Framing the Analysis - Hospital Performance

[DAB 10X Support - Analytics Toolkit](https://docs.google.com/document/d/1-VqfVE-hPZLbFrUzvTBmLddKcsNQzIF4cF6kNKXmSFI/edit?usp=sharing)

## **Thoughts**

1. Find your problem statement, not use your data to create the problem statement.
2. Scorecards for the performance indicators.
3. “Without data, you’re just another person with an opinion.” William E. Demings
4. Define the data like an encounter. Do this in the [02-Data-Prep](https://docs.google.com/document/d/1q7AxvSCzmEtWBP5VU9ZGo_aubqxKPLPYgShI4KAO8r4/edit?usp=sharing) stage.

## 

## **References**

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## 

## **Introduction**

According to a Deloitte survey in 2025, hospital executives look to improve operational efficiencies and productivity gains this year. As part of the survey, a quarter of the surveyed executives listed “improve consumer experience, engagement, and trust” as one of the priorities in 2025 by leveraging the use of data like Electronic Medical Record (EMR) to improve patient outcomes.1

Using data to analyze a hospital performance have values like improving operational efficiency, minimizing financial risks and increasing savings, or enhancing patient outcomes.2

## **Problem Statement**

Massachusetts General Hospital (MGH) executives have poor visibility of the hospitals’ performance. Data are often fragmented, time-consuming to prepare, and decentralized. This has caused the executives to miss out opportunities to improve patient outcomes and internal operations. They would like to have a dashboard to monitor, analyse and take strategic & operational adjustments based on their hospital’s performance indicators.

How can executives in MGH take actionable insights based on the key performance indicators?

## 

## **Stakeholders involved**

**Chief Financial Officer**

I can report the financial performance of the hospital to the board using the dashboard.

**Chief Operating Officer**

I can report the operating performance of the hospital to the board.

**Billing Specialists**

I can extract financial info like average cost per visit or % procedures covered by insurance.

[**Case Managers**](https://www.casemanagement.sg/about-us/about-case-manager/what-is-a-case-manager/)

[**Operations Managers**](https://www.indeed.com/career-advice/career-development/operations-hospital)

I can extract the operation information like total patients staying in the hospital, total encounters.

How many unique patients were admitted each quarter over time?

**Clinical Heads**

I can check which patients have the most readmissions to further understand / check in with these patients or the clinician treating these patients.

How many unique patients were admitted each quarter over time?

[Ambulatory](https://everynurse.org/what-is-ambulatory-care-nursing/) / Outpatient / Inpatient / Emergency Nurse

[**Patient Services Representatives**](https://info.pmimd.com/blog/what-is-a-patient-services-representative-and-why-is-this-role-critical-in-healthcare)

I can check which patients have the most readmissions.

How many unique patients were admitted each quarter over time?

## 

## **Objectives / Goals**

1. Enable hospital stakeholders to clearly & quickly understand the performance of the hospital through dashboard and reports.
2. Enable hospital stakeholders to take actionable insights from the performance dashboard & reports.
3. Build a predictive model to estimate the readmission risk of a patient.

## **Success Metrics**

1. Hospital stakeholders can understand the dashboard & reports’ performance metrics within 3-minutes of viewing the visualization.
2. Hospital stakeholders are presented with 3 actionable insights from the performance dashboard & reports.
3. The predictive model achieves an accuracy value of 75% on testing data.

## 

## **Analysis Approaches**

1. Develop hypotheses for the analysis.
   1. How good is the hospital performing?
2. Data Collection.
3. Perform Exploratory Data Analysis to know the data. As part of this analysis, perform the:
   1. Descriptive Statistic Analysis,
   2. Diagnostic Analysis,
   3. Predictive Model Analysis,
   4. Prescriptive Analysis,
   5. Features definition
4. Perform data cleaning where required.
5. Perform feature engineering where required.
6. Define, build, train, and test the predictive model.
7. Storyboard the analysis.

## 

## **Risks**

1. The dataset is a subset representation of patient records which do not represent the whole hospital data point to allow detailed analysis.

## **Assumptions**

1. The dataset does not represent the Covid-19 pandemic situation.
2. Prediction model is based only on the dataset without considering data after the patient has discharged like patients medication adherences.

## 

## **Datasets**

1. [Maven Hospital Challenge](https://mavenanalytics.io/challenges/maven-hospital-challenge/facee4d2-8369-4c87-a55e-e6c7ed2a42d8)

## Appendix:

### Maven Data Challenge Context

Build a top-level KPI dashboard to help a hospital's executive team quickly understand its recent performance in key areas.

For the Maven Hospital Challenge, you’ll play the role of an Analytics Consultant for Massachusetts General Hospital (MGH).

You’ve been asked to build a high-level KPI report for the executive team, based on a subset of patient records. The purpose of the report is to give stakeholders visibility into the hospital’s recent performance, and answer the following questions:

* How many patients have been admitted or readmitted over time?
* How long are patients staying in the hospital, on average?
* How much is the average cost per visit?
* How many procedures are covered by insurance?

The dashboard should scale to accommodate new data over time, but the CEO has asked you to summarize any insights you can derive from the sample provided.

### Analysis Segments

ENCOUNTERS OVERVIEW

-- a. How many total encounters occurred each year?

-- b. For each year, what percentage of all encounters belonged to each encounter class

-- (ambulatory, outpatient, wellness, urgent care, emergency, and inpatient)?

-- c. What percentage of encounters were over 24 hours versus under 24 hours?

COST & COVERAGE INSIGHTS

-- a. How many encounters had zero payer coverage, and what percentage of total encounters does this represent?

-- b. What are the top 10 most frequent procedures performed and the average base cost for each?

-- c. What are the top 10 procedures with the highest average base cost and the number of times they were performed?

-- d. What is the average total claim cost for encounters, broken down by payer?

PATIENT BEHAVIOR ANALYSIS

-- a. How many unique patients were admitted each quarter over time?

-- b. How many patients were readmitted within 30 days of a previous encounter?

-- c. Which patients had the most readmissions?

### Key performance indicators in a hospital

**Clinical Quality & Patient Safety**

1. **Mortality Rate:** Measures the number of deaths within a specific timeframe and patient population.
2. **Readmission Rate:** Tracks the number of patients readmitted to the hospital within a short period after discharge.
3. **Procedure time for the patient**:

**Operational Efficiency**

1. **Length of Stay (LOS):** Tracks the average duration of a patient's stay in the hospital. (Discharge date - Admission Date)

**Financial Performance**

1. **Average cost per discharge:** Measures the average cost of treating a patient and discharging them from the hospital. **Average cost per discharge = Total inpatient cost / Number of discharges**
2. **Average cost per treatment:** Measures all the expenses associated with a specific treatment or procedure, including direct costs, such as supplies and labor, and indirect costs, such as overhead and administrative expenses. Providers can use this KPI to confirm the efficiency and profitability of individual services by comparing the average cost per treatment to reimbursement rates. **Average cost per treatment = Total cost of providing treatment / Number of treatments provided**
3. **Payer Mix:** Payer mix shows the proportion of revenue that comes from different sources, including Medicare, Medicaid, private insurance, and self-pay patients, all of which reimburse at different rates. This KPI helps healthcare organizations track their revenue sources and their financial vulnerability to any changes in payer policies. By understanding payer mix, healthcare financial teams can fully grasp the distinctions among all types of payer, including their reimbursement rates and payment schedules, to mitigate risk and ensure a diverse payer mix. **Payer Mix = (Revenue from each payer source / Total Revenue) \* 100**

### Issues / Questions Faced

1. **How should I determine the type of predictive model (Regression or Classification) based on the dataset?**

Explore the dataset to see the features available to build a predictive model.

Ask Bernard for suggestions.

1. **Should I refer to work from the participants of the data challenges?**

The benefits of referring work from participants of the data challenge are:

* know what is considered as good analytic work,

The downsides of this are:

* my work may be influenced by the work of challenge submission