AIDL03 Final Project - ICU EDA with MIMIC-IV

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STEP 1: SETUP & IMPORTS

Importing the core libraries used throughout the analysis

pandas: For data manipulation and analysis

numpy: For numerical computations

matplotlib & seaborn: For creating plots and visualizations

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

# Set pandas and seaborn display options for cleaner outputs
pd.set_option('display.max_columns', 100)
sns.set(style="whitegrid")
```

Double-click (or enter) to edit

```
from google.colab import drive
drive.mount('/content/drive')

data_path = '/content/drive/MyDrive/AIDL MASTER/AIDL_03/AIDL03 NICOLAOU/'
```

```
Mounted at /content/drive
```

STEP 3: READ DATASET FILES

```
# Define a helper function to load CSVs efficiently
# We load only the first 100,000 rows to avoid memory overload, since some files are multiple GBs in size

def read_csv_efficient(path, usecols=None, nrows=100000):
    """
    Reads a large CSV file using pandas with optional row and column filters.
    Parameters:
        path (str): Full path to the CSV file
        usecols (list): Specific columns to load
        nrows (int): Number of rows to load (default: 100,000)
    Returns:
        DataFrame
    """
    return pd.read_csv(path, usecols=usecols, nrows=nrows)

# Load core MIMIC-IV tables for this analysis
patients = read_csv_efficient(data_path + 'patients.csv')
admissions = read_csv_efficient(data_path + 'admissions.csv')
icustays = read_csv_efficient(data_path + 'icustays.csv')
diagnoses = read_csv_efficient(data_path + 'diagnoses_icd.csv')
diag_lookup = read_csv_efficient(data_path + 'd_icd_diagnoses.csv')
prescriptions = read_csv_efficient(data_path + 'prescriptions.csv')
drgcodes = read_csv_efficient(data_path + 'drgcodes.csv')
```

```
/tmp/ipython-input-3-12010803.py:14: DtypeWarning: Columns (11) have mixed types. Specify dtype option on import or set low_memory=F
  return pd.read_csv(path, usecols=usecols, nrows=nrows)
```

STEP 4: MERGE TABLES

```
# Merge patient demographics, hospital admissions, ICU stays, diagnoses and descriptions
# Rationale: this combined view enables analysis on diagnoses and outcomes

# Merge patients with admissions
```

```
df1 = pd.merge(admissions, patients, on='subject_id', how='left')

# Add ICU stay data
df2 = pd.merge(df1, icustays, on=['subject_id', 'hadm_id'], how='left')

# Add diagnosis codes per admission
df3 = pd.merge(df2, diagnoses, on=['subject_id', 'hadm_id'], how='left')

# Add ICD descriptions
df_final = pd.merge(df3, diag_lookup, on='icd_code', how='left')
```

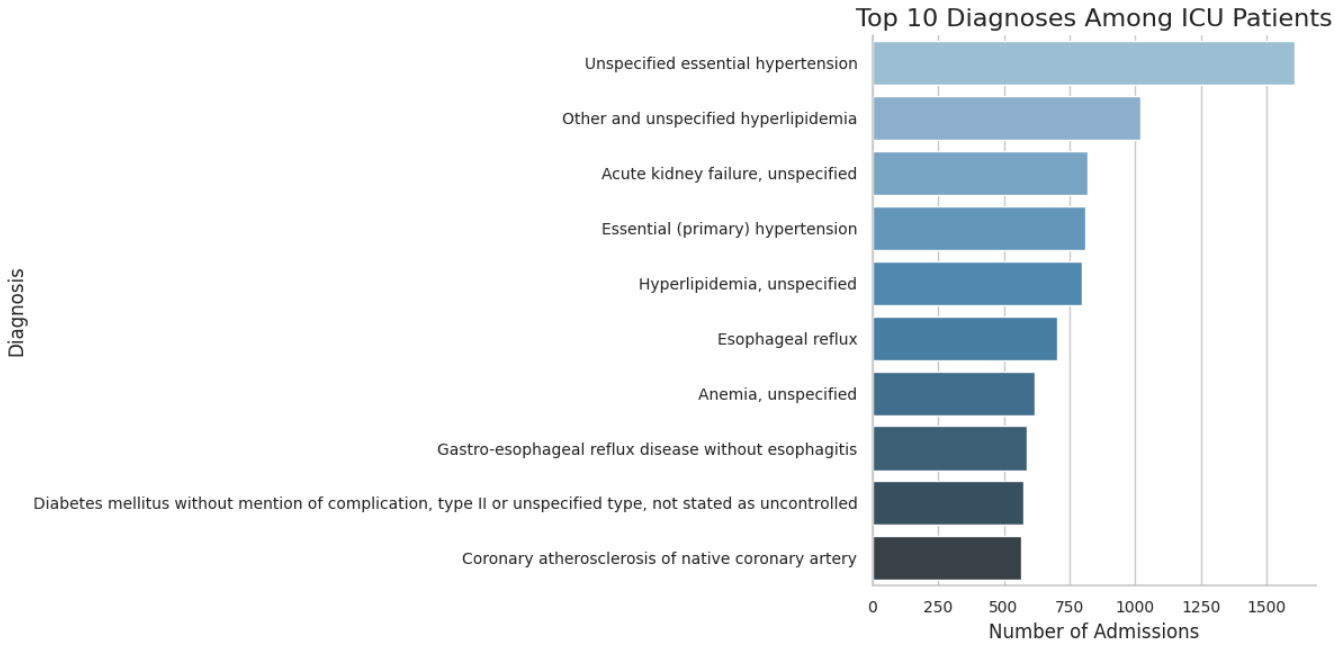
STEP 5: CLEANING & FEATURE ENGINEERING

```
# Drop any rows that don't have essential fields
# Reason: rows without these fields cannot be used for analysis or joins

# Copy for safe editing
df_cleaned = df_final.dropna(subset=['subject_id', 'hadm_id', 'icd_code', 'long_title']).copy()

# Convert timestamps and calculate Length of Stay (LOS)
df_cleaned['admittime'] = pd.to_datetime(df_cleaned['admittime'], errors='coerce')
df_cleaned['dischtime'] = pd.to_datetime(df_cleaned['dischtime'], errors='coerce')
df_cleaned = df_cleaned.dropna(subset=['admittime', 'dischtime'])
df_cleaned['length_of_stay'] = (df_cleaned['dischtime'] - df_cleaned['admittime']).dt.days
```

STEP 6: Q1 - Top Diagnoses

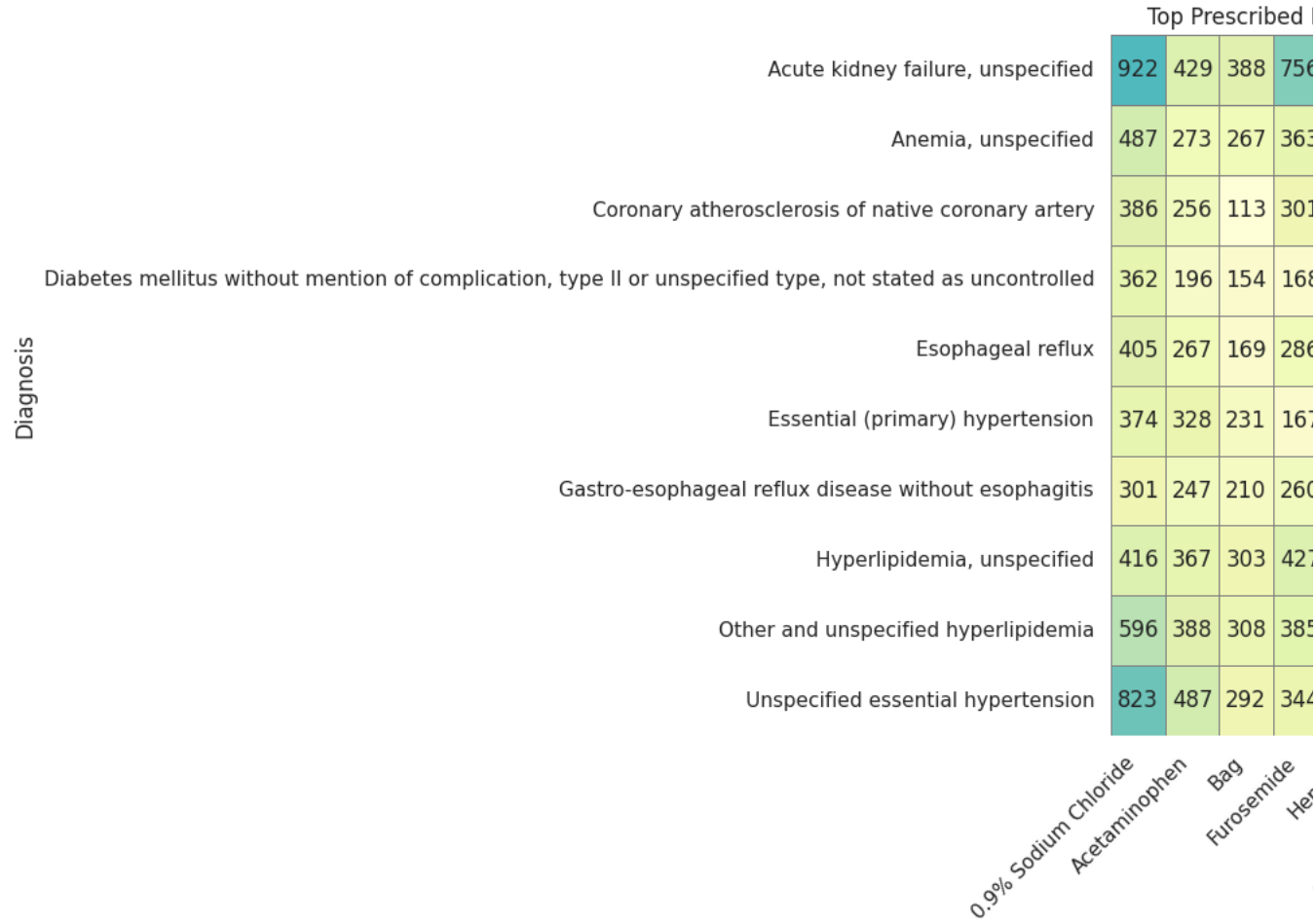
```
# Get top 10 most frequent diagnoses
top_diagnoses = df_cleaned['long_title'].value_counts().head(10)

# Plot
plt.figure(figsize=(12, 6))
sns.barplot(
    y=top_diagnoses.index,
    x=top_diagnoses.values,
    palette='Blues_d'
)

# Title and axis formatting
plt.title("Top 10 Diagnoses Among ICU Patients", fontsize=16)
plt.xlabel("Number of Admissions", fontsize=12)
plt.ylabel("Diagnosis", fontsize=12)
plt.xticks(fontsize=10)
plt.yticks(fontsize=10)

# Remove spines and tighten layout
sns.despine()
plt.tight_layout()
plt.show()
'''I used AI to apply the "Blues_d" color palette to this plot.
I asked ChatGPT the following:
"Can you give me 4 ideas on how to make this plot look better and more readable"
Also i have trouble with the text the one letter is on the other how can i fix that? '''
```

```
/tmp/ipython-input-7-579324920.py:6: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `y` variable to `hue` and set `le

  sns.barplot(
```



STEP 7: Q2 - Prescription Patterns

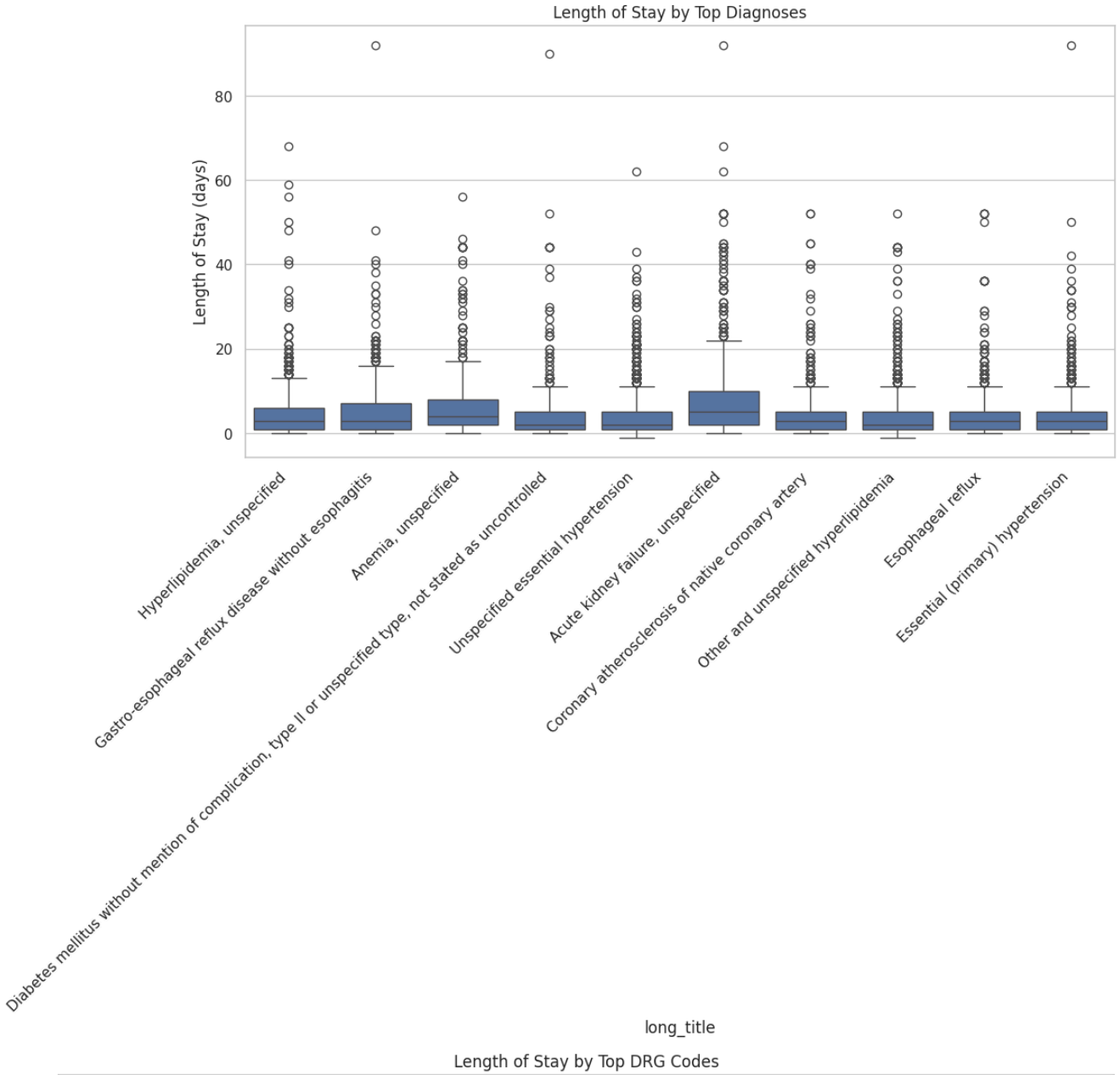
```
# Merge with prescription data to analyze medications
prescriptions = prescriptions.dropna(subset=['hadm_id', 'drug'])
df_presc = pd.merge(df_cleaned, prescriptions, on='hadm_id', how='inner')

# Filter to top diagnoses
top_diag_names = df_cleaned['long_title'].value_counts().head(10).index.tolist()
df_presc_top = df_presc[df_presc['long_title'].isin(top_diag_names)]

# Count drugs per diagnosis
drug_counts = df_presc_top.groupby(['long_title', 'drug']).size().reset_index(name='count')
top_drugs = drug_counts.groupby('drug')['count'].sum().sort_values(ascending=False).head(10).index.tolist()
drug_counts_top = drug_counts[drug_counts['drug'].isin(top_drugs)]

# Pivot for heatmap
heatmap_data = drug_counts_top.pivot(index='long_title', columns='drug', values='count').fillna(0)

plt.figure(figsize=(14, 8))
sns.heatmap(heatmap_data, annot=True, fmt='.0f', cmap='YlGnBu', linewidths=0.5, linecolor='gray', cbar_kws={'label': 'Prescription Count'
plt.title("Top Prescribed Drugs Across Top Diagnoses")
plt.xlabel("Drug")
plt.ylabel("Diagnosis")
plt.xticks(rotation=45, ha='right')
plt.tight_layout()
plt.show()

'''I used AI just to help with some visual aspects of the plot like picking a suitable color palette ("YlGnBu") and tweaking things like
the figure size and text alignment to make it more readable. All of the data processing, merging, and analysis were done by me.'''
```

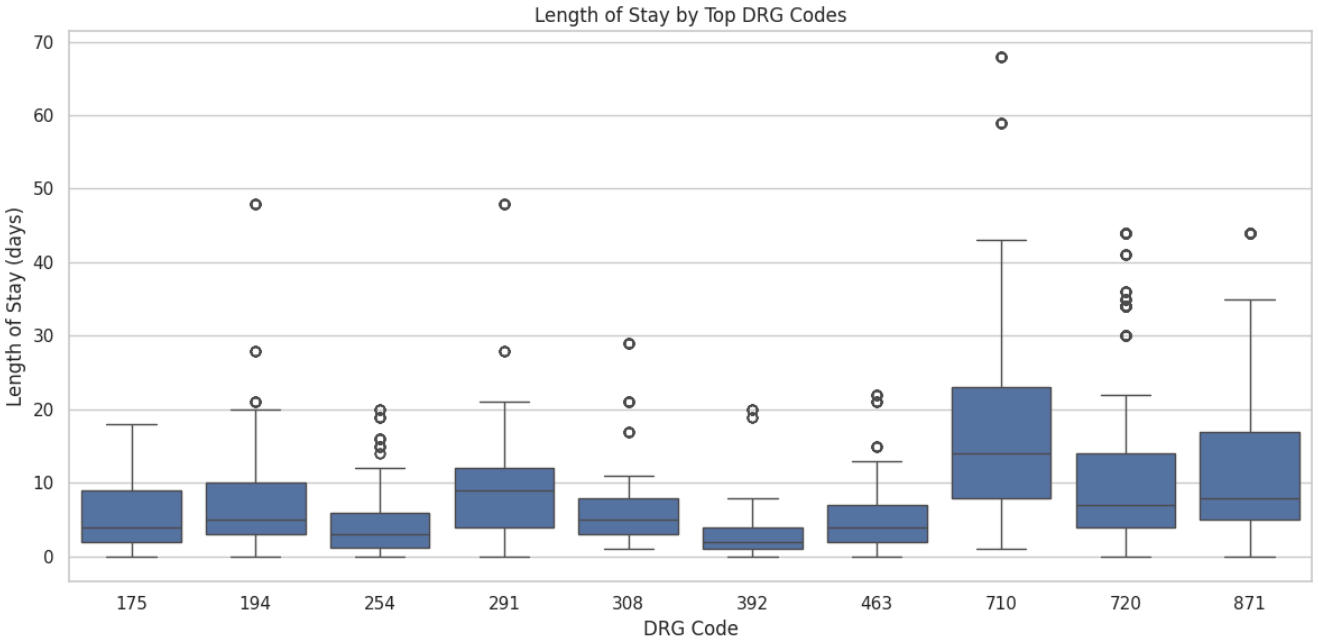


STEP 8: Q3 - LOS by Diagnosis and DRG

```
# Boxplot: LOS by Diagnosis
df_top_los = df_cleaned[df_cleaned['long_title'].isin(top_diag_names)]
plt.figure(figsize=(12,6))
sns.boxplot(data=df_top_los, x='long_title', y='length_of_stay')
plt.title("Length of Stay by Top Diagnoses")
plt.ylabel("Length of Stay (days)")
plt.xticks(rotation=45, ha='right')
plt.tight_layout()
plt.show()

# Boxplot: LOS by DRG
df_drg = pd.merge(df_cleaned, drgcodes[['subject_id', 'hadm_id', 'drg_code']], on=['subject_id', 'hadm_id'], how='inner')
top_drg = df_drg['drg_code'].value_counts().head(10).index.tolist()
df_drg_top = df_drg[df_drg['drg_code'].isin(top_drg)]

plt.figure(figsize=(12, 6))
sns.boxplot(data=df_drg_top, x='drg_code', y='length_of_stay')
plt.title("Length of Stay by Top DRG Codes")
plt.xlabel("DRG Code")
plt.ylabel("Length of Stay (days)")
plt.tight_layout()
plt.show()
```

```
/tmp/ipython-input-17-38026946.py:8: UserWarning: Tight layout not applied. The bottom and top margins cannot be made large enough
  plt.tight_layout()
```





STEP 9: Statistical Summary

```
# LOS stats by Diagnosis
los_by_diag = df_top_los.groupby('long_title')['length_of_stay'].agg(['count', 'mean', 'median', 'std']).sort_values(by='count', ascend:
display(los_by_diag)

# LOS stats by DRG
los_by_drg = df_drg_top.groupby('drg_code')['length_of_stay'].agg(['count', 'mean', 'median', 'std']).sort_values(by='count', ascending=
display(los_by_drg)
```

long_title	count	mean	median	std
Unspecified essential hypertension	1606	3.689290	2.0	5.084945
Other and unspecified hyperlipidemia	1019	4.043180	2.0	5.668832
Acute kidney failure, unspecified	818	8.212714	5.0	9.776761
Essential (primary) hypertension	809	4.332509	3.0	6.465977
Hyperlipidemia, unspecified	796	5.183417	3.0	6.785410
Esophageal reflux	703	4.322902	3.0	6.167614
Anemia, unspecified	618	6.030744	4.0	7.576345
Gastro-esophageal reflux disease without esophagitis	586	5.537543	3.0	7.398045
Diabetes mellitus without mention of complication, type II or unspecified type, not stated as uncontrolled	575	4.088696	2.0	7.201732
Coronary atherosclerosis of native coronary artery	564	4.725177	3.0	6.795464

drg_code	count	mean	median	std
720	2478	11.545601	7.0	11.797517
194	2069	6.903335	5.0	6.981000
871	2006	12.297607	8.0	11.995205
710	1167	17.537275	14.0	14.954423
291	1071	9.514472	9.0	8.272549
463	1003	5.037886	4.0	4.635901
392	1001	2.903097	2.0	2.964726
308	915	6.653552	5.0	6.135342
254	914	4.563457	3.0	4.661701
175	892	5.364350	4.0	4.626400