EXECUTIVE SUMMARY

Project Overview

Patient churn presents a significant challenge for healthcare providers, affecting revenue stability, continuity of care, and patient outcomes. This project analyzes a dataset of **2,000 patient records** to identify the key drivers of patient attrition and quantify the business impact of churn. Using Python for data cleaning and analysis, Streamlit for visualization and structured documentation, the analysis explored demographic, service utilization, satisfaction, engagement, and financial factors influencing patient churn.

Dataset Information

- **Source:** https://www.kaggle.com/datasets/nudratabbas/patient-churn-prediction-dataset-for-healthcare
- **Records:** 2,000 patients
- **Features:** 20 variables (demographics, satisfaction, engagement, financial)
- **Target Variable:** Churned (0 = Retained, 1 = Churned)

Data Preprocessing:

- Column names were standardized for consistency
- No missing values
- No duplicate records
- All Patient IDs are unique
- New features were engineered, including engagement categories, satisfaction groups, and churn risk scores

Project Objectives

The objectives of this project includes the following:

- Analyze patient churn patterns and quantify churn rates.
- Identify key drivers of patient attrition across experience, engagement, and financial dimensions.
- Assess the financial impact of churn through revenue-at-risk estimation.
- Profile high-risk patient segments using data-driven indicators.
- Provide actionable insights and recommendations to support patient retention strategies

Key Findings

Overall Churn Overview
The dataset revealed a **high overall churn rate of 68.35%**, with **1,367 patients churned** and **633 patients retained**. This underscores the urgency for targeted patient retention strategies.

Demographic & Tenure Insights

- **Age-related churn** was highest among younger patients aged **18–30 years (76.9%)**, while patients aged **46–60 years showed lower churn (65.1%)**.
- **Gender differences were minimal**, with churn rates of **67.7% for females** and **69.0% for males**, indicating that gender alone is not a strong predictor of churn.

- Patients with **shorter tenure (<1 year)** exhibited the highest churn rate (**75.6%**), while patients with **5+ years tenure** had relatively lower churn (**64.7%**), suggesting loyalty strengthens over time.

Geographic & Accessibility Factors

- Churn rates varied moderately across states, ranging from **64.1% in California** to **72.4% in Georgia**.
- Distance to facility showed a clear pattern: patients living **very far from facilities (30+ miles)** had the highest churn rate (**72.6%**), compared to **62.2% among patients living within 6–15 miles**.

Service Utilization Drivers

- Specialty-based churn was highest in **Neurology (70.3%)** and **Family Medicine (70.2%)**, while **Orthopedics (64.0%)** showed the lowest churn.
- Patients with **frequent or regular visits** still showed elevated churn (~**70%**), indicating that visit frequency alone does not guarantee retention.
- Patients with **3–5 missed appointments** had the highest churn rate (**72.6%**), highlighting missed appointments as a strong churn signal.

Satisfaction Metrics Analysis

Churned patients consistently reported lower satisfaction scores:

- **Overall satisfaction:** 3.15 (churned) vs 3.48 (retained)
- **Wait time satisfaction:** 3.24 vs 3.41
- **Provider rating:** 3.71 vs 3.79

This confirms that patient experience, particularly satisfaction with care delivery and wait times, is a critical driver of churn.

Engagement & Behavioral Insights

- Patients inactive for **365+ days** had the highest churn rate (**72.4%**).
- Patients **not using the patient portal** churned at **70.1%**, compared to **61.7% among portal users**.
- Patients who made **no referrals** showed the highest churn (**71.8%**), while churn steadily declined as referral activity increased.

These results demonstrate that engaged patients are significantly more likely to remain loyal.

Financial Drivers & Revenue Impact

- Churned patients incurred higher **average out-of-pocket costs ($859 vs $788 for retained patients)**.
- Patients in the **high-cost group (>$1,000)** had the highest churn rate (**72.1%**).
- Patients experiencing **billing issues** showed a substantially higher churn rate (**77.1%**) compared to those without billing issues (**67.6%**).

Revenue at Risk:
The estimated **total revenue at risk due to churn is $1,174,452**, highlighting the direct financial consequences of patient attrition.

Risk Profiling Summary

A composite risk profiling approach combining satisfaction, engagement, inactivity, cost burden, and billing issues identified a **high-risk patient segment** with significantly elevated churn rates. These patients typically exhibit:

- Low satisfaction scores
- Long gaps since last visit
- No portal usage or referrals
- Higher out-of-pocket costs
- Presence of billing issues

CONCLUSION AND RECOMMENDATIONS

Conclusion

This analysis demonstrates that patient churn is largely driven by **experience, engagement, accessibility, and financial friction**, rather than demographic characteristics alone. While age, gender, and location showed some variation in churn, they are not sufficient predictors on their own. Instead, churn occurred after a **progressive decline in engagement and satisfaction** which was then exacerbated by **financial challenges**.

Patients with **shorter tenure**, **long gaps since their last visit**, **lower satisfaction scores**, and **limited interaction with digital tools** displayed higher churn consistency. These patterns suggest that patients often disengage gradually before fully leaving the healthcare provider, creating multiple opportunities for early intervention. Satisfaction metrics emerged as a critical indicator of loyalty. Patients who churned reported lower overall satisfaction, poorer wait-time experiences, and slightly weaker provider ratings. Although the differences in scores may appear modest numerically, they translate into substantial increases in churn when applied across a large patient population. This highlights how even small declines in patient experience can have outsized financial and operational consequences.

Financial analysis further revealed that **billing issues and higher out-of-pocket costs** substantially increase churn risk and contribute directly to revenue loss. The estimated revenue at risk highlights the tangible financial impact of patient attrition and reinforces the importance of addressing non-clinical pain points alongside care delivery.

By combining engagement, satisfaction, and financial indicators into a risk profiling model, this project identified a clearly defined **high-risk patient segment** with significantly elevated churn rates. This confirms that patient churn is both **predictable and manageable** when early warning signs are monitored and addressed proactively.

Recommendations

1. **Implement Early Warning Systems for Patient Inactivity;** Patients with extended periods since their last interaction should be automatically flagged for follow-up. Proactive outreach within 60–90 days of inactivity can help re-engage patients before disengagement becomes permanent.

2. **Improve Patient Experience at Key Touchpoints;** Reducing wait times, improving appointment flow, and strengthening staff-patient communication should be prioritized. Even small improvements in perceived service quality can lead to meaningful reductions in churn.

3. **Increase Digital Engagement Through Patient Portal Adoption;** Patient portal usage is strongly associated with lower churn. Simplifying onboarding, educating patients on portal benefits, and integrating portal reminders into routine care can improve engagement and retention.

4. **Strengthen Billing Processes and Cost Transparency;** Billing issues represent a major churn trigger. Faster issue resolution, clearer billing communication, and flexible payment options can reduce financial frustration and improve patient trust.

5. **Focus Retention Efforts on High-Risk Patient Segments;** Rather than broad retention campaigns, providers should prioritize patients identified as high risk through data-driven profiling. Targeted interventions such as personalized follow-ups, financial counseling, or satisfaction recovery calls are more cost-effective and impactful.

6. **Continuously Monitor Churn Drivers Through Dashboards;** Ongoing tracking of satisfaction, engagement, billing issues, and inactivity through dashboards enables timely intervention and supports a proactive retention strategy.

By acting on these insights, healthcare organizations can improve patient loyalty, protect revenue, and enhance long-term care outcomes.

References

- Healthcare patient churn dataset (from kaggle)
- Python libraries: pandas, numPy, matplotlib, seaborn
- Streamlit Deskstop
- Google colab