

# **Case Study 2: Project Dashboard**

## **PESTEL Analysis of Healthcare Sector**

**By: Group CS3\_ 7**

Fatima, Naaz (NF1020595),  
Vijayan, Vishnupriya Kulathingal (NF1001530),  
Olanipekun, Olumide (NF1000897),  
Singh, Yuvraj (NF1016125)

Master in Data Analytics, University of Niagara Falls



**Data Analytics Case Study 2 (DAMO-511-2)**

**Professor:** Touraj Banirostan

Jun 22, 2025

## Table of Contents

<b>1</b>	<b>INTRODUCTION .....</b>	<b>3</b>
<b>2</b>	<b>EXECUTIVE SUMMARY .....</b>	<b>3</b>
<b>3</b>	<b>DASHBOARD .....</b>	<b>5</b>
3.1	GENERAL OVERVIEW .....	5
3.2	POLITICAL, ECONOMIC & SOCIAL OVERVIEW (PES).....	6
3.2.1	<i>Political Section</i> .....	7
3.2.2	<i>Economic Section</i> .....	8
3.2.3	<i>Social Section</i> .....	9
3.3	TECHNOLOGICAL, ENVIRONMENTAL & LEGAL OVERVIEW (TEL).....	9
3.3.1	<i>Technological Section</i> .....	10
3.3.2	<i>Environmental Section</i> .....	11
3.3.3	<i>Legal Section</i> .....	12
<b>4</b>	<b>RECOMMENDATIONS .....</b>	<b>13</b>
<b>5</b>	<b>DASHBOARD SIGNIFICANCE FOR STRATEGIC PLANNING .....</b>	<b>14</b>
<b>6</b>	<b>CONCLUSION .....</b>	<b>14</b>
<b>7</b>	<b>REFERENCES .....</b>	<b>15</b>

# 1 INTRODUCTION

The healthcare industry is made up of many organizations and companies that help people stay healthy by providing services related to treating patients, preventing disease, and improving overall well-being. Some of the organizations which are part of healthcare system are hospitals, medical equipment OEMs, pharmaceuticals, and health insurance providers.

In many developed countries it is seen that the healthcare industry contributes to 10% of GDP and it is considered to be one of the biggest and fastest-growing industries globally.

This industry is very important because it affects people's health and the growth of a country. Post COVID-19 pandemic, there were many changes in healthcare, new technologies were used, the cost of treatment became higher, and there were sudden changes in health insurance and rules. Hospitals being the core element of the health system as an operating arm, they provide acute and long-term care.

## 2 EXECUTIVE SUMMARY

Healthcare is the system which gets affected easily by many factors, thus by using PESTEL [political, economic, society, technology, economic, and legal] framework, operational risks or opportunities in healthcare sector can be identified and analyzed, emphasizing on supply chain management or labor dynamics.

Each segment of PESTEL framework has key risks/opportunities as listed below, which would be analyzed by using various statistical analyzing models and visual representations to support this analysis.

### **Key Risks:**

- Dependency on insurance provider, which can be a political risk.

- Variance in the cost based on the type of the disease or condition contributing to economical risk.
- Social risk can be in the form of aging population.
- Inconsistency in diagnostics/results can be a result of technological risk.
- Wastage of medical waste can be categorized as part of environmental risk.
- Billing frauds or data privacy forms Legal risk.

**Key opportunities:**

- Insurance diversification like allowing many insurance providers to contribute can be seen as a political opportunity.
- Implementing different cost models can be an economical opportunity.
- Social opportunity visualized by targeted preventive health care based on the age/condition.
- Technology can be used for optimizing the inventory.
- By implementing certain practices in order to reduce the medical waste can be a part of environmental opportunity.
- Developing various security policies and procedures can be taken as a legal opportunity.

Based on the identification of these key risks and opportunities, strategic recommendations can be outlined, which can support the health sector to effectively understand and utilize the resources.

### 3 DASHBOARD

This section describes about the dashboard of Healthcare Sector Analysis using PESTEL framework. The interactive dashboard is divided into three main sections.

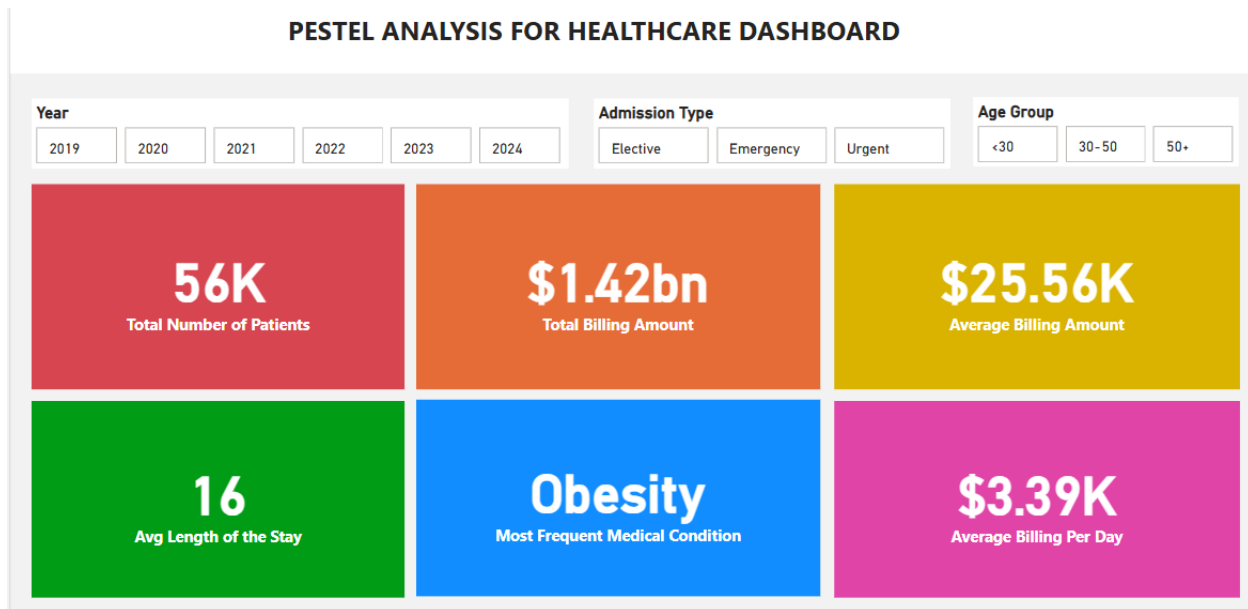
1. General Overview
2. Political, Economic & Social Overview (PES)
3. Technological, Environmental & Legal Overview (TEL)

Relevance Summary Table

PESTEL Factor	Dataset Fields Used
Political	Insurance Provider, Admission Type
Economic	Billing Amount, Stay Duration
Social	Age, Gender, Condition
Technological	Medication, Test Results
Environmental	Derived: Stay, Medication
Legal	Doctor, Insurance, Admission Type

#### 3.1 GENERAL OVERVIEW

The overall summary is presented in form of KPI cards listing various parameters and filters showing metrics from 2019-2024, Admission Type (Elective, Emergency, Urgent) and Age Group (-30, 30-50, 50+).



Below is the summary of the displayed cards:

- Total Number of Patients: 56K
- Total Billing Amount: \$1.42 billion
- Average Billing Amount: \$25.56K
- Average Length of Stay: 16 days
- Most Frequent Medical Condition: Obesity
- Average Billing Per Day: \$3.39K

### 3.2 POLITICAL, ECONOMIC & SOCIAL OVERVIEW (PES)

This section of the dashboard supports healthcare management decision-making by:

- Monitoring insurance and hospital partnerships/relationships (Political)
- Analyzing cost drivers in treatments and billing (Economic)
- Understanding patient demographics and medical needs (Social)

The dashboard is grouped into three sections (Political, Economic & Social), under each heading two visuals are presented.



### 3.2.1 Political Section

This section is explored by using two visuals one demonstrating average billing by insurance provider (Pie Chart) & another providing glimpse of Total Patients by Hospital and Insurance Provider (Treemap).

#### Average Billing by Insurance Provider (Pie Chart)

**Metric:** Average billing amount by each insurance provider.

**Insight:** The billing amounts appear to be evenly spaced out across the providers including Medicare as well as Aenta, Cigna UnitedHealthcare, and Blue Cross, all having average billing of approximately \$25.4K–\$25.6K.

**Usage:** This shows there is no actual substantial difference between the 5 major insurance companies, suggesting routine billing.

### **Total Patients by Hospital and Insurance Provider (Treemap)**

**Metric:** Total number of patients, based on pairings of hospitals & insurance companies.

**Functionality:** The size of the boxes represents the total patients.

**Usage:** This is also useful for evaluating the relationships between medical providers and insurers. For instance, you can easily see how many patients Ltd Smith that has are billed with Cigna.

### **3.2.2 Economic Section**

This section is explored by using two visuals one demonstrating Average Billing Amount by Length of Stay (Scatter Plot) & another providing glimpse of Sum of Billing Amount by Medical Condition (Word Cloud).

#### **Average Billing Amount by Length of Stay (Scatter Plot)**

**X-Axis:** Length of stay (in days)

**Y-Axis:** Mean billing amount

**Insight:** There is no direct linear correlation between length of stay and billing, possibly indicating a complex billing strategy or a variable number of treatment types.

#### **Sum of Billing Amount by Medical Condition (Word Cloud)**

**Metric:** Total billed across medical conditions.

**Use:** In this example we can see conditions such as Obesity, Diabetes, and Arthritis are larger than others. This helps indicate total billed sum amounts, where we know that these conditions are often chronic conditions that produce higher billed amounts.



### 3.2.3 Social Section

This section is explored by using two visuals one demonstrating Patient Count by Age Group and Medical Condition (Stacked Bar Chart) & another providing glimpse of Total Number of Patients by Blood Type and Gender (Clustered Bar Chart).

#### **Patient Count by Age Group and Medical Condition (Stacked Bar Chart)**

**Axes:** Age Group vs Patient Count

**Legend:** Medical Condition

**Insight:** The older age group (50+) has the highest patient count for all conditions, specifically Arthritis and Cancer.

#### **Total Patients by Blood Type and Gender (Clustered Bar Chart)**

**Axes:** Blood Type vs Patient Count

**Legend:** Gender

**Insight:** There is gender balance across all blood types, so the demographic profile is balanced.

## 3.3 TECHNOLOGICAL, ENVIRONMENTAL & LEGAL OVERVIEW (TEL)

This section of the dashboard supports healthcare management decision-making by analysing:

- Technology: Diagnostic accuracy vs. stay length
- Environment: Cost trends over time and medication dependencies
- Legal: Balance in patient admission types and regulatory compliance



### 3.3.1 Technological Section

This section is explored by using two visuals, Test Results versus Length of Stay (Decomposition Tree) & Count of Medical Condition by Test Results (Pie Chart).

#### Test Results versus Length of Stay (Decomposition Tree)

**Metric:** Average Length of Stay grouped with test results.

**Result:**

Normal: 15.55

Abnormal: 15.51

Inconclusive: 15.47

**Purpose:** To understand if diagnostic outcomes impact the length of stay in the hospital.

There is slight variation seen, but very minimal.

#### Count of Medical Condition by Test Results (Pie Chart)

**Metric:** Count of medical conditions among different test results.

**Insight:**

Normal: 33.56%

Abnormal: 33.07%

**Inconclusive:** 33.36%

**Interpretation:** almost evenly distributed; there is no real variability, thus not necessarily going to see variance in the actual diagnosis even if there is variance in test outcome.

### 3.3.2 Environmental Section

This section is explored by using two visuals, Avg Billing Per Day by Year (Line Chart) & Count of Medication by Length of Stay and Medical Condition (Matrix Table).

**Avg Billing Per Day by Year (Line Chart)**

**Metric:** Avg billing amount per patient per day, reported yearly from 2019 - 2024.

**Insight/Trends:**

Decrease in 2020 (likely pandemic-related)

Increase in 2022-2023

Decreased again in 2024

**Use:** Supports budget projections and planning for cost mitigation.

**Count of Medication by Length of Stay & Medical Condition (Matrix Table)**

**X-Axis:** Medical Condition

**Y-Axis:** Length of Stay

**Metric:** Number of medications prescribed

**Insight:**

The most medications prescribed for Hypertension and Obesity.

More medications are prescribed with longer length of stay.

**Use:** Identifies high-cost and high-intervention medical conditions.

### 3.3.3 Legal Section

This section is explored by using two visuals, Avg Billing Per Day by Year (Line Chart) & Count of Medication by Length of Stay and Medical Condition (Matrix Table).

#### **Count of Medical Condition by Admission Type (Donut Chart)**

**Metric:** Total cases per admission type (Elective, Urgent, Emergency).

**Insight:** Even distribution:

Emergency: 33.47%

Elective: 32.92%

Urgent: 33.61%

**Use:** Compliance monitoring and categorization of admission types for regulatory reporting.

#### **Total Number of Patients by Admission Type and Insurance Provider (Stacked Bar Chart)**

**Axes:** Admission Type vs % of patients

**Legend:** Insurance Providers (Aetna, Blue Cross, Cigna)

**Insight:** Uniform patient distribution across insurance providers for each admission type, each covering ~20% share.

**Use:** Ensures no bias or dependency on any single insurance provider in critical care scenarios.

## 4 RECOMMENDATIONS

The following recommendations & justifications are derived through the dashboard.

Area	Recommendation	Justification
Insurance	Broaden payer mix beyond Medicare and Aetna	Reduce political and reimbursement risk
Condition Management	Implement bundled payment models for high-cost conditions (e.g., Cancer)	Control billing variance and reduce financial risk
Technology	Use predictive modeling to flag high-cost patients early	Enable early interventions and care coordination
Labor Planning	Prepare for a geriatric care surge by hiring/trainings	Ensure adequate workforce for future demand
Inventory	Automate medication forecasting based on usage trends	Prevent drug shortages and cut procurement costs
Legal Readiness	Conduct periodic audits on billing and diagnostics	Ensure compliance and avoid penalties

## 5 DASHBOARD SIGNIFICANCE FOR STRATEGIC PLANNING

**Visualization of Risk Areas:** Each PESTEL factor is supported with graphs or KPIs.

**Data-Driven Decision Making:** Visuals guide executive focus on cost, care access, and infrastructure.

**Interactive Filters:** Dashboards allow slicing data by insurance, hospital, month, and more.

## 6 CONCLUSION

The dashboard supports strategic insight generation through a structured PESTEL lens. From billing efficiency to technology upgrades and demographic targeting, the visualized data forms a foundation for sustainable, risk-mitigated

## 7 REFERENCES

- Healthcare Industry Wikipedia [https://en.wikipedia.org/wiki/Healthcare\\_industry](https://en.wikipedia.org/wiki/Healthcare_industry)
- Selection of dataset from Kaggle <https://www.kaggle.com/>
- PESTEL analysis <https://libguides.libraries.wsu.edu/c.php?g=294263&p=4358409>
- Microsoft. (2024). Data Analysis and Visualization with Power BI. Coursera. Retrieved from <https://www.coursera.org/learn/data-analysis-and-visualization-with-power-bi>