

Hospital Readmission & Risk Analysis Report

1. Problem & Background

Scenario: You are a data analyst in a large hospital's administration department in Novartis, focusing on improving patient care while reducing unnecessary readmissions. Recently, the hospital has seen a spike in readmission rates, leading to increased healthcare costs and indicating potential quality of care issues. The administration is concerned about the impact on patient outcomes and the hospital's reputation. Your task is to analyze hospital admission data to identify patterns and factors associated with high readmission rates.

Addressing high readmission rates is crucial for enhancing patient care quality, optimizing hospital resource allocation, and complying with healthcare regulations. Identifying the underlying causes can lead to targeted interventions, improved patient outcomes, and potentially significant cost savings.

2. Solution

The solution developed in this project leverages data analytics to understand and mitigate readmission risk by:

- Segmenting patients using a **risk-based scoring model**
- Identifying **clinical, demographic, and departmental drivers** of readmission
- Recommending evidence-based strategies for high-risk patients
- Equipping hospital leadership and clinical teams with **real-time dashboards** and KPIs

By analyzing encounter data and creating stratified **RiskCategories (High, Moderate, Low)**, stakeholders can take proactive action to reduce readmission rates, particularly among vulnerable populations.

3. Project Scope

Objective: Identify factors contributing to hospital readmissions and develop strategies to reduce them through data-driven insights.

Process:

- **Data Collection:**
Extract patient encounter data from the Electronic Health Records (EHR) system, including demographics, clinical variables, hospital stay details, and readmission status.
- **Data Cleaning:**
Preprocess the dataset to address missing values, normalize formats, and create derived fields (e.g., RiskScore, RiskCategory).
- **Exploratory Data Analysis (EDA):**
Analyze trends in readmission rates by age, gender, race, department, emergency visits, lab procedures, and medication count.

- **Predictive Modeling:**
Apply rule-based stratification to categorize patients into Low, Moderate, and High Risk based on clinical indicators.
 - **Strategy Development:**
Generate actionable strategies for reducing readmissions through improved discharge planning, follow-up care, medication management, and departmental intervention.
-

Timeline:

- **Week 1–2:** Data extraction, integration, and cleaning
- **Week 3–4:** Exploratory data analysis and identification of patterns
- **Week 5–6:** Risk model development and patient segmentation
- **Week 7:** Strategy development, dashboard deployment, and final report

Stakeholders:

- **Internal:**
Data analysts, clinical quality improvement teams, patient care coordinators, hospital administration, and departmental leads (Internal Medicine, Emergency, etc.)
 - **External:**
Patients and families, healthcare regulatory bodies, insurance providers, and hospital board executives
-

4. Methodology

Data Collection

- Patient encounter records were sourced from the hospital's **Electronic Health Records (EHR)** and imported into **Power BI**.
- Data elements included: patient ID, age, gender, medications, hospital stay duration, emergency visits, lab procedures, and readmission flags.

Data Preparation

- Data was cleaned to handle:
 - Missing or inconsistent values
 - Standardization of age brackets, departments, and time formats
- Calculated fields were created:
 - **RiskScore**
 - **RiskCategory**

Analysis Techniques

- **Descriptive Analytics:** Bar charts, histograms, and scatter plots to explore trends.
 - **Rule-Based Risk Modeling:** Patients assigned scores based on 5 binary risk conditions (e.g., >10 medications).
 - **Dashboard Visualization:** Power BI is used to create interactive views by demographic, specialty, and risk level.
-

5. Goals and KPIs

Primary Goals

- Reduce the 46.2% readmission rate through data-informed interventions
- Improve departmental accountability through stratified performance metrics
- Target care transitions and high-risk patients with proactive planning

Key Performance Indicators

KPI	Value
Total Patient Encounters	66,590
Total Readmissions	30,760
Readmission Rate	46.20%
Average Hospital Stay	4.40 days
High-Risk Patient %	0.8%
Avg Medications (High-Risk)	22

6. Technical Processes

- **Data Ingestion:** EHR data extracted and transformed into structured tables.
- **Visualization:** Power BI dashboard with dynamic filters by gender, race, age, and department.
- **RiskScore Logic:**
 - +10 points for each of the following conditions:
 - `num_medications > 10`
 - `time_in_hospital > 5`
 - `number_emergency >= 2`
 - `change = Yes`
 - `diabetesMed = Yes`
 - Patients categorized as:
 - **High Risk:** ≥ 40
 - **Moderate Risk:** ≥ 20
 - **Low Risk:** < 20
- **Sample Patient View:**

- Patient 135: Female, [50–60], 14 medications, 3-day stay → *Moderate Risk*
 - Patient 1152: Female, [60–70], 16 medications, 8-day stay → *Moderate Risk*
 - Risk distribution by age groups is visualized to target high-risk populations.
-

7. Business Concepts Used

- **Risk Stratification:** Used to focus clinical attention on patients with a high likelihood of readmission.
 - **Population Health Management:** Grouping by age, gender, and race to identify systemic disparities.
 - **Service Line Optimization:** Departmental readmission volumes are used to prioritize resource allocation.
 - **Outcome-Based Performance:** Linking readmission rates to operational KPIs and departmental accountability.
 - **Preventive Care Planning:** Encouraging early discharge planning and post-discharge monitoring.
-

8. Recommended Analysis (Key Findings)

Executive Summary

- **46.2% readmission rate** is far above acceptable thresholds.
 - **30.76K readmissions** out of 66.59K encounters.
 - Departments like **Internal Medicine (4.2K)** and **Emergency/Trauma (2.5K)** have the highest burden.
 - Older adults ([60–90]) represent the largest readmitted population.
 - Key drivers include **multiple medications, emergency visits, and extensive lab work.**
-

Clinical Insights

- **Age:** Patients aged **[70–80]** had the highest readmission count (8.2K).
 - **Race/Gender:** Caucasian females (12.5K) and males (11.0K) had the largest demographic volume.
 - **Lab Procedures:** Readmission rates peaked with **41–60 lab procedures.**
 - **Emergency Visits:** Patients with 2+ prior visits contributed the most to readmissions.
 - **Medication Load:** Patients with 10+ medications and short stays (1–3 days) are at high risk if follow-up is not managed.
-

Risk Profile

- **High-Risk Age Groups:**
 - [60–70]: 119
 - [50–60]: 110
 - [70–80]: 88
- **High-Risk Indicators:**

- 22 average medications
 - Prior ER use
 - Chronic conditions (e.g., diabetes)
 - **Readmitted High-Risk Patients:** 378 out of 30K+ were flagged as high risk using model logic.
 - Conditional formatting highlights cases for escalation.
-

9. Conclusion

The analysis reveals a clear opportunity for hospital leadership to proactively address the systemic and clinical drivers of readmissions. With actionable insights, stratified risk models, and focused KPIs, the organization can now:

- Deploy **targeted discharge planning** for older adults
 - Strengthen **medication reconciliation processes**
 - Prioritize **post-discharge engagement** (calls, telehealth, in-home care)
 - Implement **department-specific interventions** in high-volume specialties
-

Project owner

Name: [Kunal Malviya](#)

Date: 18-07-2025