### **📊 Executive Summary: Customer Churn Analysis**

This customer churn analysis explores key behavioral patterns and service usage trends among 7,043 telecom users. The analysis includes extensive **data cleaning**, **feature transformation**, and **exploratory visualizations** aimed at identifying factors contributing to customer churn.

#### **🔧 Data Preparation:**

* The dataset was preprocessed by converting blank entries in the TotalCharges column to 0 and casting it to numeric.
* Duplicate checks and null value handling were completed with no missing values detected.
* The SeniorCitizen column was converted from binary (0/1) to categorical ("Yes"/"No") for interpretability.

#### **📉 Churn Overview:**

* **Overall Churn Rate**: **26.54%** of customers have churned, while **73.46%** have stayed.
* The **pie chart** visualization highlights the significant proportion of customer attrition.

#### **🧓 Demographic Insights:**

* **Senior Citizens**:  
  + While they form a smaller part of the customer base (**~16%**), **41.7%** of senior citizens have churned compared to **23.3%** of non-senior citizens.
  + This suggests a higher vulnerability to churn in the senior customer segment.
* **Gender**:  
  + The churn rate is fairly balanced across genders: **26.5%** for males and **26.6%** for females, indicating gender is not a strong churn predictor.

#### **⏳ Tenure Analysis:**

* A **histogram analysis** shows churn rates are highest among customers with **tenure less than 12 months**.
* Customers with long-term association (tenure > 40 months) are significantly less likely to churn, demonstrating the value of customer loyalty programs and onboarding experiences.

#### **🔌 Service-Based Insights:**

A series of **stacked countplots with Churn as hue** reveal strong correlations between service features and churn:

* **Online Security**:  
  + Customers without this service: **35% churn rate**
  + Customers with security enabled: only **15% churn rate**
* **Tech Support**:  
  + Customers without tech support: **35% churn rate**
  + Customers with support: **15% churn rate**
* **Device Protection** and **Online Backup** follow similar trends — lack of these services increases churn likelihood by over 2x.
* **Internet Service Type**:  
  + **Fiber optic** users show the highest churn rate (~**42%**), while **DSL** users churn at ~**19%**.
  + Customers without internet service have a very low churn rate (~**7%**), possibly due to minimal service usage.
* **Phone Services**:  
  + Customers with no phone service or multiple lines (but no added benefits) show moderately higher churn, though the effect is weaker than internet-based features.

#### **💡 Key Takeaways:**

* Customers using **value-added services** such as TechSupport, OnlineSecurity, and OnlineBackup tend to stay longer.
* **Senior citizens**, **fiber optic users**, and **new customers (tenure < 1 year)** are most prone to churn.
* Subscription upgrades and loyalty initiatives for at-risk groups could significantly reduce churn.