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Week 11 Deliverables

Group Name: The Data Doctors

16-Dec-2023

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Problem Description

One challenge for all Pharmaceutical companies is to understand the persistence of a drug as per the physician's prescription. To solve this problem ABC Pharma company approached an analytics company to automate this process of identification.

Data Description

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Data Understanding

- The dataset provides the factors impacting the patient’s persistence to New Therapy Medication (NTM) by ABC pharmaceutical company prescribed by various physicians.

- The aim is to build a machine-learning model that classifies the patient into **Persistent** (Compliant) and **Non-persistent** (Non-Compliant).

- The dataset consists of 3242 records and is a an imbalanced dataset due to low number of **Persistent** records as compared to **Non-persistent**.

Data Understanding

- The dataset contains a total of 69 features that are divided into multiple categories -
    - 1 Target variable: Persistency_Flag
    - 1 Unique identifier for each patient: Ptid
    - 6 Demographic variables of the each patient: Age_Bucket, Gender, Race, Ethnicity, Region, Idn_Indicator
    - 3 Physician Specialist attributes: Ntm_Speciality, Ntm_Specialist_Flag, Ntm_Specialist_Bucket
    - 13 Clinical factors: T-Score details, Risk_Segment details, Multiple risk factors count, DEXA details, Fragility fracture details, Glucocorticoid details
    - 45 Disease/Treatment factors: Injectable drugs, Risk factors, Comorbidities, Concomitancies, Adherence to therapy

Data Analysis

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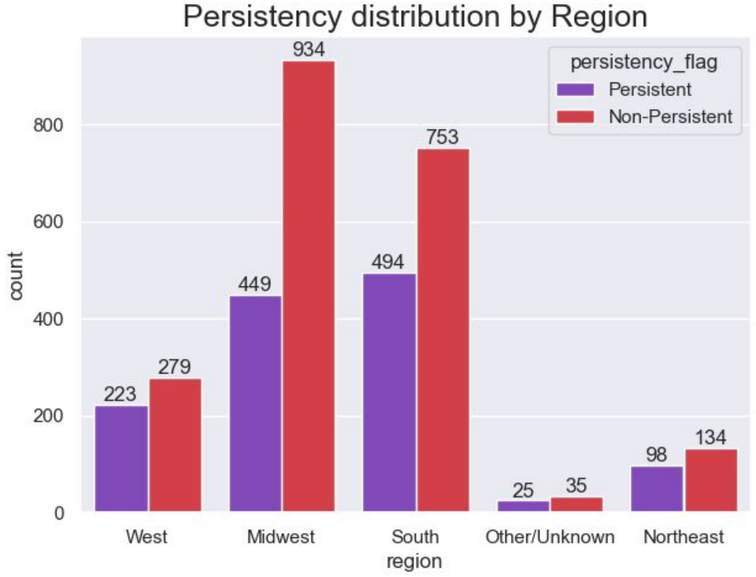
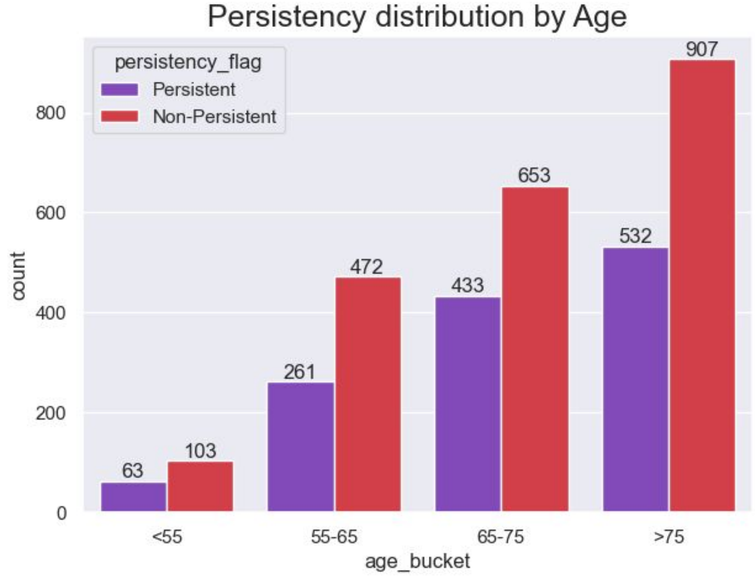
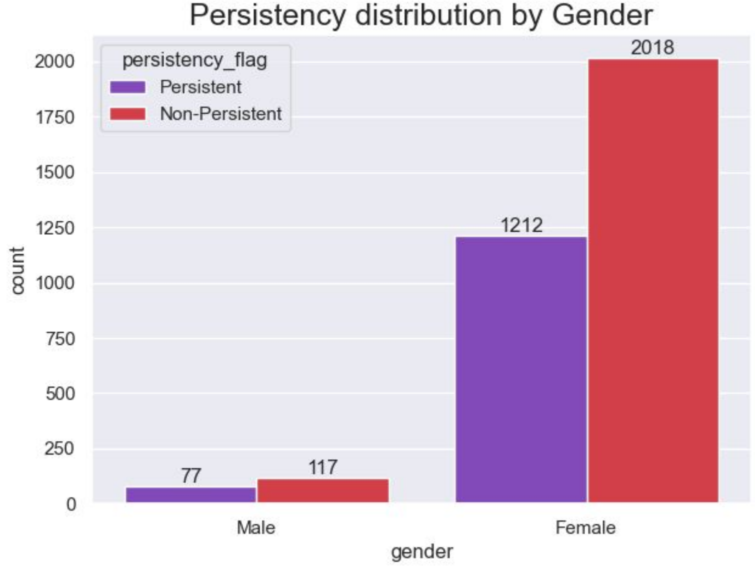
Demographic Data

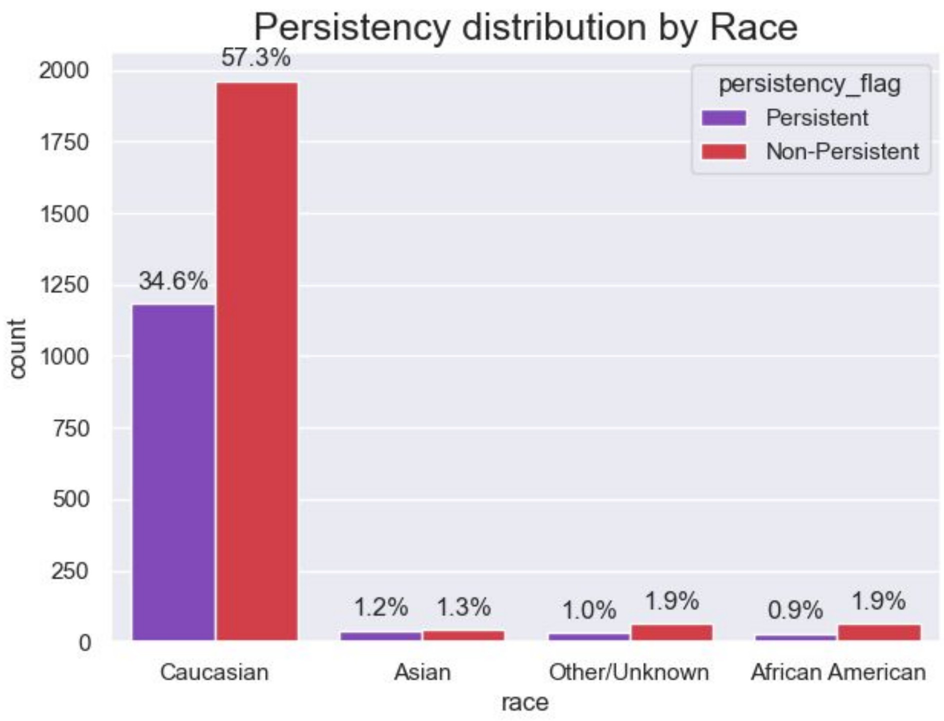

Persistency distribution by Region

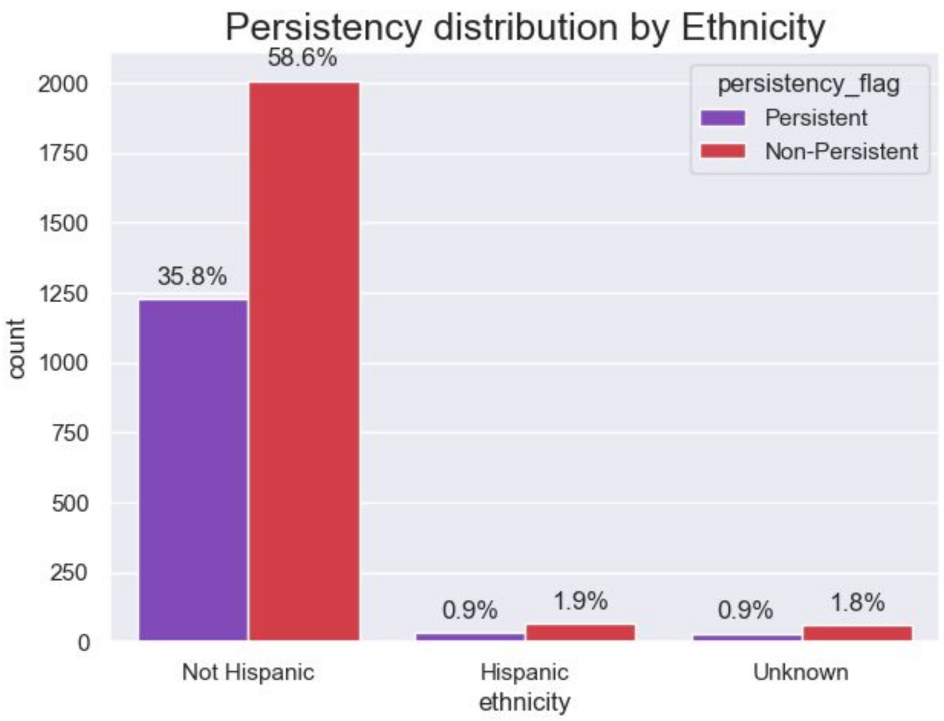

Persistency distribution by Age


Persistency distribution by Gender

- Majority of the patients recorded are **Females** and most of them are **Non-Persistent** to NTM therapies.
- We can observe that majority of the patients are aged above *55 years* and majority **Non-Persistent** patients fall in the age group of more than *75 years* of age.
- *Midwest*, *South*, and *West* regions display majority of the patients recorded.

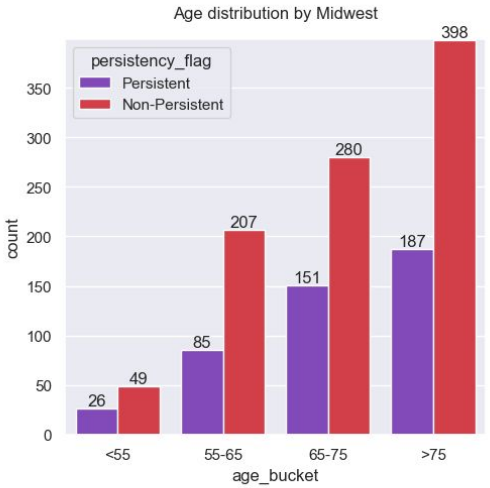
Demographic Data

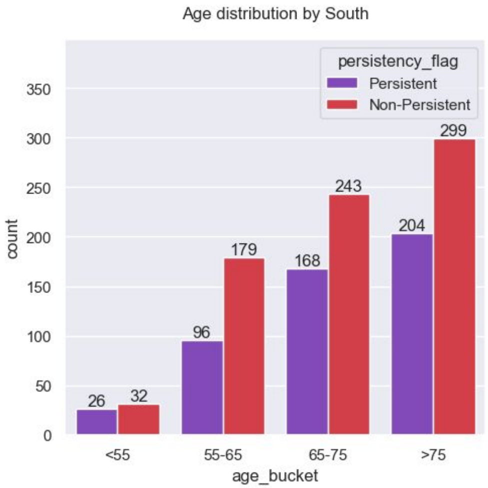


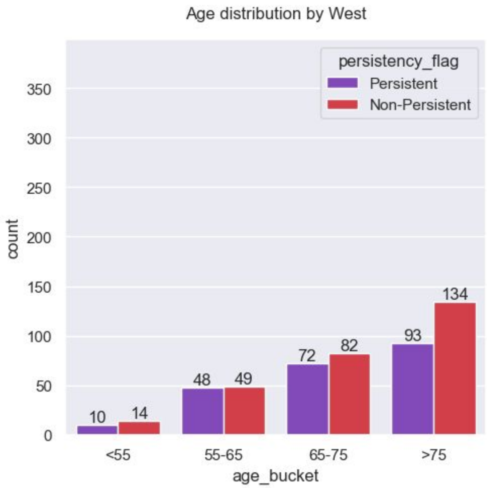


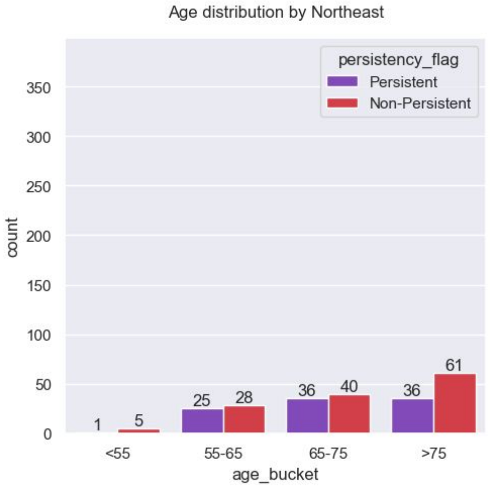
- We can see that majority of the patients are **Caucasian** and **Non-Hispanic**.

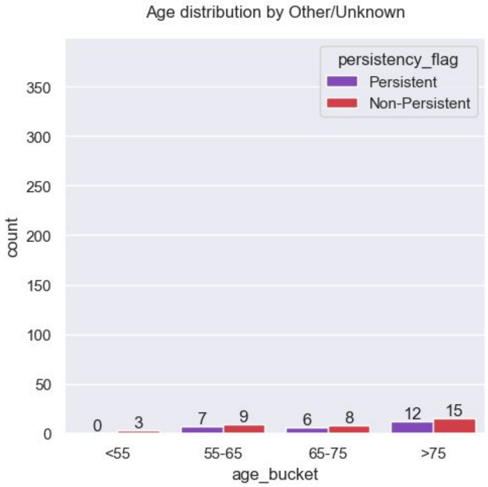
Demographic Data


Age distribution by Midwest


Age distribution by South


Age distribution by West

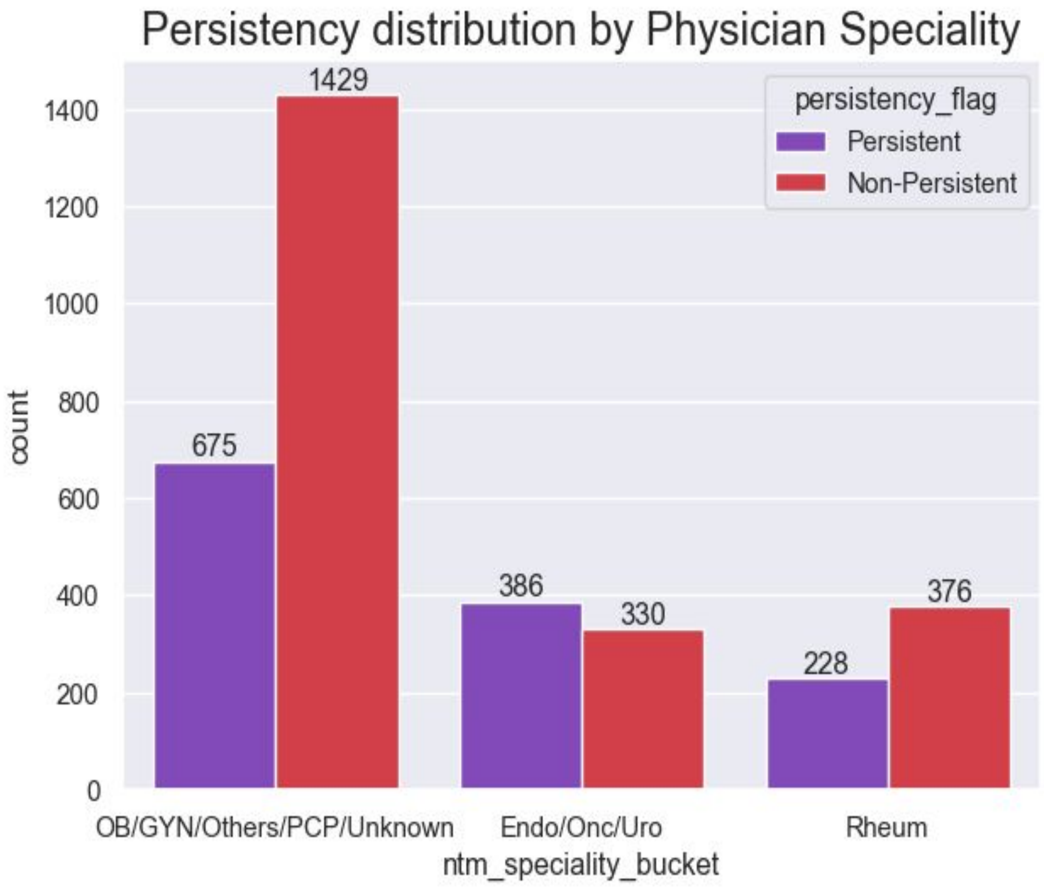

Age distribution by Northeast

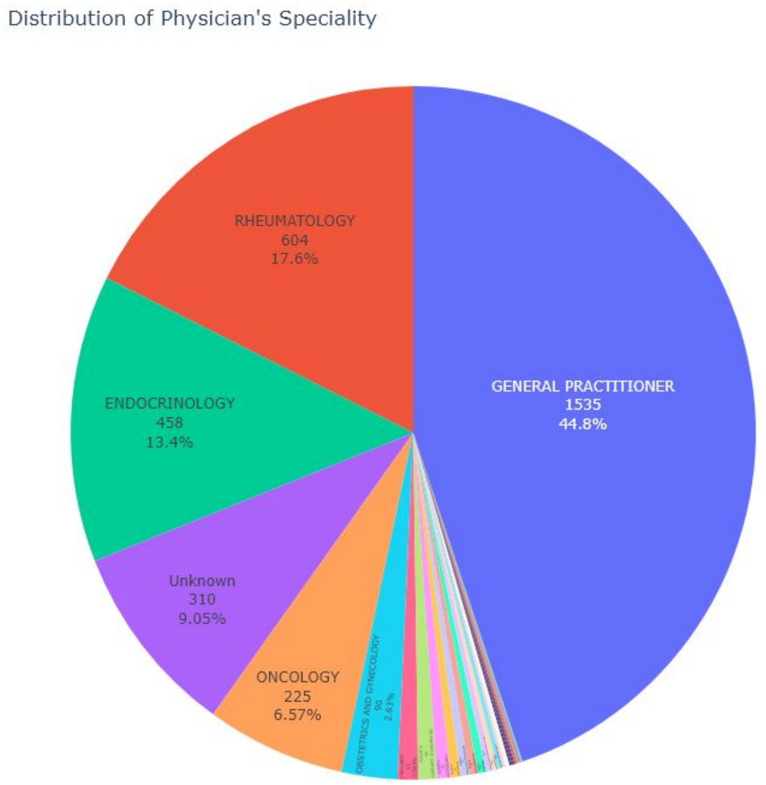

Age distribution by Other/Unknown

- Majority of **Non-Persistent** patients belong to the age group above *75 years* in the **Midwest** region.

Physician Attributes

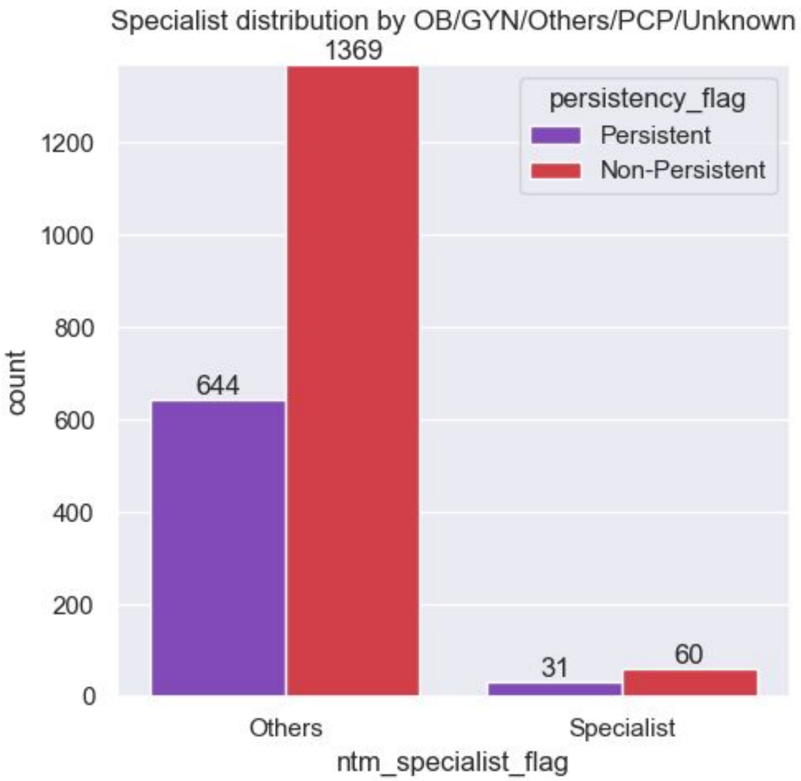
- Around **45%** of Physicians who have prescribed new medication to the patients are *'General Practitioners'*.



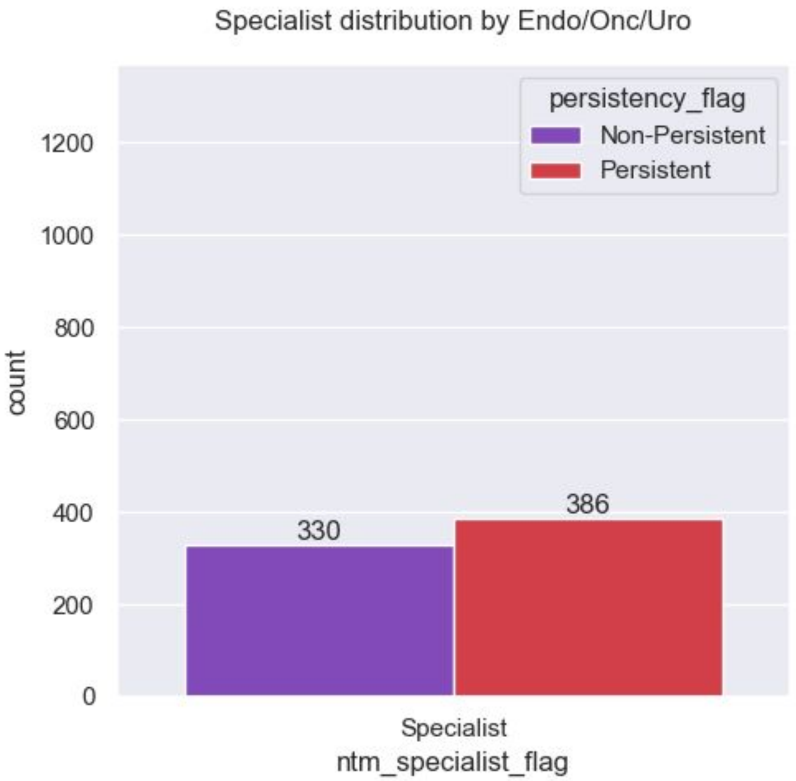


Physician Attributes

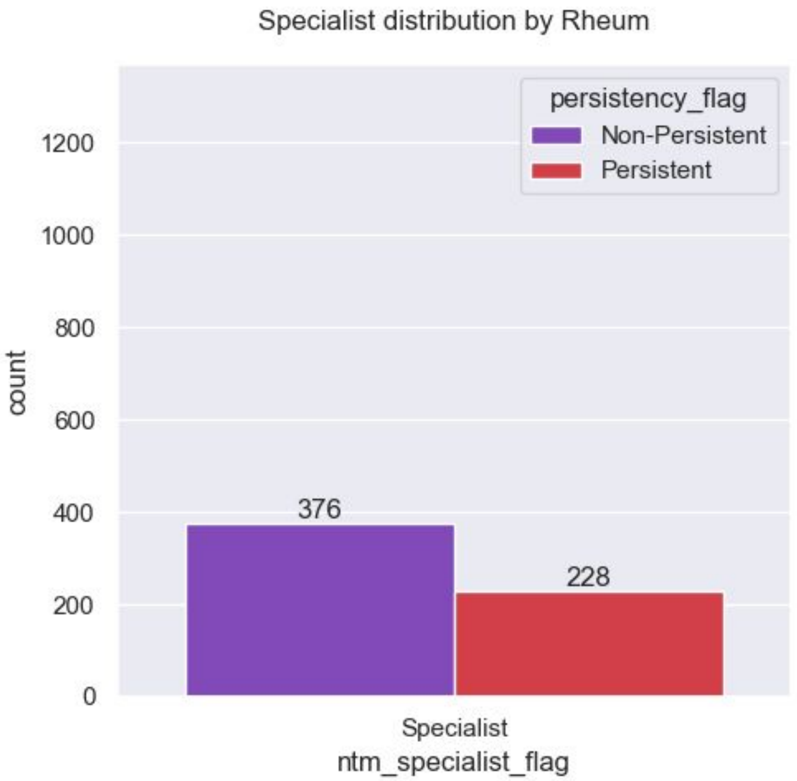
- Majority of the **Non-Persistent** patients have been prescribed the new medication by Physicians who are not *Specialists*.



Specialist distribution by OB/GYN/Others/PCP/Unknown



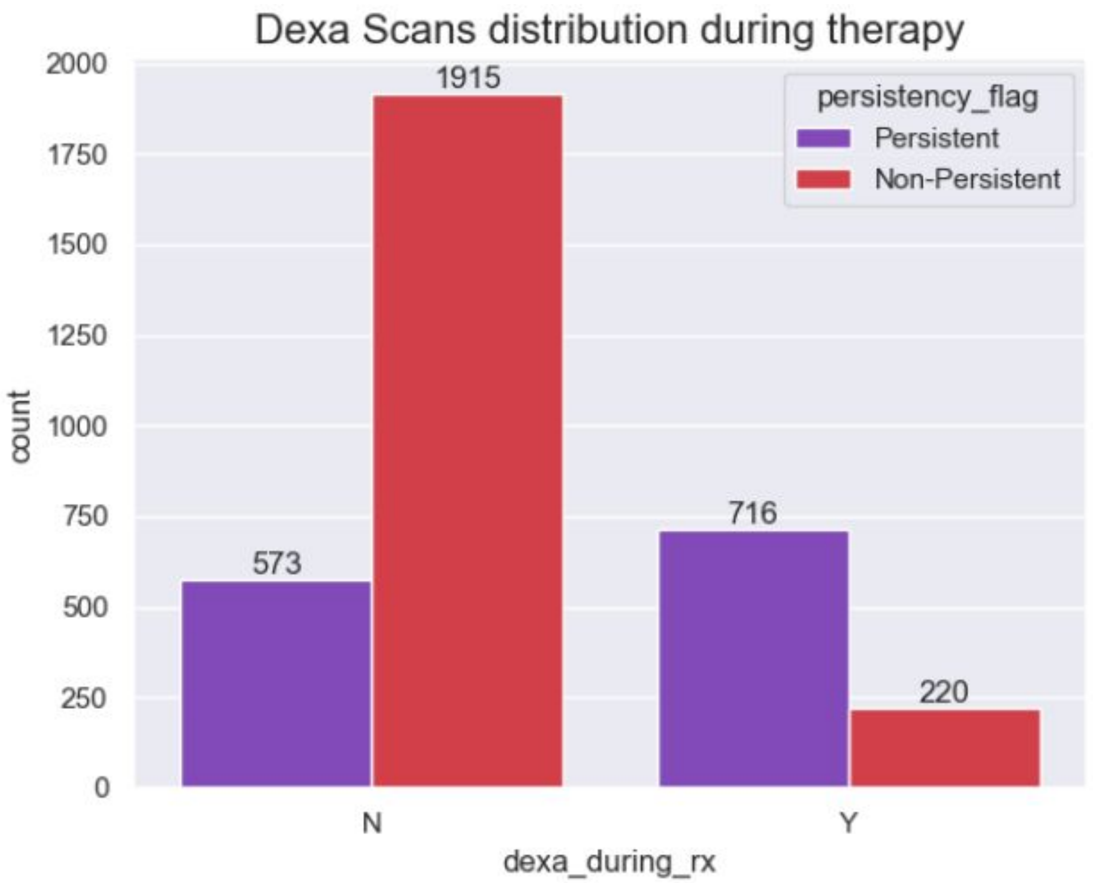
Specialist distribution by Endo/Onc/Uro



Specialist distribution by Rheum

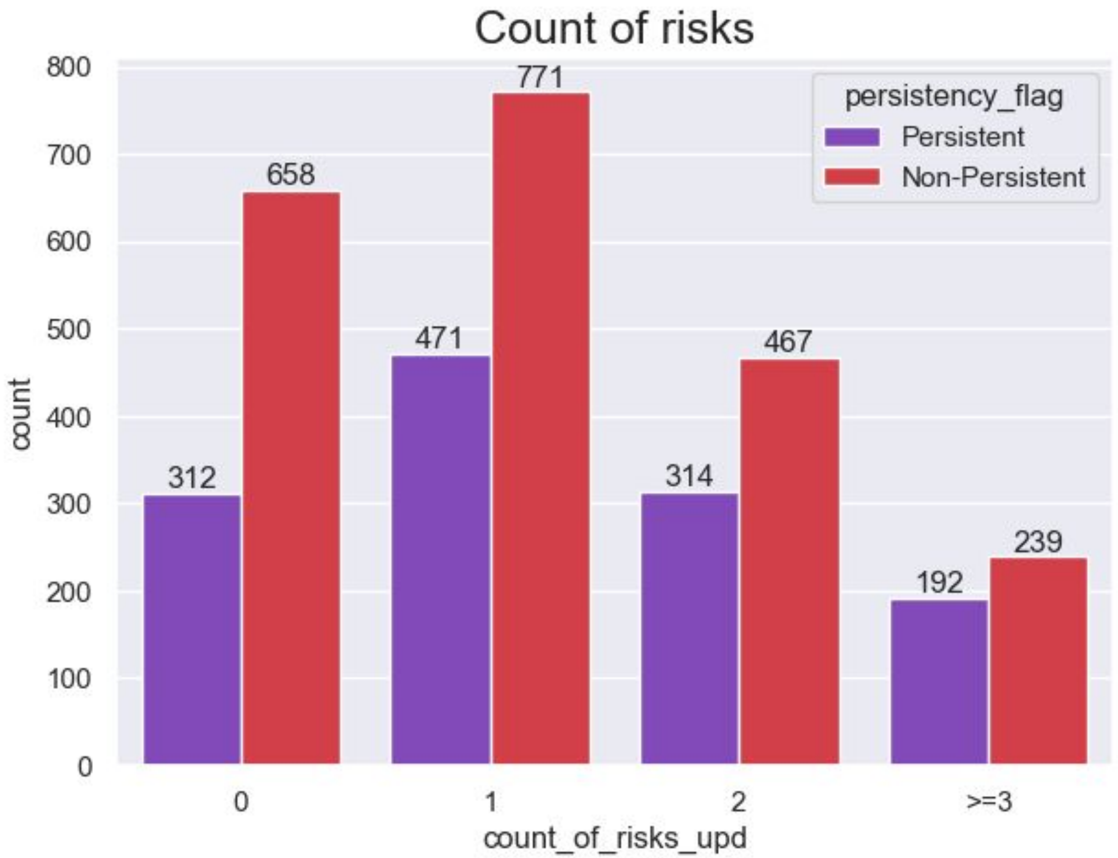
Clinical Factors

- Based on the below graph, the *Dexa Scans* is part of the therapy and majority of patients who haven't gone through *Dexa Scans* are **Non-Persistent**.



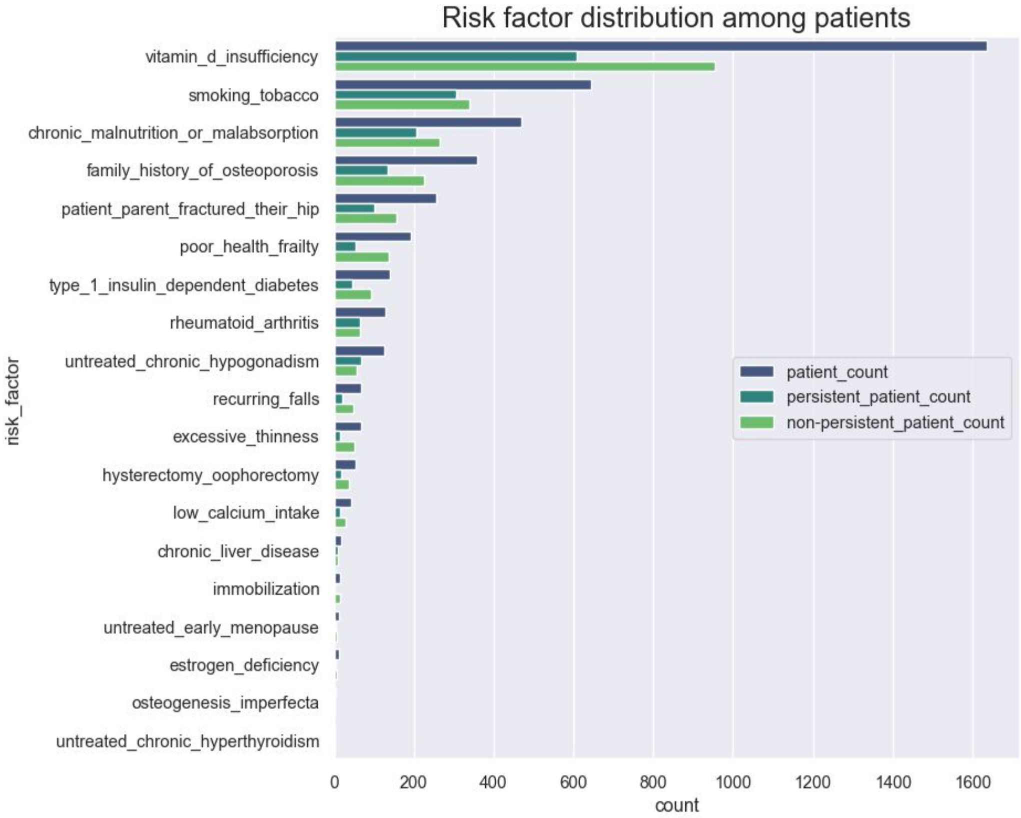
Risk Factors

- As the number of risks per patient increases, the number of **Non-Persistent** patients decreases.



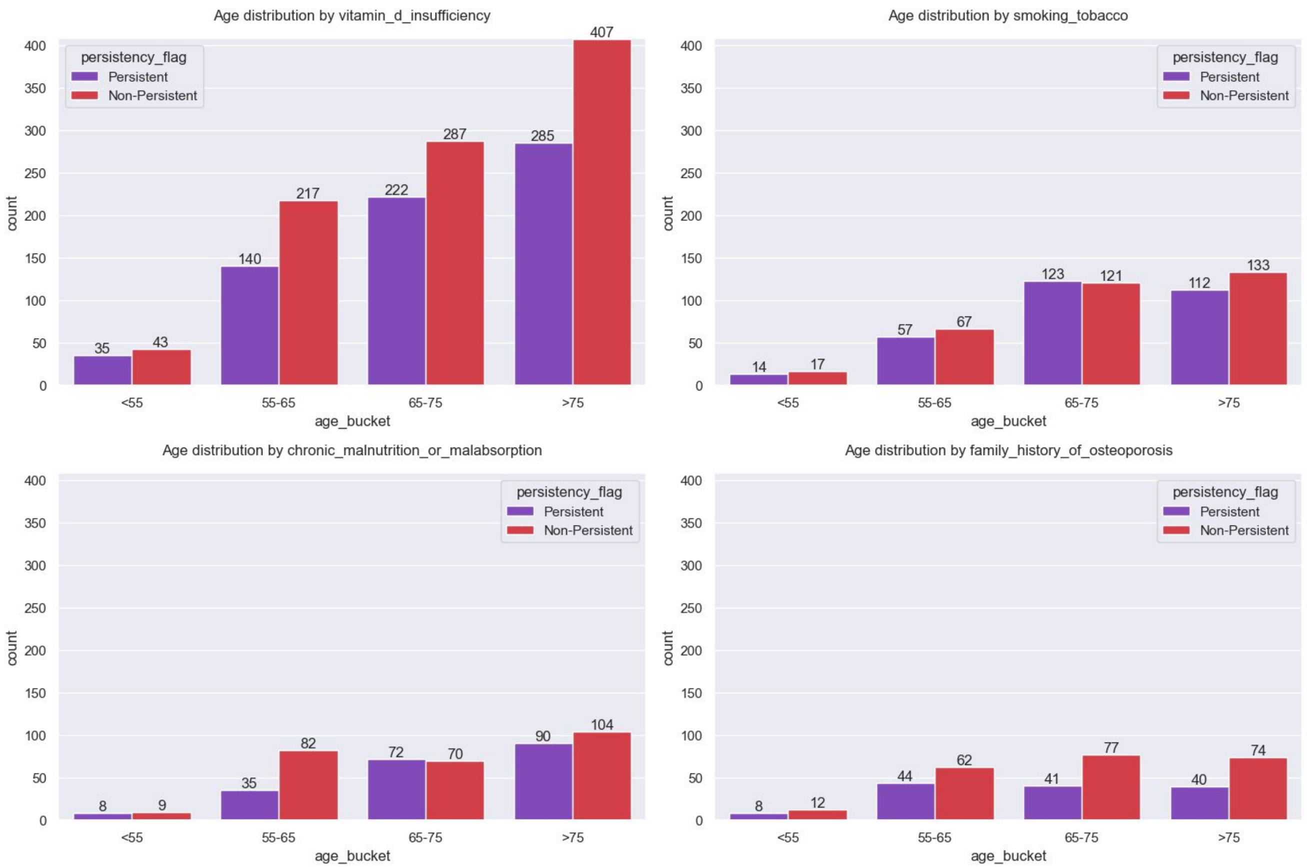
Risk Factors

- Majority of the patients have been susceptible to **Risk Factors** such as *'Vitamin D insufficiency'*, '*smoking tobacco*', *'chronic malnutrition or malabsorption'* and have a *'family history of osteoporosis'*.
- Due to heavy imbalance of data in **Risk Factor** categories, we can reduce dimensionality by reducing the categories capturing less data into a single category.



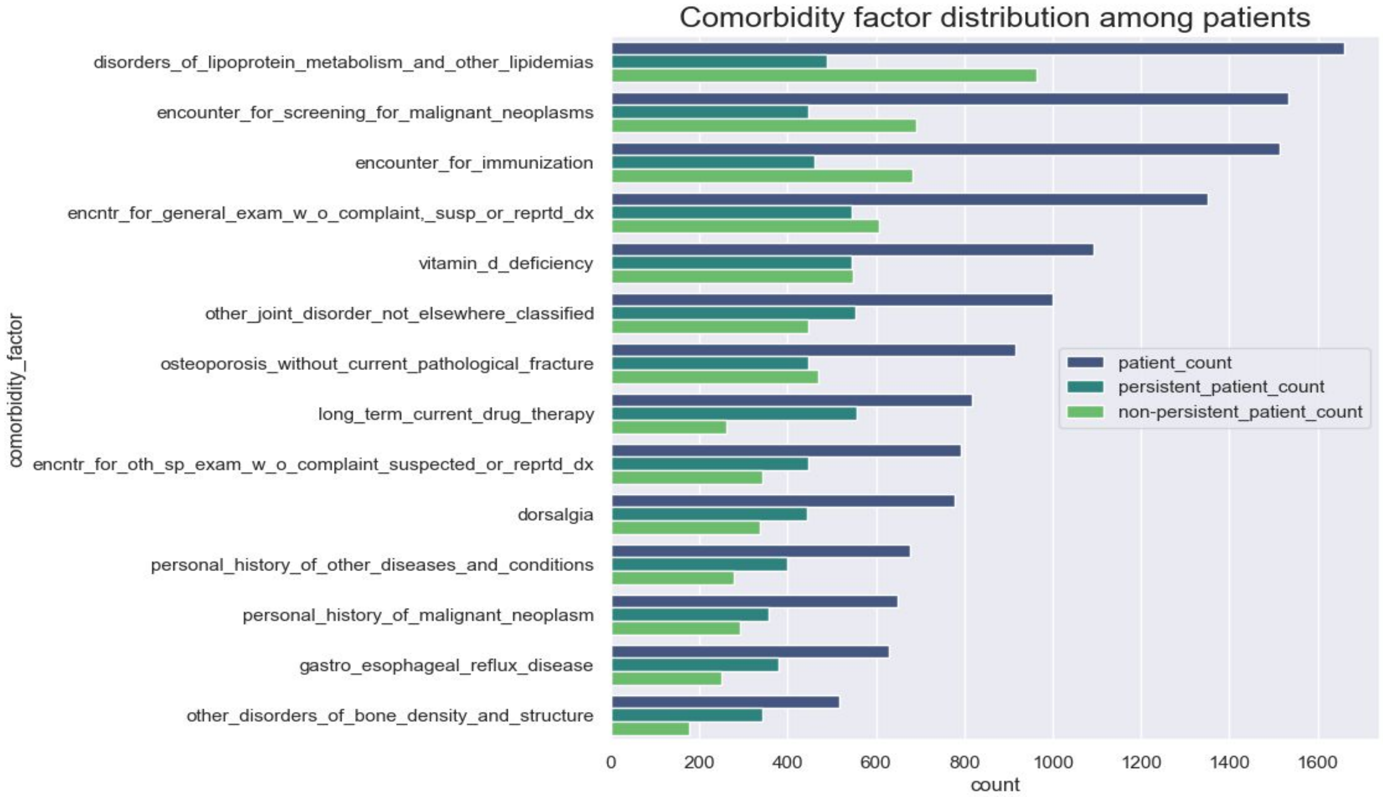
Risk Factors

- Below graph displays the distribution of top **Risks** between different **Age** groups 1 year prior starting NTM therapy.



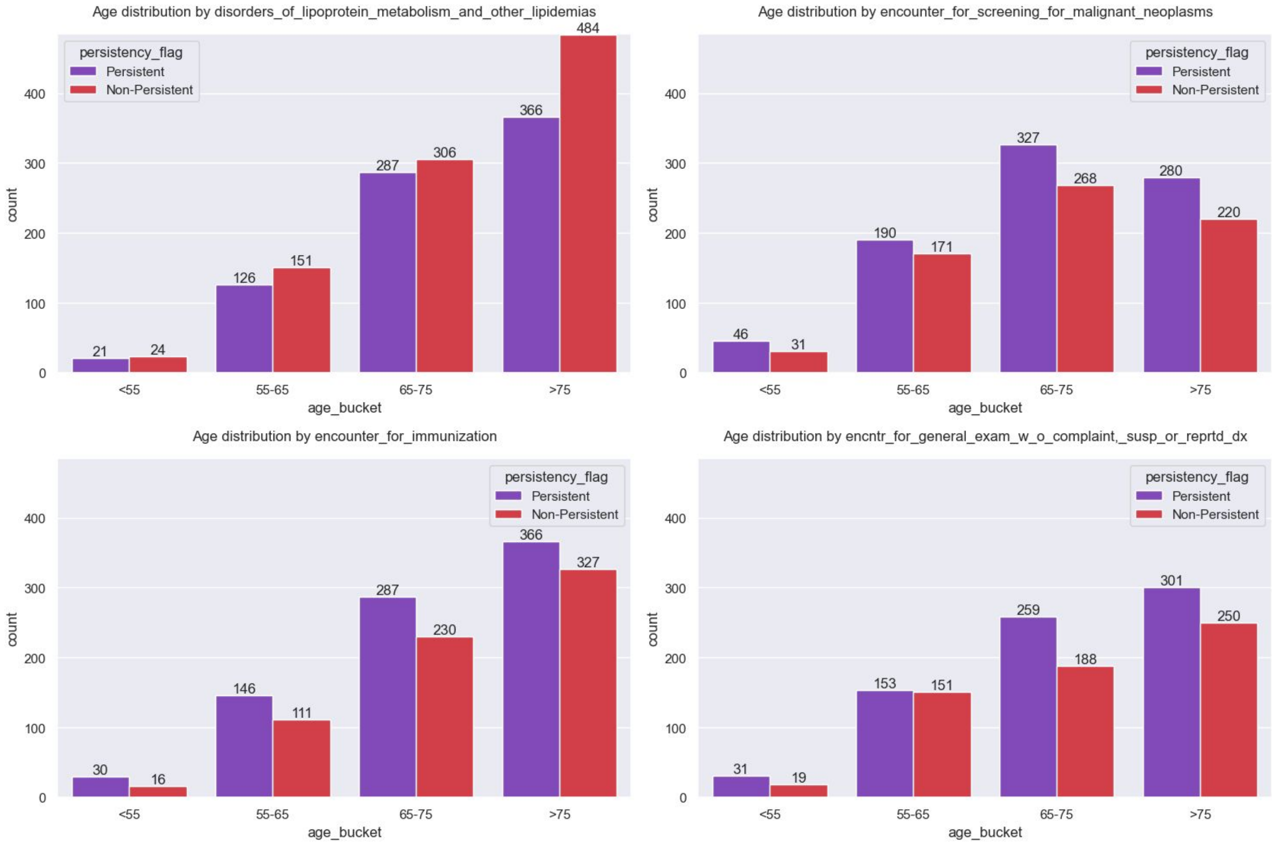
Comorbidity Factors

- There are total 14 **Comorbidity Factors** recorded for each patient.
- The top **Comorbidity Factors** include *disorders_of_lipoprotein_metabolism_and_other_lipidemias*, *encounter_for_screening_for_malignant_neoplasms*, *encounter_for_immunization,* and *encntr_for_general_exam_w_o_complaint,_susp_or_reprtd_dx.*



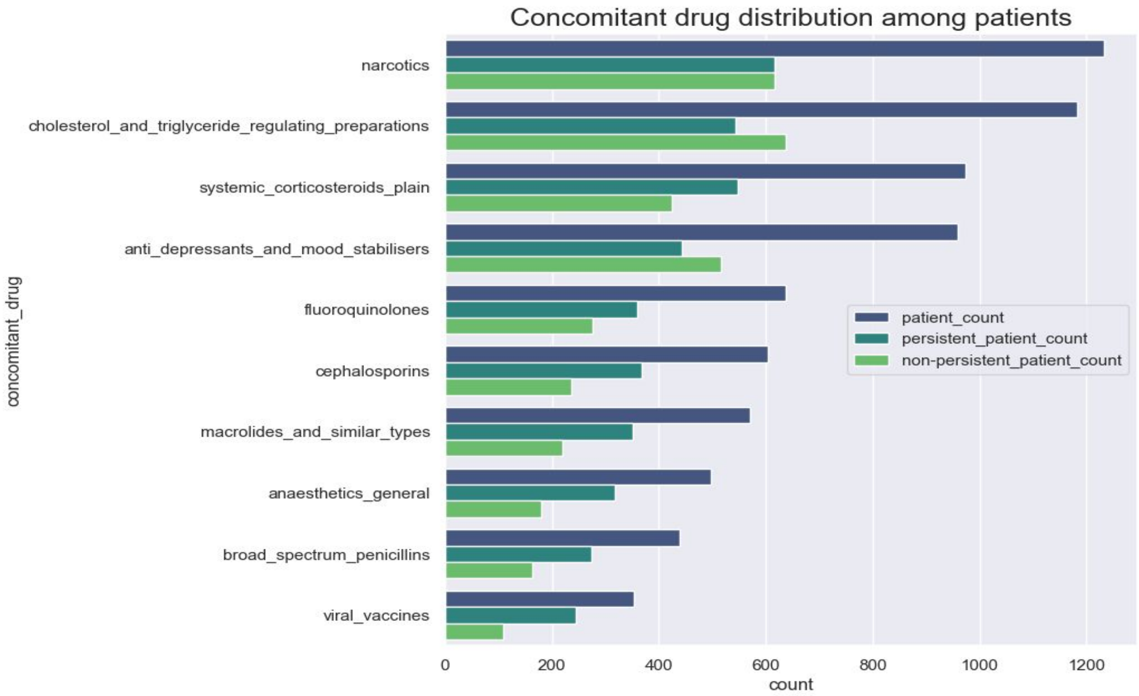
Comorbidity Factors

- Below graph displays the distribution of top **Comorbidities** between different **Age** groups 1 year prior to NTM OP therapy.



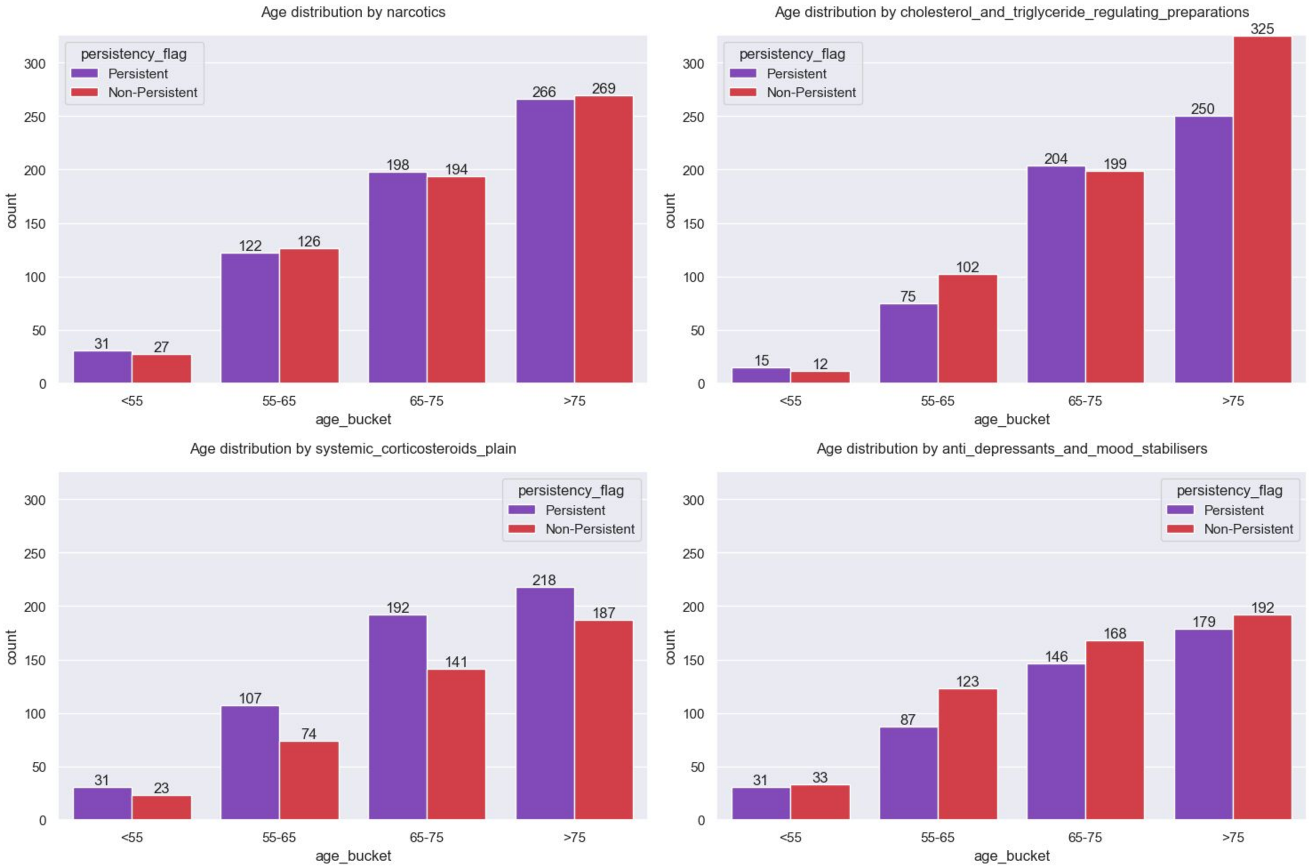
Concomitant Drugs

- We can see that the graph shows the distribution of patients who have received **Concomitant Drugs** 1 year prior to start therapy.
- The count for **Non-Persistent** patients who have been given **Concomitant Drugs** such as *Narcotics, cholesterol_and_triglyceride_regulating_preparations,* and *anti_depressants_and_mood_stabilisers* is greater compared to the other categories.



Concomitant Drugs

- Below graph displays the distribution of top **Concomitant Drugs** administered to patients between different **Age** groups 1 year prior to NTM OP therapy.



Recommendations

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Recommended Models

- Majority of the attributes in the dataset are categorical in nature. **Label Encoding** will help in converting the data type from string to numerical.

- As the problem statement requires a classification model, following models are recommended - **Logistic Regression**, **Support Vector Classifier**, **Random Forest**, **Decision Tree Classifier** etc.

- Model optimisation can be carried out by applying **Grid Search** with **Cross Validation** as it helps in hyper-parameter tuning.

- Methods like **Recursive Feature Elimination**, **Attribute Relevance Analysis**, **Principal Component Analysis(PCA)** can be employed to handle dimensionality and complexity of dataset.

- Performance metrics such as **AUC-ROC curves**, **Accuracy**, and **F1-Score** will help us understand the performance of the models.

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Thank You