Capstone Project on HealthCare Insights Dashboard

AN INTERNSHIP REPORT

Submitted by

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Abstract

This report presents the development of an **interactive Healthcare Dashboard** built in Tableau, focusing on the analysis of patient records, revenue, expenses, and treatment distribution across regions and departments. The dashboard enables users to explore **Key Performance Indicators (KPIs)** such as total patients, total revenue, and average treatment cost, along with advanced visualizations like dual-axis line charts, bar charts, pie charts, combo charts, and heatmaps.

The main goal of this project was to help healthcare organizations gain **data-driven insights** into operational efficiency, departmental performance, and patient distribution trends. Analysis revealed that certain departments consistently attract more patients and generate higher revenue, while other regions struggle with lower patient counts. Furthermore, treatment type and payment method strongly influence both revenue generation and cost optimization.

The dashboard provides actionable insights that can improve hospital resource allocation, enhance decision-making for administrators, and support strategies to deliver more **efficient and patient-centric healthcare services**.

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1. Introduction

1.1 Introduction

Healthcare systems around the world generate an enormous amount of data on a daily basis. This includes patient demographics, admission records, diagnostic reports, treatment types, financial transactions, departmental operations, and regional distributions of patients. Despite this availability of data, decision-makers often struggle with identifying patterns, inefficiencies, and opportunities due to the lack of proper visualization tools.

This project focuses on building an interactive Healthcare Insights Dashboard in Tableau, which consolidates data into a single visual platform. The dashboard is designed to provide instant clarity on patient flow, treatment costs, departmental performance, revenue generation, and profit margins.

Unlike traditional tabular reports, the dashboard allows real-time filtering and drill-down analysis, helping healthcare administrators and policymakers quickly identify trends and make informed decisions. The project demonstrates the power of data visualization in transforming raw healthcare data into actionable intelligence.

1.2 Problem Statement

The healthcare industry faces several challenges that motivated this project:

1. Fragmented Data: Patient, financial, and departmental data are often scattered across multiple systems, making holistic analysis difficult.
2. Rising Costs: Treatment costs and operational expenses are rising, and management needs tools to identify where cost optimizations can be applied.
3. Uneven Patient Distribution: Some departments (like Cardiology and Emergency) experience very high patient inflow, while others remain underutilized.

4. Unclear Revenue Insights: Administrators lack clear insights into which treatments, regions, or payment methods generate the most revenue.
5. Decision Delays: Manual reports take time to prepare, leading to delays in responding to critical operational needs.

Key Question: How can we create a unified system that provides real-time, interactive insights into patient numbers, financial performance, and departmental operations?

1.3 SDG Contribution

The project contributes to the United Nations Sustainable Development Goals (SDGs) as follows:

- SDG 3 – Good Health and Well-Being
    - By analyzing patient inflow, treatment costs, and revenue trends, hospitals can allocate resources more efficiently, ensuring better patient care.
    - The insights allow hospitals to identify underperforming departments and focus on improving services for chronic diseases and preventive care.
- SDG 8 – Decent Work and Economic Growth
    - Financial insights into revenue, profit, and expenses help healthcare organizations run sustainably.
    - Optimizing healthcare operations supports growth while ensuring employment stability for medical staff.

Thus, this project bridges data analytics and healthcare management, enabling hospitals to align with global health and economic goals.

2. Overview of Internship Topic

2.1 Project Objectives and Hypothesis

Objectives:

1. To analyze patient distribution across departments, regions, and treatment types.
2. To calculate financial KPIs such as Total Revenue, Profit, Expenses, and Average Cost per Patient.
3. To visualize trends in patients and revenue over time.
4. To identify the impact of payment methods and currencies on financial performance.
5. To design a dynamic, interactive, and user-friendly dashboard in Tableau that supports filtering and drill-down analysis.

Hypothesis:

- Departments with a higher diversity of treatment types will attract more patients and generate higher revenue.
- Revenue is influenced not only by the number of patients but also by payment method preferences and regional demographics.
- Interactive visualizations will provide faster and more accurate insights compared to static reports.

2.2 Methodology and Dashboard Design

Step 1: Data Collection & Preprocessing

- The dataset was provided in Excel format with fields:
  Date, Region, Department, Treatment_Type, Number_of_Patients, Treatment_Cost, Total_Revenue, Expense, Profit, Year, Currency, Payment_Method.

- Data cleaning included checking for missing values, standardizing date formats, and ensuring numeric consistency for costs and revenue.

Step 2: Tools & Technologies Used

- Microsoft Excel: For preprocessing and initial data exploration.
- Tableau Public: For building dashboards with interactive charts.
- TabPy (Optional): For Python integration to support advanced calculations.

Step 3: Dashboard Design

The dashboard was divided into 8 sheets, each contributing a key visualization:

1. KPI Cards – Total Patients, Total Revenue, Avg. Treatment Cost
2. Bar Chart – Patient distribution across Regions, Departments, and Dates
3. Dual Line Chart – Trend of Patients and Revenue over time
4. Pie Chart – Department-wise distribution of treatment types
5. Bar + Line Combo Chart – Patients vs Revenue comparison
6. Heatmap – Revenue distribution across Department, Region, and Payment Method

Filters were added for:

- Year
- Department
- Region
- Currency
- Payment Method

This allowed users to dynamically analyze the data at different levels of granularity.

2.3 Data Analysis and Key Findings

1. Patient Analysis

- The highest patient inflow was observed in Emergency and Cardiology departments, indicating demand for urgent and chronic care.
- Some departments had significantly fewer patients, suggesting underutilized resources.

2. Revenue Insights

- Revenue was highest in Cardiology and Orthopedics, primarily due to higher treatment costs.
- Certain regions consistently generated more revenue per patient, likely due to economic differences.

3. Cost and Profit Analysis

- Average treatment costs varied by department. For example, surgeries had higher average costs compared to general check-ups.
- Departments with high expenses sometimes had lower net profit margins, despite high revenue.

4. Payment Method Preferences

- Insurance and online payments contributed to most revenue in urban regions.
- Cash payments dominated rural areas but were associated with lower average costs.

5. Time-Based Trends

- Patients and revenue showed seasonal peaks, e.g., higher inflow during flu/cold seasons.
- Long-term trend: steady increase in total patients and revenue over the years.

3. Technical Report of Healthcare Dashboard

3.1. Key Performance Indicators (KPIs)

The dashboard captures three major KPIs at the top (numeric cards):

1. **Total Patients** → SUM(Number_of_Patients)
    - Measures the overall patient inflow across all departments.
2. **Total Revenue** → SUM(Total_Revenue)
    - Indicates the hospital's total income from treatments and services.
3. **Average Cost per Patient** → SUM(Treatment_Cost) / SUM(Number_of_Patients)
    - Shows the efficiency of resource utilization and cost management.

3.2. Charts & Visualizations

3.2.1 Bar Chart (Top Left – Department, Region, Currency, Expense)

- **X-axis:** Department / Region / Currency
- **Y-axis:** SUM(Expense)
- **Color:** Treatment Type
- **Purpose:**
    - To compare **departmental expenses** across **regions and currencies**.
    - Identifies which regions and departments have the highest cost burden.

3.2.2 Heatmap (Top Right – Region, Department, Treatment Type)

- **Rows:** Region, Treatment Type

- **Columns:** Department
- **Color Intensity:** SUM(Total_Revenue)
- **Purpose:**
    - To visualize **revenue contribution** from each department-treatment combination across regions.
    - Darker colors show **high-revenue treatments**, lighter ones indicate underperforming areas.

3.2.3 Pie Charts (Bottom Left – Department vs Region)

- **Slices:** SUM(Number_of_Patients)
- **Color:** Treatment Type
- **Separated by Region & Department**
- **Purpose:**
    - To display **patient distribution** across treatment types within each department/region.
    - Quickly shows which treatments dominate in each specialty.

3.2.4 Dual Line Chart (Bottom Right – Patients & Revenue Over Time)

- **X-axis:** Date
- **Left Y-axis:** SUM(Number_of_Patients)
- **Right Y-axis:** SUM(Total_Revenue)
- **Color:** Measure Names (Patients vs Revenue)

- **Purpose:**
    - To identify **seasonal or time-based trends** in both patient numbers and hospital revenue.
    - Helps spot peaks (e.g., flu season, surgery demands) and declines.

3.3. Filters & Parameters Applied

1. **Date Filter** → Year/Month granularity.
    - Allows trend analysis by time period.
2. **Region Filter** → East, West, North, South.
    - Enables regional analysis of patients and revenue.
3. **Department Filter** → Cardiology, Emergency, Oncology, Pediatrics, etc.
    - Focuses on department-specific insights.
4. **Currency Filter** → INR, USD, EUR.
    - Analyzes financial variations across currency systems.
5. **Payment Method Filter** → Cash, Insurance, Online.
    - Studies the impact of payment methods on revenue collection.

3.4. Key Findings from Dashboard

1. **Expenses vs Revenue**
    - Some departments (e.g., Oncology, Emergency) have **high expenses**, but also generate **significant revenue**.

- Preventive/General departments show **low expenses but limited revenue contribution**.

2. **Regional Differences**
    - East and South regions have higher patient numbers but **lower revenue per patient**.
    - West and North show higher **average treatment costs** due to expensive treatments.
3. **Payment Method Insights**
    - **Insurance-based payments** dominate high-revenue departments like Cardiology and Oncology.
    - Cash payments are more common in low-cost treatments (consultations, diagnostics).
4. **Seasonal Trends**
    - Peaks in patient visits occur during **mid-year and winter seasons**, aligning with flu and chronic disease patterns.
    - Revenue follows the same peaks, showing a strong correlation with patient volume.
5. **Treatment Type Impact**
    - Surgeries and specialized therapies generate **higher revenue**.
    - Consultations/diagnostics account for **high patient count but low revenue per patient**.

3.5. Dashboard Impact

- Provides a **360° view** of hospital performance.

- Helps **administrators allocate resources** (e.g., more budget for Emergency during peak months).
- Supports **strategic planning** by analyzing treatment, region, and payment method performance.
- Enhances **financial decision-making** through expense vs revenue comparisons.

4. Summary / Conclusions

4.1 Proposed Solutions and Recommendations

1. Resource Allocation Optimization
    - Focus on scaling high-demand departments like Cardiology and Emergency.
    - Redistribute resources from underutilized departments to reduce idle capacity.
2. Cost Control Measures
    - Standardize treatment costs across regions to minimize patient dissatisfaction.
    - Identify departments with high expenses and implement cost-saving initiatives.
3. Enhance Payment Flexibility
    - Promote digital and insurance-based payments to speed up processing.
    - Launch awareness programs for patients in rural areas about digital payment options.
4. Regional Strategy Development
    - Regions with lower patient inflow should receive targeted healthcare campaigns.
    - Telemedicine and outreach programs can balance disparities in patient distribution.
5. Adopt Preventive Healthcare Measures
    - Invest in preventive departments (e.g., diabetes management, nutrition care).
    - Preventive healthcare reduces long-term costs and increases patient loyalty.

4.2 Conclusion and Impact

The Healthcare Insights Dashboard successfully consolidated complex datasets into a clear and interactive visualization platform. The analysis highlighted:

- Key departments driving patient volume and revenue
- High-cost treatments and their impact on profit margins
- The importance of payment method diversity
- Seasonal trends in patient inflow

By implementing the recommendations, hospitals can:

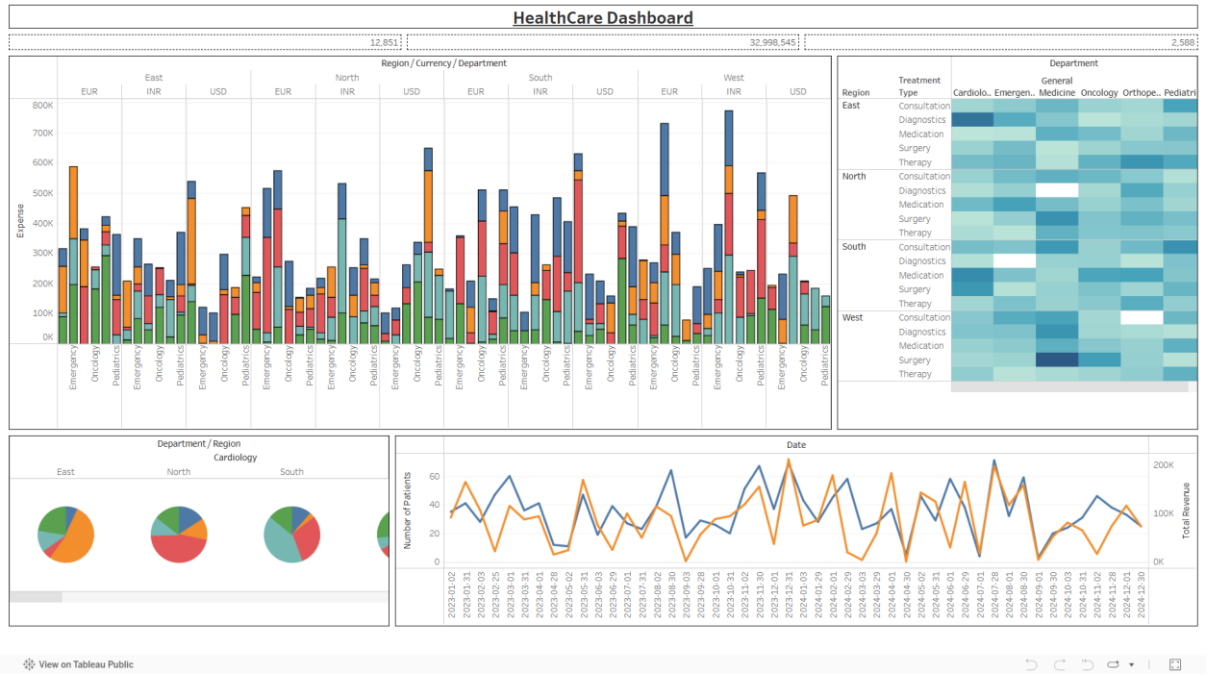
- Improve financial sustainability
- Deliver better patient outcomes
- Optimize resource utilization
- Support global health and economic goals (SDG 3 & SDG 8)

This project demonstrates the transformative role of data visualization in healthcare management and serves as a model for data-driven decision-making.

5. References

- Healthcare dataset (2023–2025) provided for this project.
- Tableau Documentation – Tableau Help for creating charts and dashboards.
- United Nation Sustainable Development Goals (SDG 3 and SDG 8).
- Academic resources and faculty guidance from IBM Skill Build / CSRBOX and SVIT, Vasad.

Dashboard visualization



Reference Link for Viewing the Dashboard :
https://public.tableau.com/app/profile/harshil.patel6328/viz/HealthCareDashboard_17525673119630/Dashboard1