# Hospital Admission Prediction

Mid-Term Presentation
Course: BA878E1
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## Mission

To enhance emergency care by providing real-time, data-driven insights for optimized hospital admission decisions, improving resource allocation and patient outcomes.

## Vision

To seamlessly integrate machine learning in healthcare, facilitating proactive decision-making, improved patient satisfaction, and operational efficiency in emergency departments, leading towards a more responsive healthcare system.

" Harnessing data is about ensuring the right care, at the right place, at the right time for every patient."

—Chat GPT

# Introduction

- Critical decision on hospital admissions postED stay impact patient care and resource allocation
- Current Decision making can be enhanced with data driven insights.

# Table of Contents



# Data Overview

- The MIMIC-IV-ED dataset is a comprehensive collection of data related to emergency department (ED) admissions at the Beth Israel Deaconess Medical Center from 2011 to 2019.
- Dataset Composition:
    - Total ED Stays: “~425000”
    - Time Frame: “2011-2019”
- Data Categories:
    - Diagnoses: "ICD coded diagnoses for each admission."
    - ED Stays: "Details of each ED visit including admission and discharge times."
    - Medication Reconciliation: "Medication information at the time of admission."
    - Medication Administration: "Detailed medication administration records during ED stay."
    - Triage: "Vital signs and chief complaints at the time of admission."
    - Vital Signs: "Continuous monitoring of vital signs during ED stay."

Info: All data have been de-identified to comply with HIPAA Safe Harbor provisions.

02

# First Look

You can enter a subtitle
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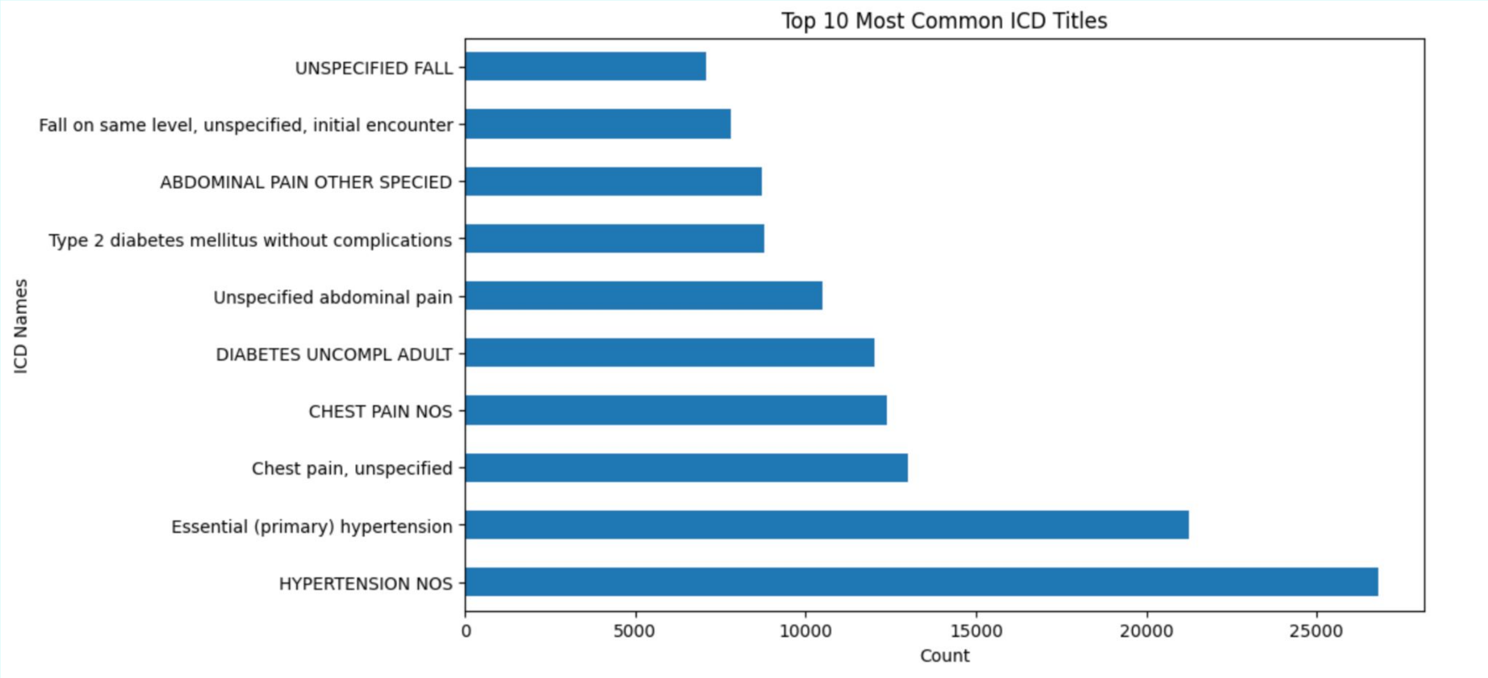
# Imputing Nulls

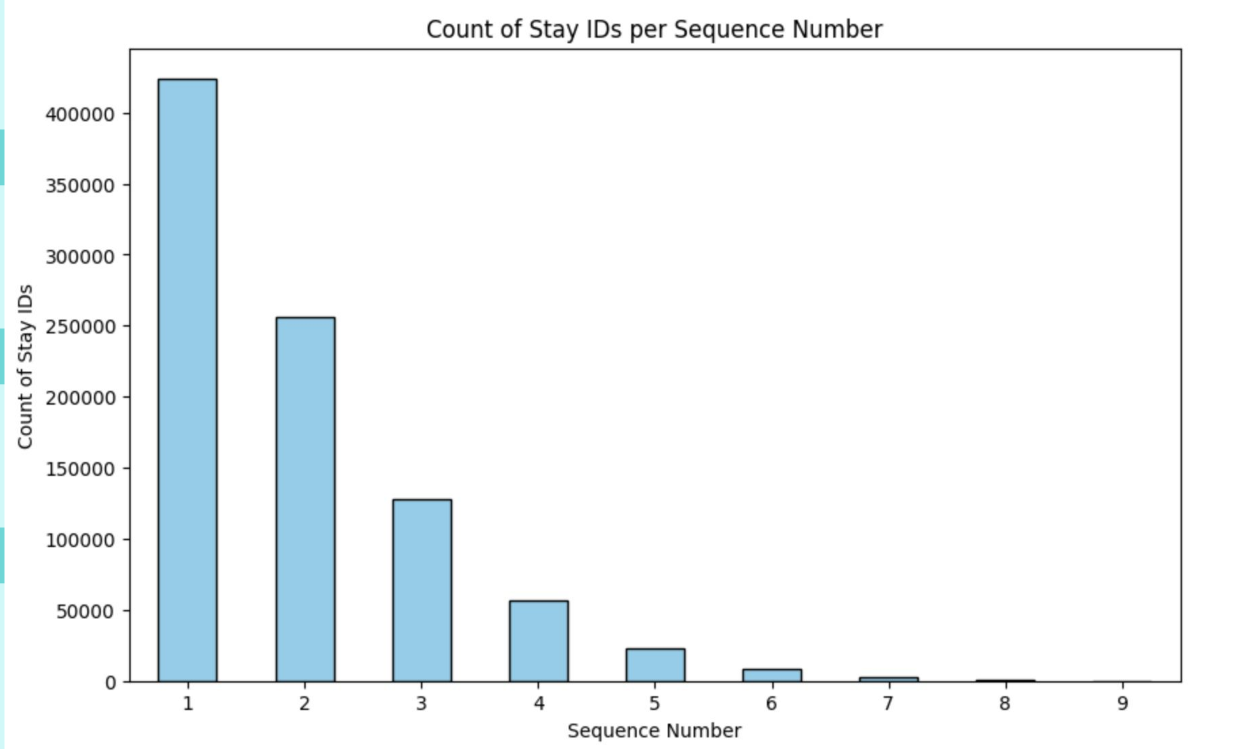
1. vitalsign_df : Imputed missing values in numerical columns with the median of the respective column.
2. triage_df: Imputed temperature, heart rate, resprate, o2sat, sbp, and dbp columns with their respective median values.

| Dataset | Missing Before Imputation | Missing After Imputation |
|---|---|---|
| Diagnosis | 0 | 0 |
| ED Stays | 222,071 | 0 |
| Med Recon | 23,456 | 0 |
| Pyxis | 35,452 | 0 |
| Triage | 121,758 | 0 |
| Vital Sign | 3,194,329 | 0 |
| **Total** | **3,597,066** | **0** |

# Top 10 most common ICD (International Classification of Diseases)



# Stay vs Treatment Order

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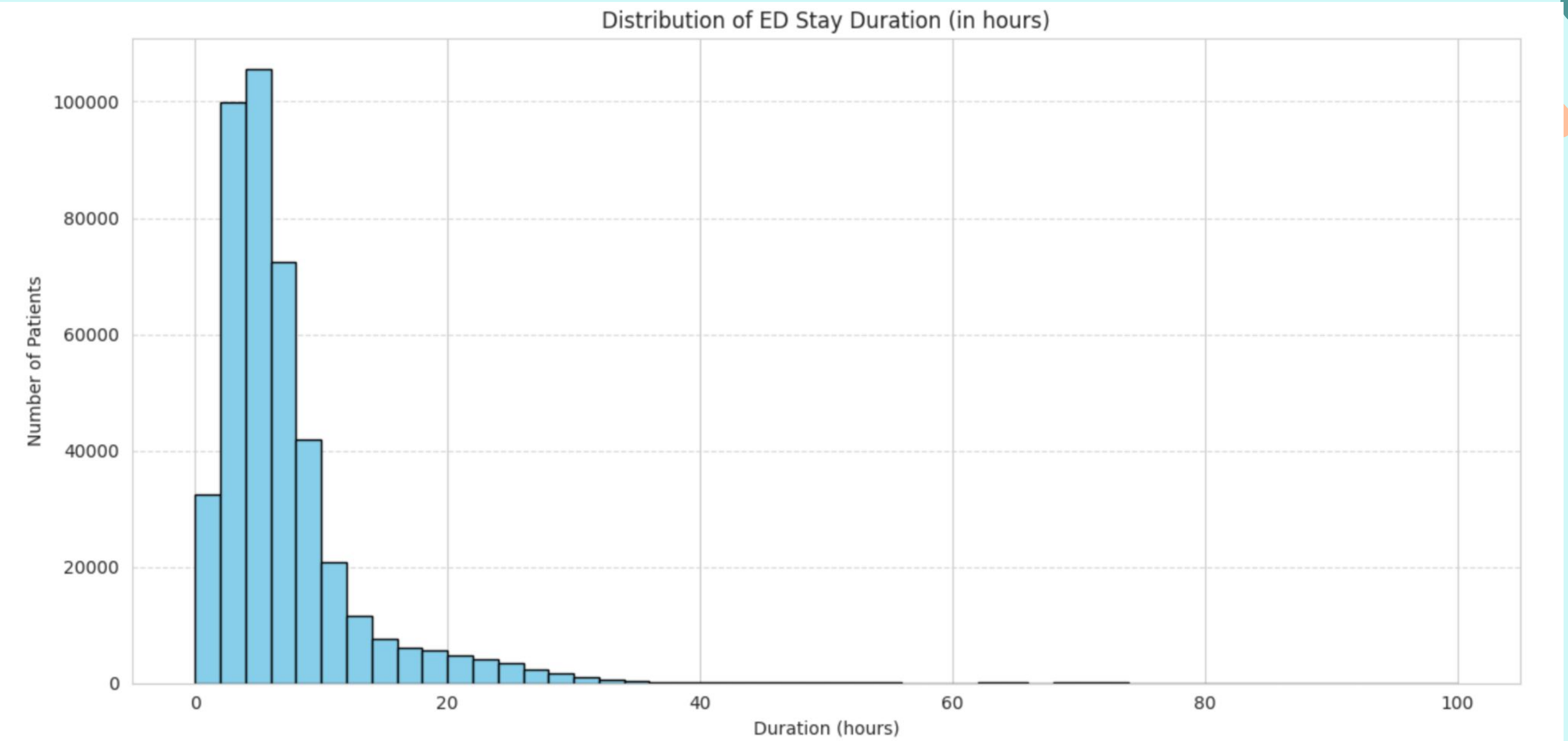
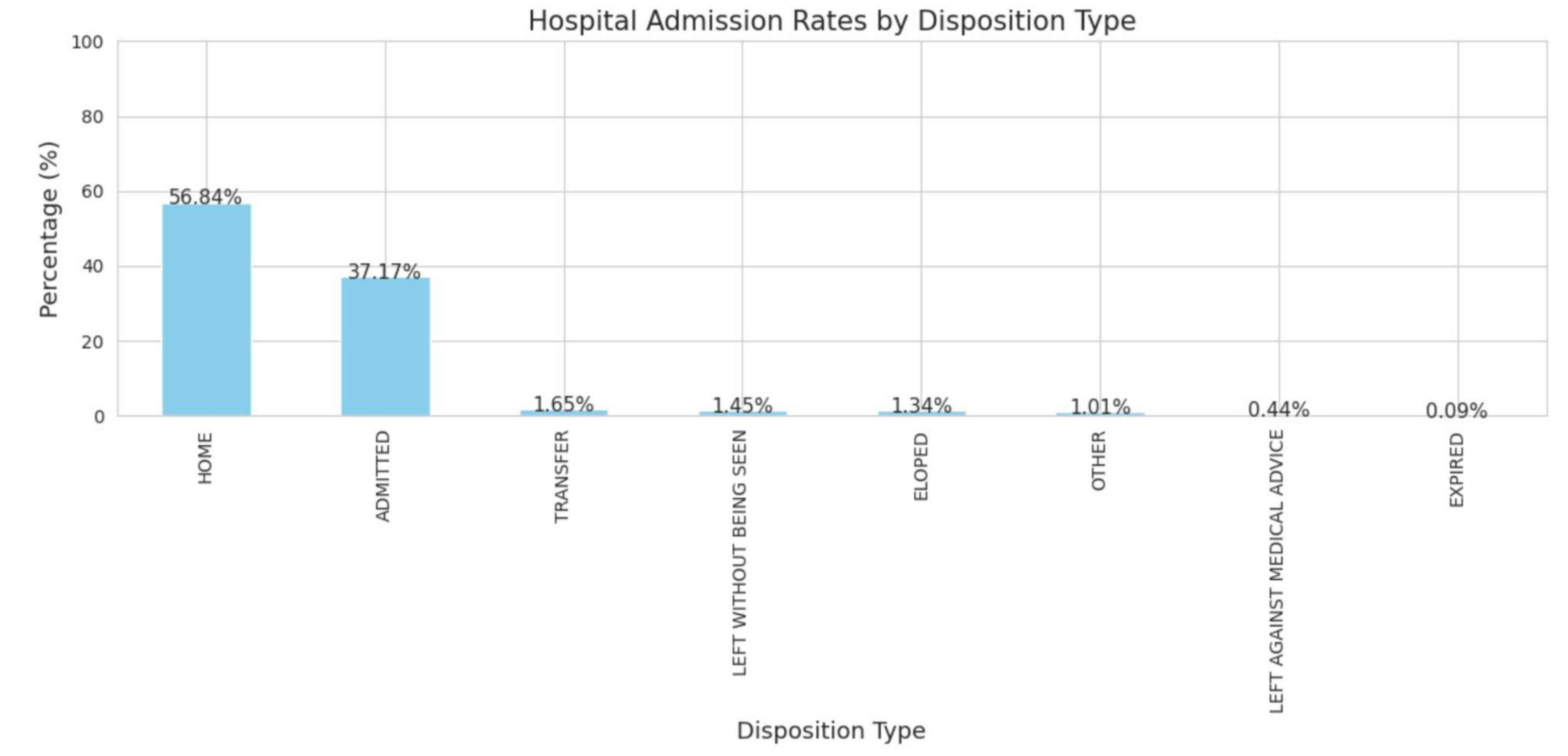
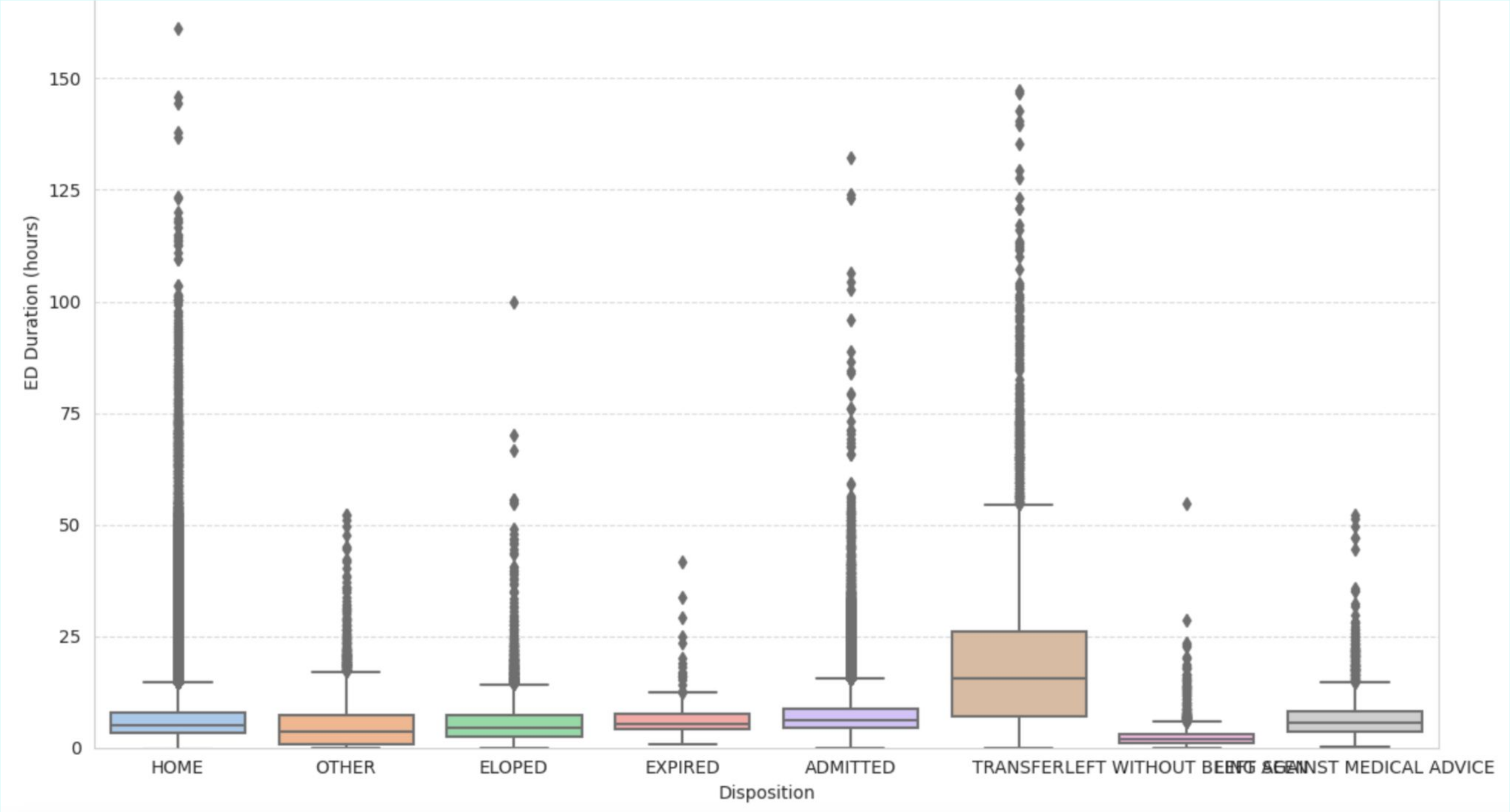
# ED Stay Duration (in hours)



# Hospital Admission Rates by Disposition Type



# ED Duration Distribution by Disposition



# Analysis Of Variance

**Interpretations:**

1. **Diagnosis Dataset**: The difference in `stay_id` across genders is not statistically significant.
2. **Triage Dataset**: There is a highly significant difference in `stay_id` across genders.
3. **Vital Sign Dataset**: The difference in `stay_id` across genders is highly significant.

# 03 Model Development:

Accuracy: 79.59%

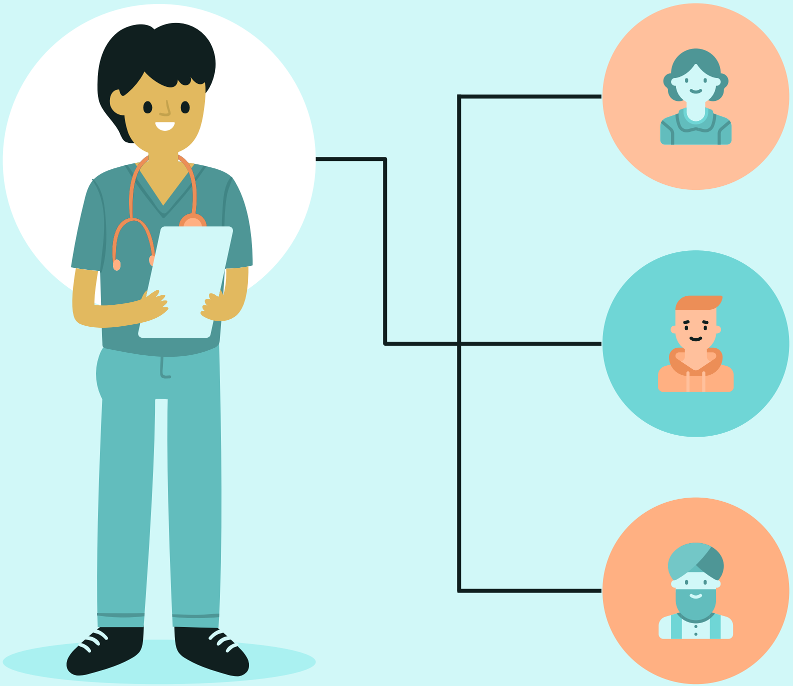
ROC-AUC: 0.76

```
Accuracy: 0.7958667576277965
ROC-AUC: 0.7606371138375659

Classification Report:
              precision    recall  f1-score   support

           0       0.80      0.90      0.85     53514
           1       0.78      0.62      0.69     31504

    accuracy                           0.80     85018
   macro avg       0.79      0.76      0.77     85018
weighted avg       0.79      0.80      0.79     85018


Confusion Matrix:
 [[47987  5527]
 [11828 19676]]
```

# Feature Importance

```
Model Coefficients:
                                                      Coefficient
icd_title_Unspecified jaundice                           4.879360
icd_title_Acute cholecystitis                            4.684009
icd_title_CHOLANGITIS                                    4.649790
icd_title_Hepatic failure, unspecified without ...       4.632882
icd_title_Cholangitis                                    4.632338
...                                                           ...
icd_title_Oth adverse food reactions, not elsew...      -4.335766
icd_title_PERSONAL HISTORY OF CONTACT WITH AND ...      -4.348800
icd_title_SPRAIN OF ANKLE NOS                           -4.485867
icd_title_SPRAIN OF NECK                                -4.736000
icd_title_OPEN WOUND OF FINGER                          -6.020055
```

# Current Recommendations, Next Steps & Potential Improvements:



Advanced Algorithms: Random Forest might potentially enhance prediction accuracy.

Class Imbalance: if there's a significant imbalance in the target classes.

Hyperparameter Tuning: Optimize model parameters to achieve better results.

Feature Engineering: Explore additional features or transformations to improve model insights.

# Questions ???

# Our Team

**Nurse**

Prateek

**Doctor**

Sam

**Medical Student**

ChatGPT

**Surgeon**

Yutao