# Prediction  of Seasonal vaccine uptake

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**Business Understanding**

**Goal**: Predict whether individuals will take the seasonal flu vaccine based on demographics, socioeconomic factors, and behaviors.

**Business Objective**: Improve vaccination rates by identifying individuals likely to get vaccinated.

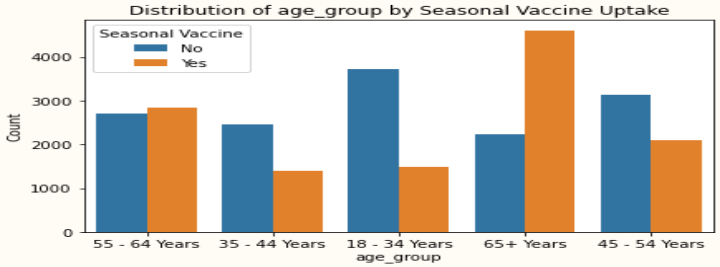
**Key Benefit**:

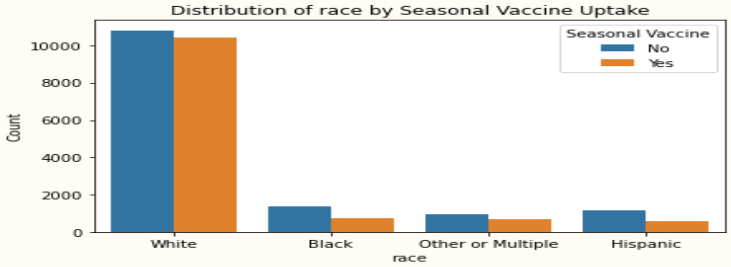
- Enable targeted interventions to encourage vaccination.
- Improve public health outcomes.
- Reduce healthcare costs associated with flu-related illnesses.

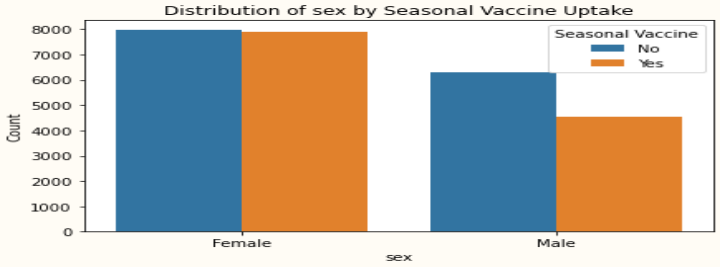
# Business and Data Understanding

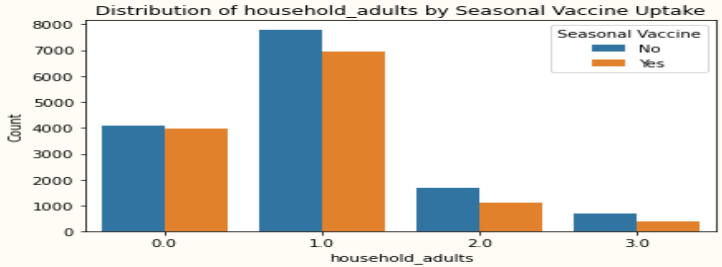


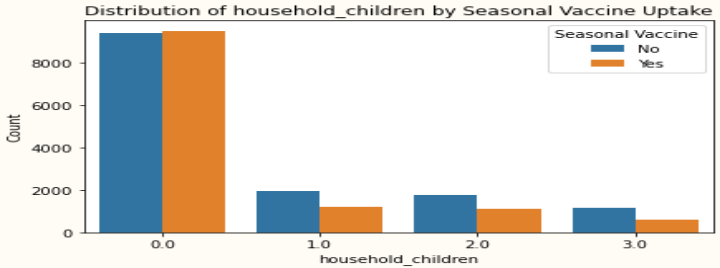
## Data Understanding

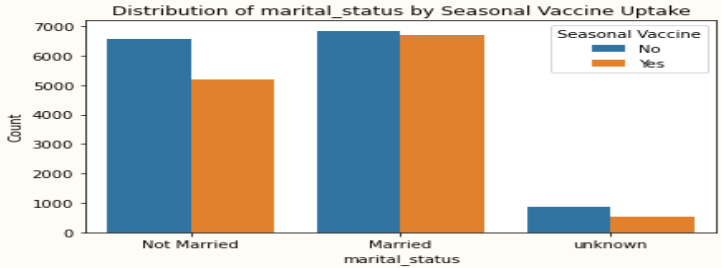


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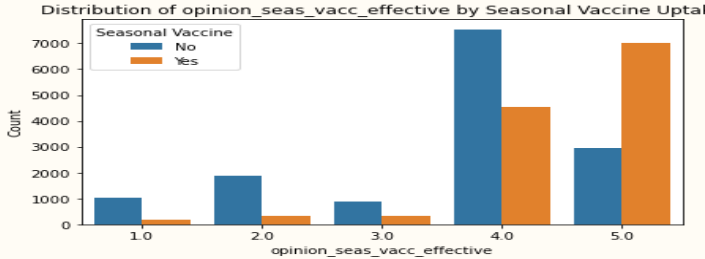


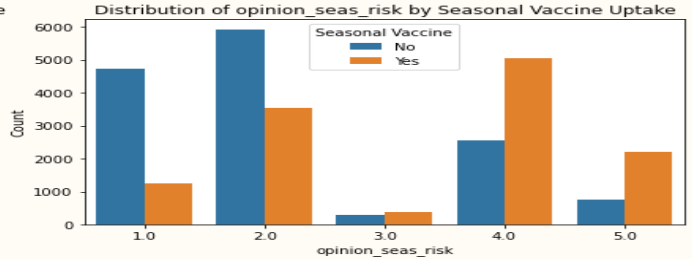


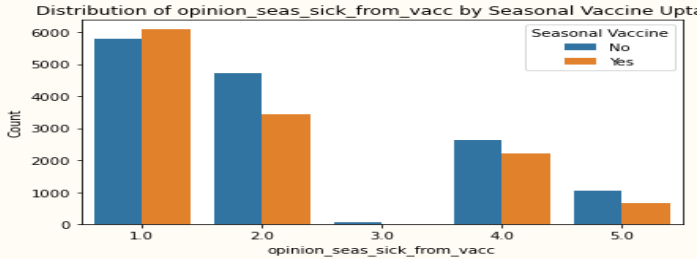


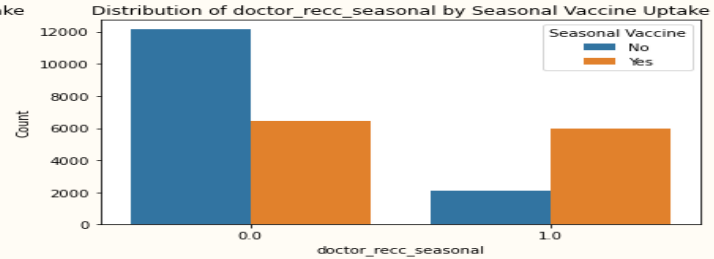


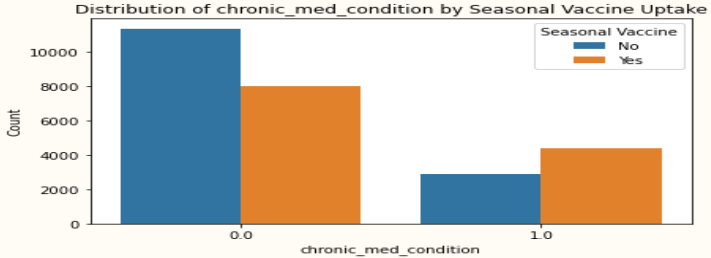

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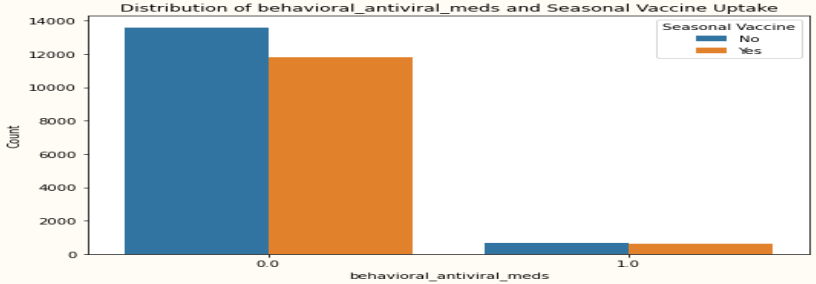
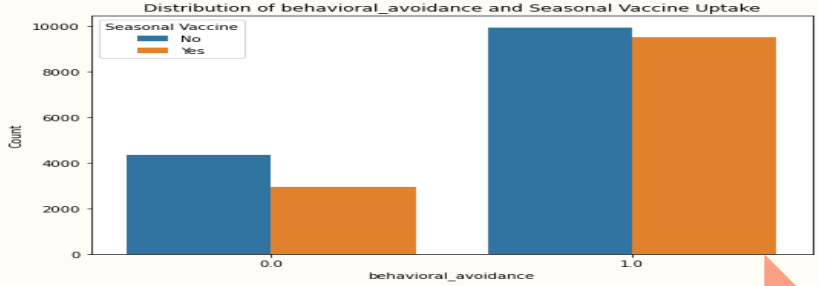
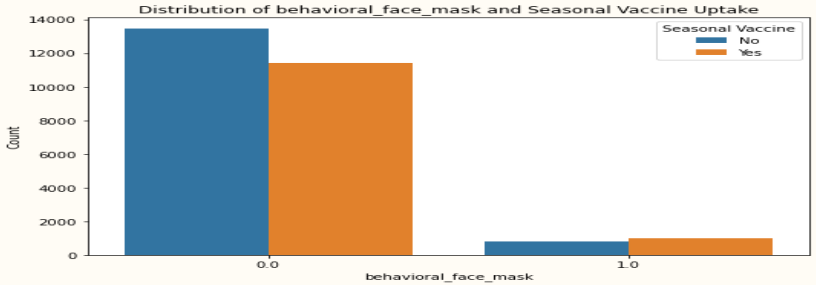
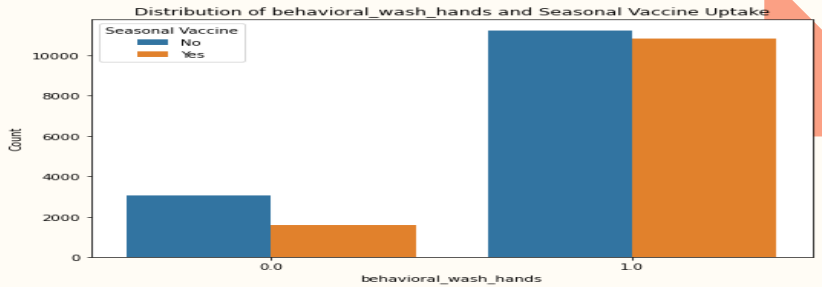
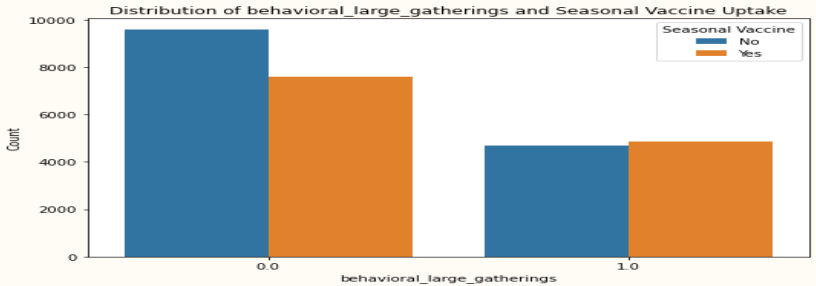
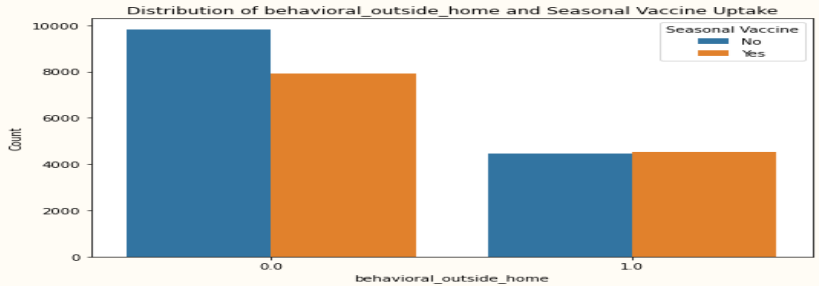


# Modelling

**Baseline Model**: The Dummy Classifier (baseline) has limited predictive value, with a high recall (100%) but low precision (45.81%), resulting in an F1-Score of 62.84%. It predicts all instances as vaccinated, which is not practical.

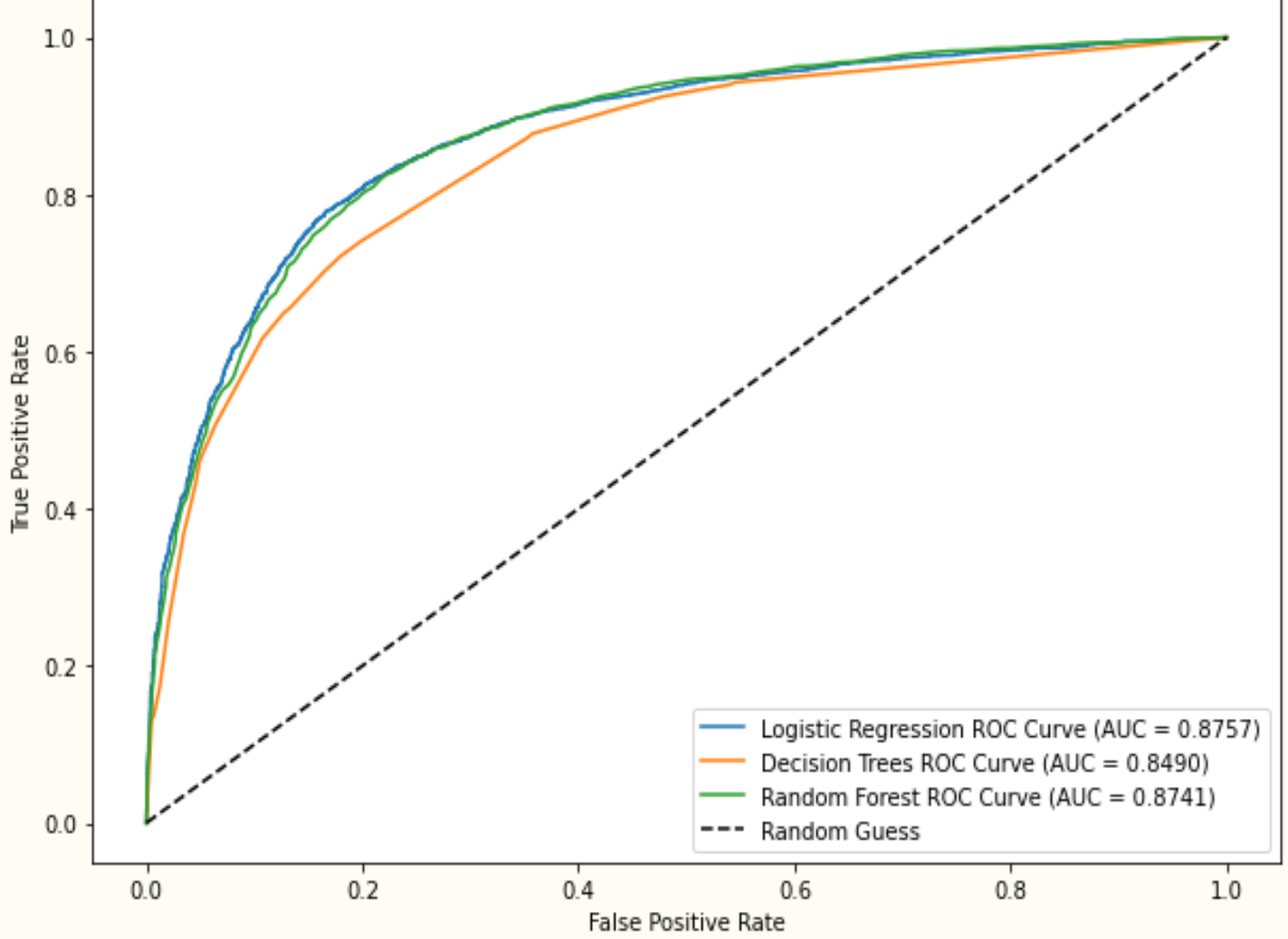
**Logistic Regression**: This model is the strongest, with an accuracy of 80.7%, precision of 80.6%, and recall of 76.0%. Its F1-Score of 78.3% and ROC AUC of 0.876 indicate strong performance in distinguishing between vaccinated and non-vaccinated individuals. It's preferred for its simplicity and interpretability.

**Random Forest**: With an accuracy of 80.1%, precision of 79.2%, and recall of 76.8%, Random Forest performs similarly to Logistic Regression. Its F1-Score is 78.0% and ROC AUC is 0.874. It is useful for more complex, non-linear relationships.

**Decision Trees**: Decision Trees performed slightly worse than Logistic Regression and Random Forest, with an accuracy of 77.5% and recall of 72.0%. The ROC AUC score of 0.849 suggests lower class discrimination but still a functional model.

**ROC Curve and Class Discrimination**: All models (except baseline) show strong performance in distinguishing between classes, with ROC AUC scores above 0.8.

**Real-World Application**: Logistic Regression is ideal for simple, interpretable models, while Random Forest can handle more complexity. Decision Trees may be less favorable unless simplicity is prioritized.


True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0
Logistic Regression ROC Curve (AUC = 0.8757)
Decision Trees ROC Curve (AUC = 0.8490)
Random Forest ROC Curve (AUC = 0.8741)
Random Guess

# CONCLUSIONS AND RECOMMENDATIONS

**Conclusion**:

- **Baseline Model**: Simple reference model, predicting everyone will get vaccinated.
- **Logistic Regression**: Promising results, good prediction accuracy.
- **Decision Tree**: Less accurate but still viable for predicting vaccine uptake.
- **Random Forest**: Best overall performance, strong ability to predict vaccine uptake.

**Recommendations**:

- **Improving Vaccination Rates**: Target at-risk individuals with personalized communication and incentives.
- **Tailored Campaigns**: Use Logistic Regression and Random Forest for targeted educational campaigns and reminders.
- **Resource Allocation**: Efficiently allocate resources by focusing on segments predicted to need intervention.
- **Continuous Improvement**: Regularly monitor and retrain models to maintain prediction accuracy as trends change.

# THANK YOU!!!