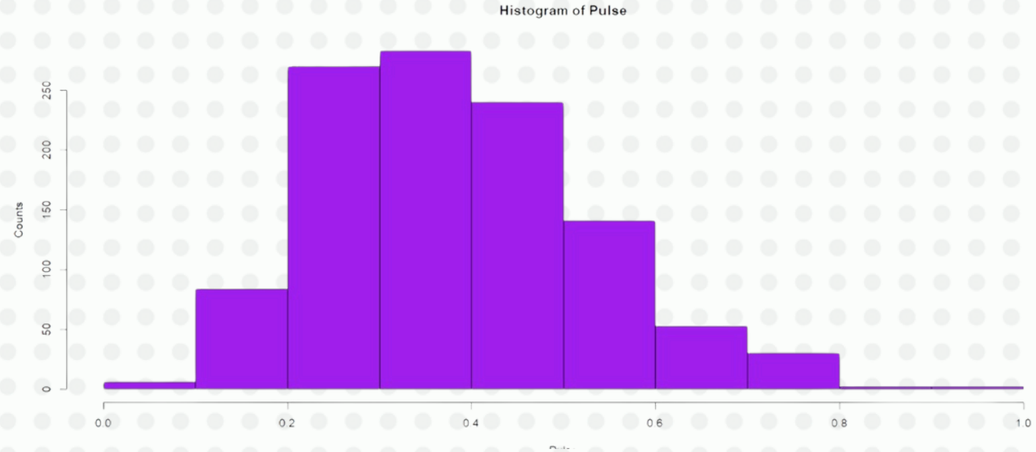
Column (Variable) Name	Definition
Age	Age of patient, in years
Gender	Patient gender (recorded as Male/Female)
PrimaryInsuranceCategory	Insurance provider for the patient
Flipped	Binary variable that is 1 if the patient "flipped" from OBSERVATION status to INPATIENT status, and 0 if the patient stayed in OBSERVATION status and was discharged from the OU
OU_LOS_hrs	Length of stay in the OU in hours
DRG01	Initial diagnosis-related group (code) corresponding to the patient's primary complaint
BloodPressureLower	Diastolic, or lower, blood pressure number in mm Hg
BloodPressureUpper	Systolic, or upper, blood pressure number in mm Hg
BloodPressureDiff	Difference between systolic and diastolic blood pressure
Pulse	Patient pulse
Pulse Oximetry	Measure of level of oxygen in patient's blood
Respirations	Number of breaths patient takes per minute
Temperature	Patient's temperature in Fahrenheit

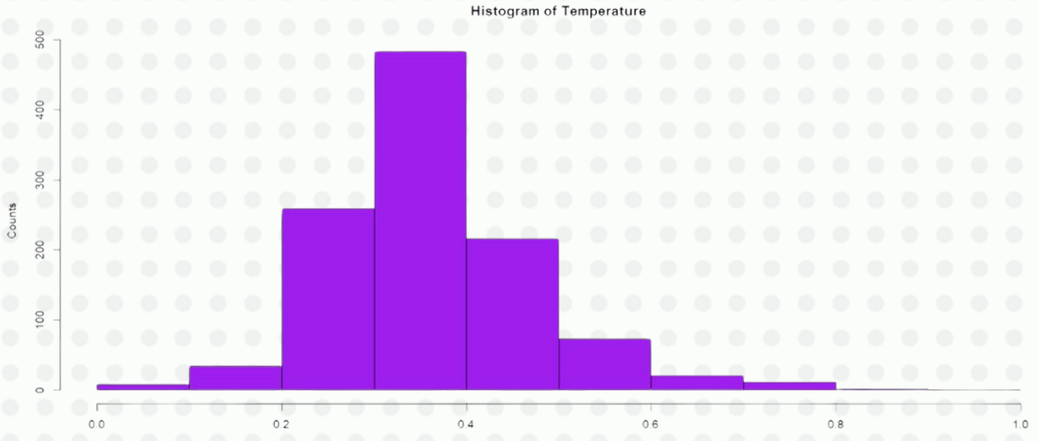


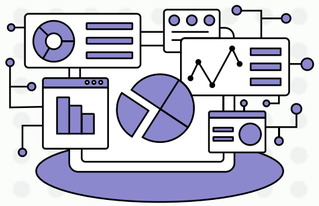
EXPLORATORY DATA ANALYSIS











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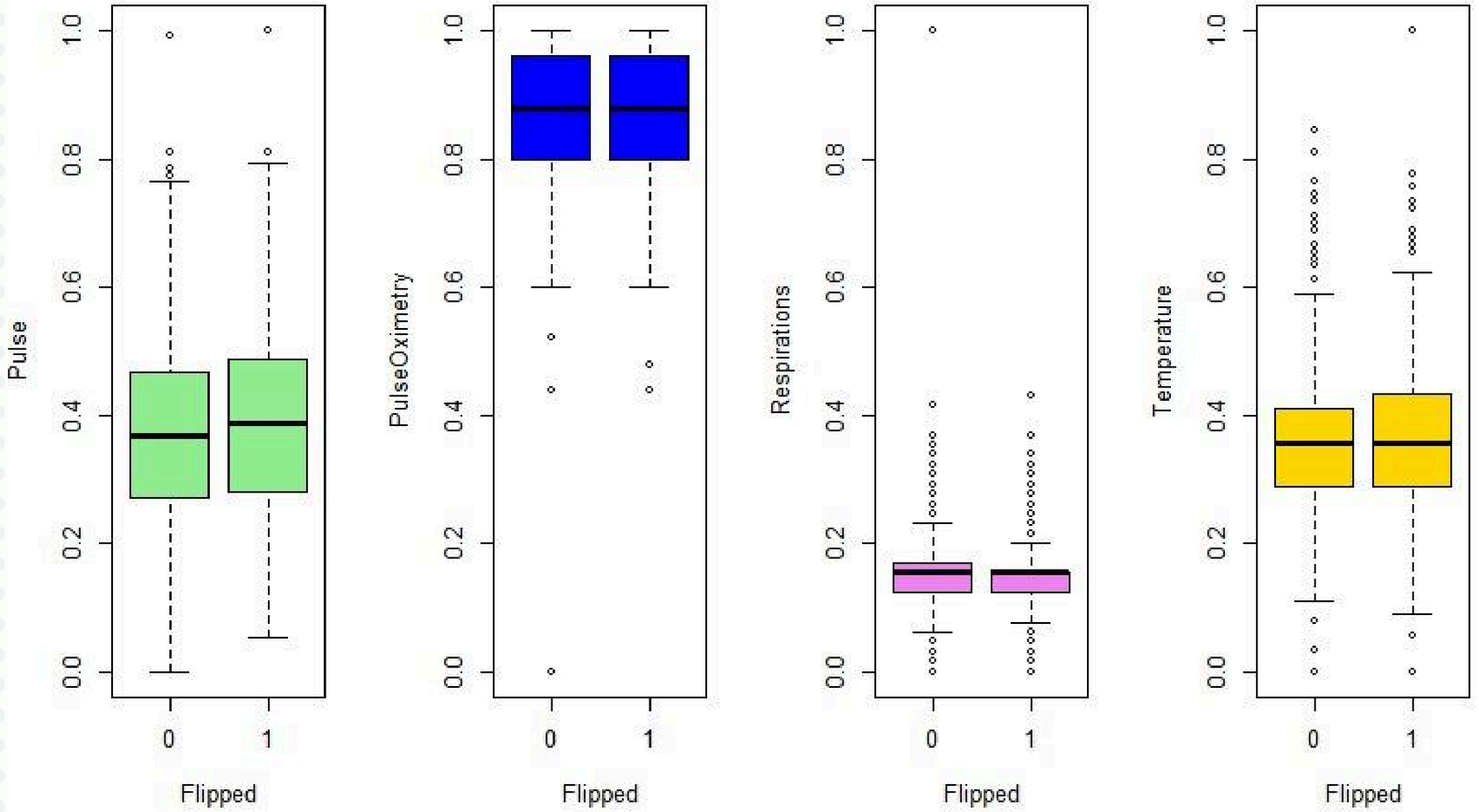

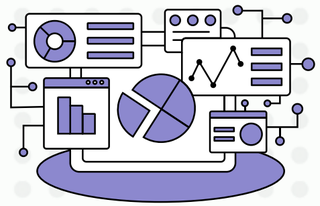

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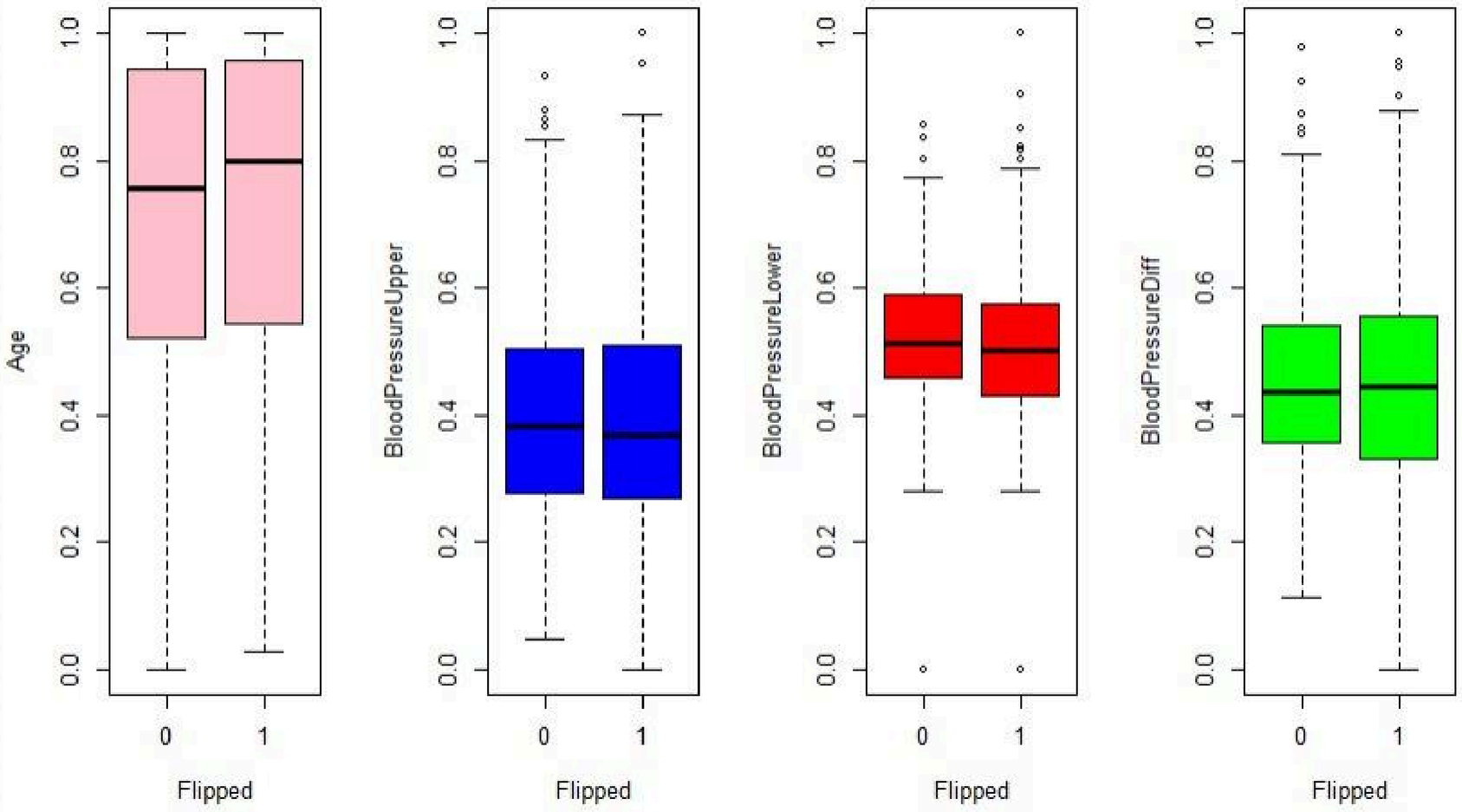


DATA PREPROCESSING

- IDENTIFICATION OF MISSING VALUES AND OUTLIERS
- REPLACING MISSING VALUES WITH MEAN OR MEDIAN
- CORRELATION BETWEEN VARIABLES TO CHECK
- MULTICOLLINEARITY
- DATA PARTITIONING INTO TRAINING AND TESTING
- DATASETS
- BALANCING THE DATASET
- NORMALIZATION OF VARIABLES

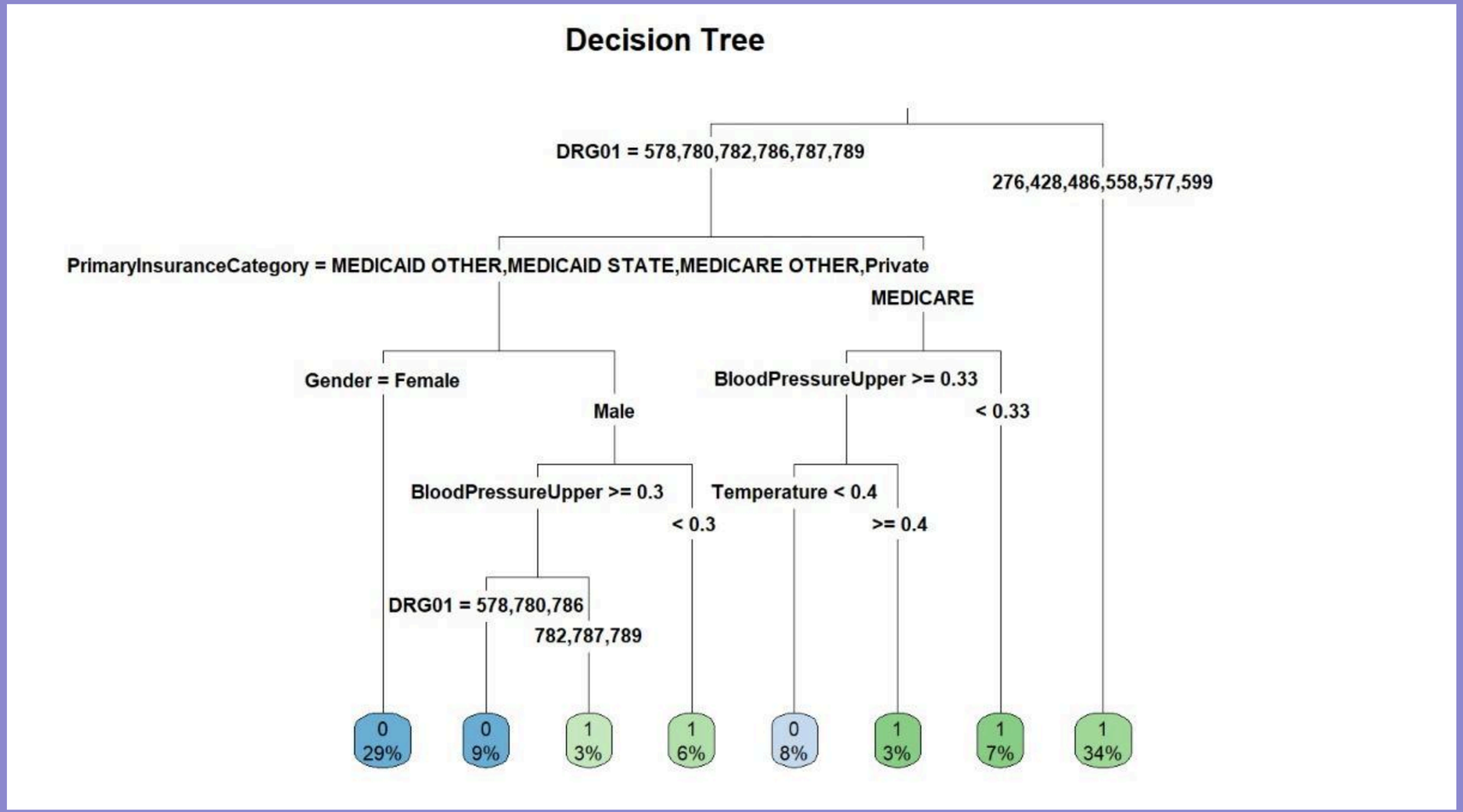
MODEL DEVELOPMENT

LOGISTIC REGRESSION

```
Call:
glm(formula = Flipped ~ ., family = "binomial", data = Train)

Coefficients:
                                          Estimate Std. Error z value Pr(>|z|)
(Intercept)                                0.76044    1.03268   0.736 0.461499
Age                                       -0.29402    0.45208  -0.650 0.515456
GenderMale                                 0.21660    0.16869   1.284 0.199143
PrimaryInsuranceCategoryMEDICAID STATE     0.11709    0.40164   0.292 0.770648
PrimaryInsuranceCategoryMEDICARE           1.45520    0.36630   3.973 7.11e-05 ***
PrimaryInsuranceCategoryMEDICARE OTHER     0.35867    0.36974   0.970 0.332021
PrimaryInsuranceCategoryPrivate            0.09653    0.35573   0.271 0.786122
DRG01428                                  -0.41436    0.45088  -0.919 0.358100
DRG01486                                  -0.17908    0.44180  -0.405 0.685221
DRG01558                                   0.85028    0.54860   1.550 0.121166
DRG01577                                   1.44247    0.82205   1.755 0.079306 .
DRG01578                                  -0.49590    0.49059  -1.011 0.312100
DRG01599                                   0.34268    0.43053   0.796 0.426053
DRG01780                                  -1.24107    0.30690  -4.044 5.26e-05 ***
DRG01782                                  -0.39177    0.67922  -0.577 0.564072
DRG01786                                  -1.25058    0.34238  -3.653 0.000260 ***
DRG01787                                  -0.93883    0.38099  -2.464 0.013733 *
DRG01789                                  -1.27593    0.36096  -3.535 0.000408 ***
BloodPressureUpper                         0.62716    0.59678   1.051 0.293306
BloodPressureLower                        -1.22885    0.98310  -1.250 0.211309
BloodPressureDiff                          0.12813    0.52998   0.242 0.808965
Pulse                                      0.05385    0.58560   0.092 0.926738
PulseOximetry                              0.07561    0.79366   0.095 0.924103
Respirations                              -1.23549    1.34320  -0.920 0.357672
Temperature                               -0.19818    0.74087  -0.268 0.789084
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 992.59  on 715  degrees of freedom
Residual deviance: 876.23  on 691  degrees of freedom
AIC: 926.23

Number of Fisher Scoring iterations: 4
```

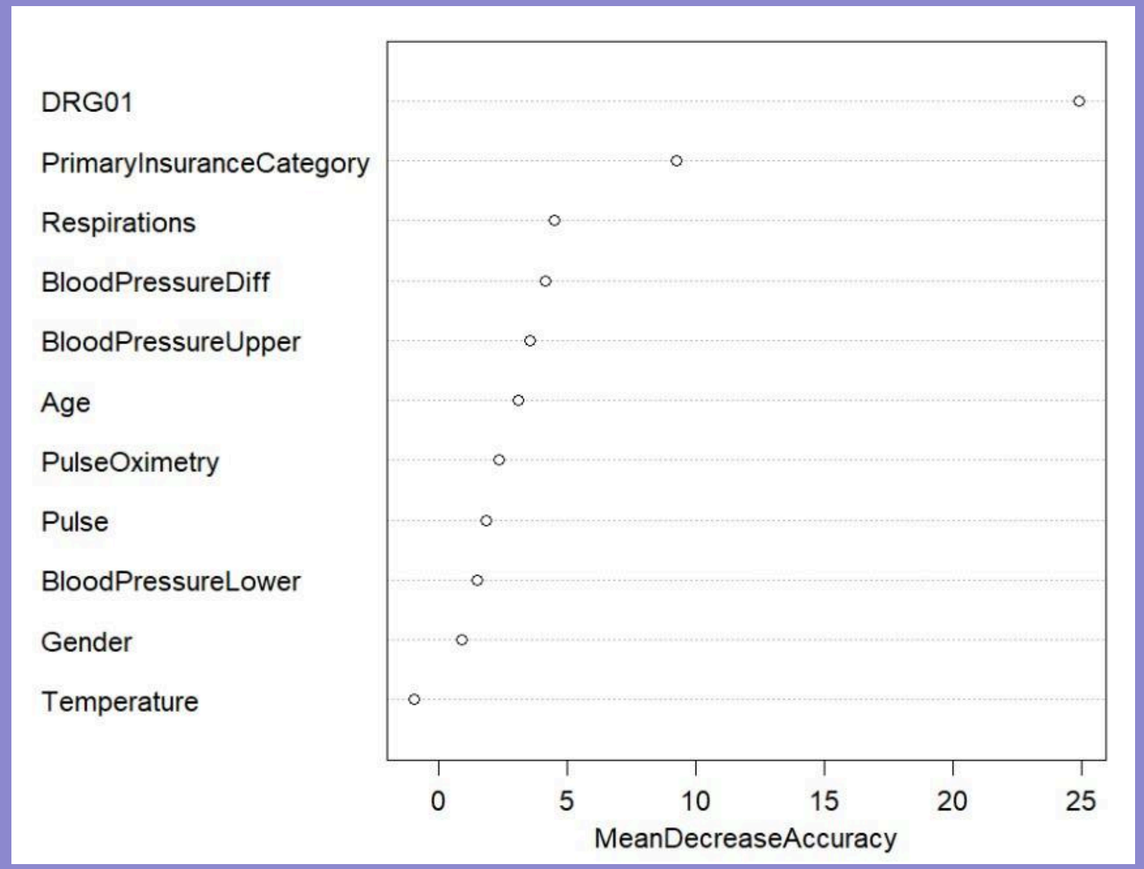
MODEL DEVELOPMENT

DECISION TREE



MODEL DEVELOPMENT

RANDOM FOREST



PREDICTIVE ANALYSIS

Model	Accuracy	Baseline	Sensitivity	Specificity	AUC
Logistic regression	0.6299	50%	0.6429	0.6169	0.643
Decision Tree	0.6104	50%	0.6558	0.5649	0.6156
Random Forest	0.6104	50%	0.6623	0.5584	0.6104

FINDINGS & RECOMMENDATIONS

- LEVERAGE PREDICTIVE MODELS TO IDENTIFY HIGH-RISK FLIPPING SCENARIOS AND CONDUCT FURTHER ANALYSIS BEFORE CONVERTING TO AN INPATIENT WARD.
- AIM TO REDUCE THE FLIPPING RATE FROM 45% TO 20% TO TREAT 570 ADDITIONAL PATIENTS ANNUALLY AND BOOST TOPLINE REVENUE.
- IMPLEMENT PROCESS IMPROVEMENTS TO INCREASE EFFICIENCY, ENHANCE JOB SATISFACTION FOR OBSERVATION UNIT (OU) STAFF, AND MINIMIZE RESOURCE MISALLOCATION.
- EXPAND THE EXCLUSION LIST TO DECREASE THE LIKELIHOOD OF FLIPPING AND ENSURE MORE EFFECTIVE PATIENT MANAGEMENT.

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