

HEALTHCARE ANALYTICS

PROJECT REPORT ON UNITED STATES HOSPITALS PATIENT SATISFACTION 2016-2020



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1. Introduction

The purpose of this study is to highlight the significance of patient happiness in the healthcare delivery system. In healthcare industry is very vital for all the hospitals to build a reputation based on great patient satisfaction, excellent service quality etc. The Centers for Medicare and Medicaid Services (CMS) have made modifications since the Affordable Care Act (ACA) went into effect by linking Medicare reimbursements to patient satisfaction ratings. This has caused hospitals across the country to concentrate more on evaluating patient experience. To achieve this, hospital management must demonstrate a strong commitment to patients. It demands work from a strategy, quality monitoring system, provider engagement, and communication plays in addition to the dedication of nurse professionals, providers, and staff. The patient wants to be treated respectfully in hospitals and health systems, starting with the hospital staff greeting them, how well nurses or doctors introduce themselves to help the patient, answering the patient's questions carefully, and appreciating their visit with respect and understandable language are all steps that need to be taken. Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey data provide insight into patient experiences in US hospitals. The motivation for this research is to investigate patient satisfaction from US hospitals as well as the delivery of healthcare service quality dimensions to ensure patient satisfaction. It is difficult for public healthcare providers to maintain their standards and achieve high performance due to intense competition in the healthcare sector. The analysis will be useful and can help healthcare organizations improve their overall performance in areas such as service quality dimensions, trust, and reputation, which are key factors in our opinion. These elements can help the organization achieve a high level of patient satisfaction.

2. Business Problem

Now a days Healthcare providers are under more pressure to provide better service quality and facing issue in building trust and establishing a good reputation. The hospital industry faces many challenges in terms of providing high quality services, building trust, and maintaining a positive reputation regarding patient satisfaction. As a result of the above factors, healthcare organizations have a significant impact on the quality of service as well as the level of satisfaction of their patients.

3. Objective

The analysis will be useful and can help healthcare organizations improve their overall performance and achieve a high level of patient satisfaction. Data insights gained from this analysis can be used to make objective and meaningful comparisons between hospitals and their services that are meaningful to patients. Patient feedback encourages hospitals to improve patient care. At Last, the benefit is enhanced accountability in health care because it increases transparency about the quality of hospital care provided.

4. Data Collection

The HCAHPS (Hospital Consumer Assessment of Healthcare Providers and Systems) is a survey instrument and data collection methodology developed for measuring patients' perceptions of their hospital experiences. Data from the survey will allow comparisons between hospitals on topics that are important to consumers to produce objective and meaningful data.

In addition, hospitals are motivated to improve the quality of care when survey results are made public & Public reporting also enhances accountability in health care by enhancing the transparency of the quality of hospital care provided in return for public funding.

The Centers for Medicare & Medicaid Services (CMS) uses a five-star quality rating system to measure the experiences Medicare beneficiaries have with their health plan and healthcare system - the Star Rating Program. Health plans are rated on a scale of 1 to 5 stars, with 5 being the highest. CMS attempts to take into consideration how well patients are treated by the healthcare service provider.

5. About the Survey

HCAHPS Survey emphasize critical aspects of hospital experiences (communication with nurses, communication with doctors, responsiveness of the hospital staff, communication about medicines, discharge information, care transition, cleanliness and quietness in the hospital environment, overall rating of the hospital, and recommendation of the hospital).

6. ANALYSIS QUESTIONS

- Which hospital needs improvement based on the patient feedback? (Based on the rank, city, top 10, or top 5)
- What are the parameters that the hospital must consider improving services
- Which Hospital Ownership has the most satisfaction rate
- What is the number of critical access hospitals needed in a city based on its mortality rate?
- In which hospital did the patients receive the best emergency care?
- What has been the overall performance of hospitals between 2016 and 2020?? Are certain locations getting better or worse overall?
- How has the readmission rate in hospitals changed over time in a particular area??
- According to the cities, which hospital type (government, private, defense) is the most famous?
- Which hospitals offer patients the highest level of safety?

7. EXPLORATORY DATA ANALYSIS(EDA)

7.1 Dataset description

This Survey is conducted by federal government of United States. Federal Government has given the responsibility to HCAPS survey team to work on this. After finalizing the research topic, we found the data in Kaggle for our further analysis. This data set contains patient survey responses from 2016 to 2020 for US (Government, Private and Tribal Hospitals).

The dataset contains 5 CSV files for the consecutive years 2016 to 2020. There are 43 features with 1.5 million records. This data set divided into 3 parts:

- Assess patients' perspectives on care by collecting data
- Hospitals to improve quality of care
- Enhance accountability in health care by increasing transparency of the quality of hospital care

7.2 Column description and data type

Feature Names	Feature Description
1.Facility ID	Facility Medicare ID
2.Facility Name	Name of the facility
3.Address	Facility street address
4.City	Facility City
5.State	Facility State
6.ZIP Code	Facility ZIP Code
7.County Name	Facility County
8.Phone Number	Facility Phone Number
9.HCAHPS Measure ID	HCAHPS Patient Survey Measure Name
10.HCAHPS Question	HCAHPS Patient Survey Question
11.HCAHPS Answer Description	HCAHPS Patient Survey Answer
12.Patient Survey Star Rating	Overall rating for survey item
13.HCAHPS Answer Percent	Percent of surveys with question answered
14.HCAHPS Linear Mean Value	HCAHPS Patient Survey question linear mean value
15.Number of Completed Surveys	Number of completed surveys for hospital. N-size.
16.Survey Response Rate Percent	Hospital survey response rate.
17.Start Date	Survey collection period start date
18.End Date	Survey collection period end date
19.Year	CMS data release year
20.Hospital Type	What type of facility is it?
21.Hospital Ownership	What type of ownership does the facility have?
22.Emergency Services	Does the facility have emergency services Yes/No?
23.Meets criteria for promoting interoperability of EHRs	Does facility meet government EHR standard Yes/No?
24.Hospital overall rating	Hospital Overall Star Rating 1=Worst; 5=Best. The aggregate measure of all other measures
25.Mortality national comparison	Facility overall performance on mortality measures compared to other facilities
26.Safety of care national comparison	Facility overall performance on safety measures compared to other facilities
27.Readmission national comparison	Facility overall performance on readmission measures compared to other facilities
28.Patient experience national comparison	Facility overall performance on pat. exp. measures compared to other facilities
29. Effectiveness of care national comparison	Facility overall performance on effect. of care measures compared to other facilities
30. Timeliness of care national comparison	Facility overall performance on the timeliness of care measures compared to other facilities
31. Efficient use of medical imaging national comparison	Facility overall performance on efficient use measures compared to other facilities

7.3 Incomplete, Missing or Invalid Records

Steps to perform EDA

1. Merged the 5 years data using Python and identify the useful columns
2. Dropped 21 Columns which were not relevant
3. Fixed the Structural Errors (Naming Convention, Improper Capitalization, incorrect word use)
4. 87 Survey Questions trimmed down text of long description
5. Grouped the 87 Survey questions and answers into 12 values using SQL
6. Removed the “Not Available” and “NA” Data using SQL

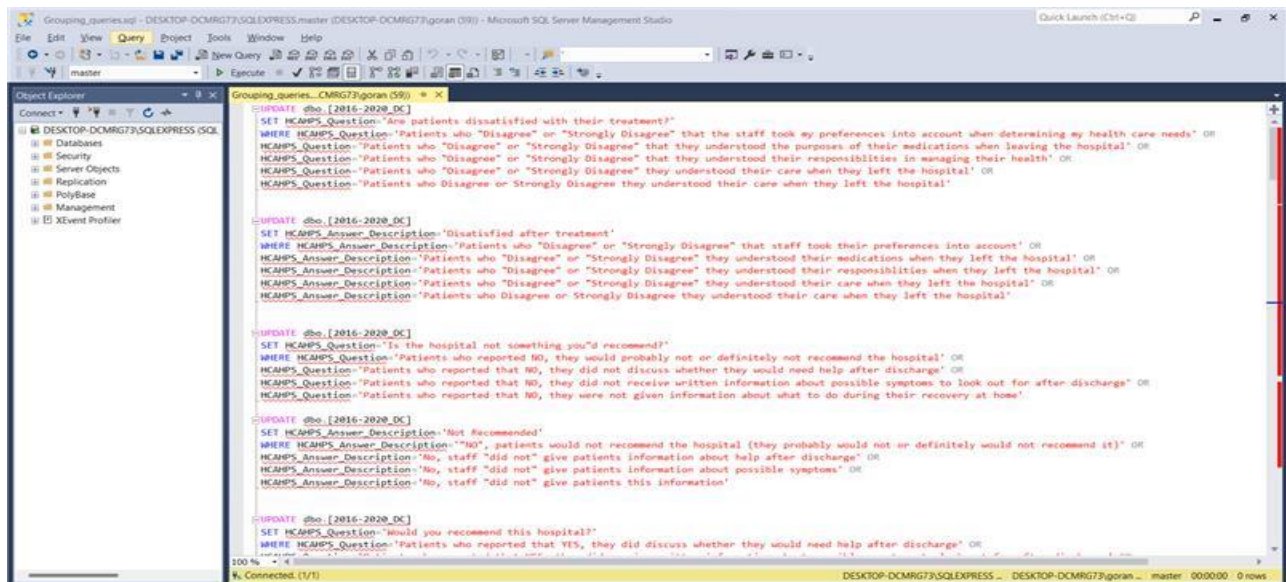
Unclean Data Screenshot

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City 0
State 0
ZIP Code 0
County Name 2400
Phone Number 0
HCAHPS Measure ID 0
HCAHPS Question 0
HCAHPS Answer Description 0
Patient Survey Star Rating 0
Patient Survey Star Rating Footnote 1576857
HCAHPS Answer Percent 0
HCAHPS Answer Percent Footnote 1306957
HCAHPS Linear Mean Value 0
Number of Completed Surveys 0
Number of Completed Surveys Footnote 1147394
Survey Response Rate Percent 0
Survey Response Rate Percent Footnote 1147394
Start Date 0
End Date 0
Year 0
Hospital Type 0
Hospital Ownership 0
Emergency Services 0
Meets criteria for promoting interoperability of EHRs 213032
Hospital overall rating 0
Hospital overall rating footnote 1211841
Mortality national comparison 0
Mortality national comparison footnote 1177732
Safety of care national comparison 0
Safety of care national comparison footnote 909346
Readmission national comparison 0
Readmission national comparison footnote 1317091
Patient experience national comparison 0
Patient experience national comparison footnote 1183381
Effectiveness of care national comparison 0
Effectiveness of care national comparison footnote 1243604
Timeliness of care national comparison 0
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Efficient use of medical imaging national comparison 0
Efficient use of medical imaging national comparison footnote 1019564
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Unclean Data Screenshot

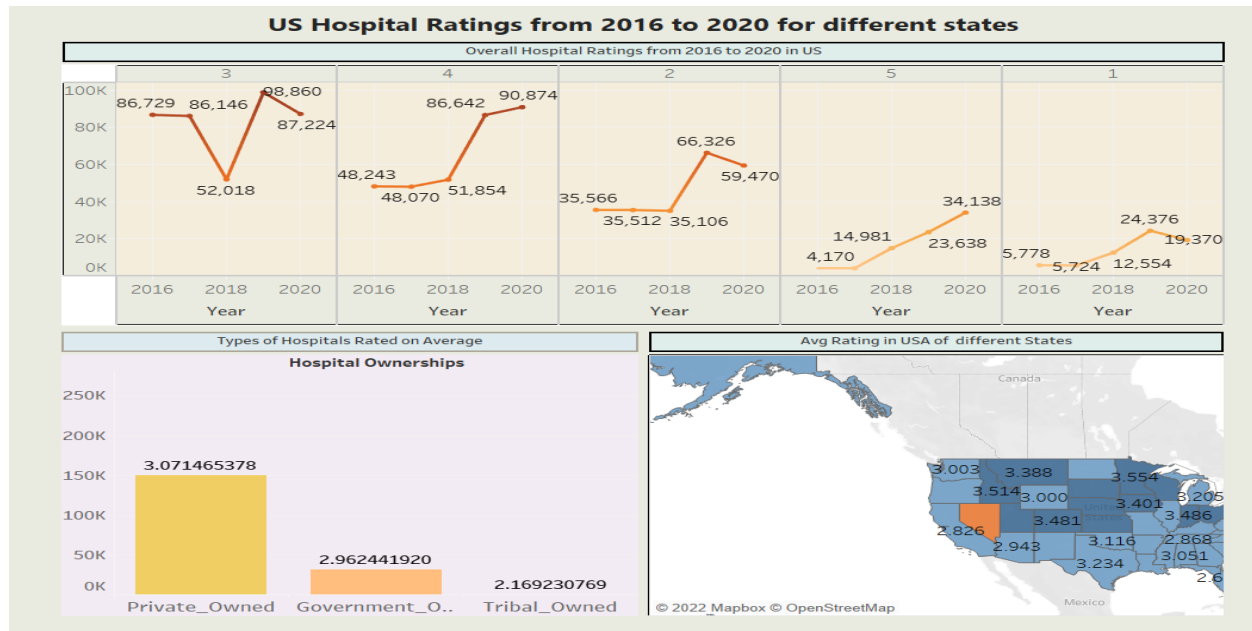
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State 0
ZIP Code 0
County Name 0
Phone Number 0
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HCAHPS Answer Description 0
Patient Survey Star Rating 0
HCAHPS Answer Percent 0
HCAHPS Linear Mean Value 0
Number of Completed Surveys 0
Survey Response Rate Percent 0
Start Date 0
End Date 0
Year 0
Hospital Type 0
Hospital Ownership 0
Emergency Services 0
Meets criteria for promoting interoperability of EHRs 0
Hospital overall rating 0
Mortality national comparison 0
Safety of care national comparison 0
Readmission national comparison 0
Patient experience national comparison 0
Effectiveness of care national comparison 0
Timeliness of care national comparison 0
Efficient use of medical imaging national comparison 0
dtype: int64
```

87 SURVEY QUESTIONS TRIMMED DOWN TEXT OF LONG DESCRIPTION



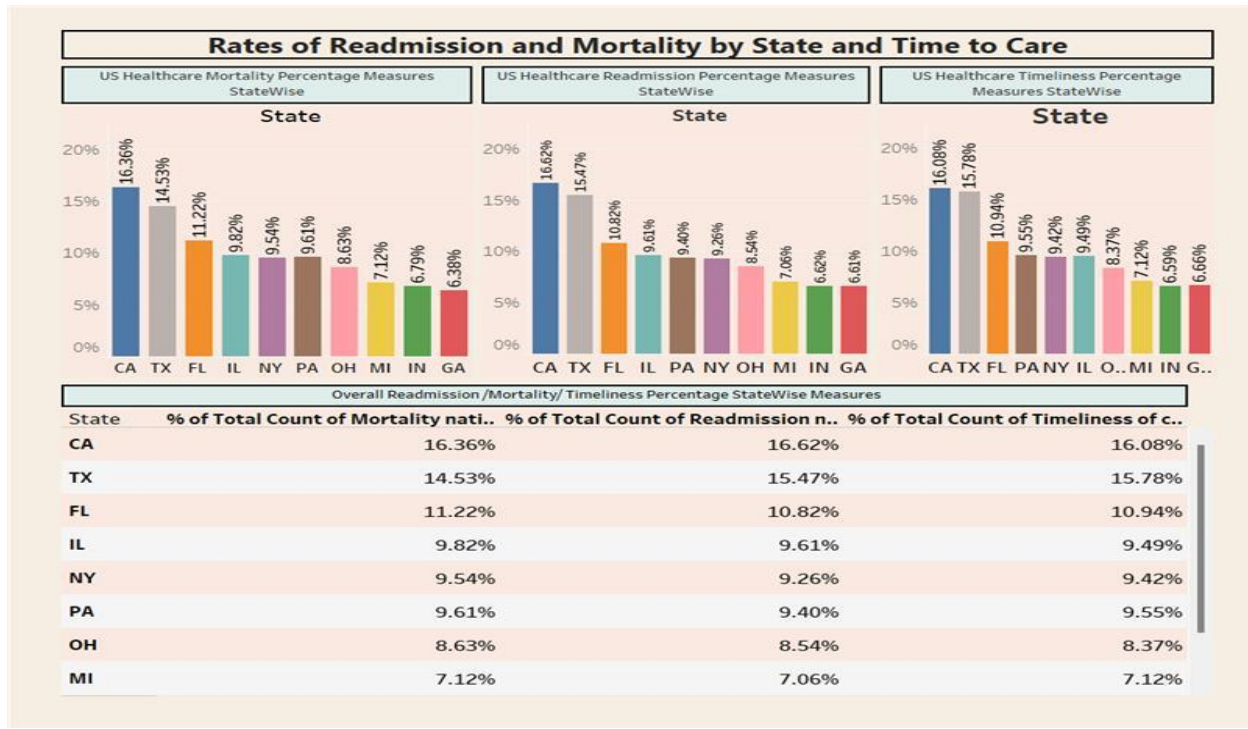
8. Data Visualization & Dashboards

DASHBOARD1: US HOSPITAL RATINGS FROM 2016 TO 2020 FOR DIFFERENT STATES

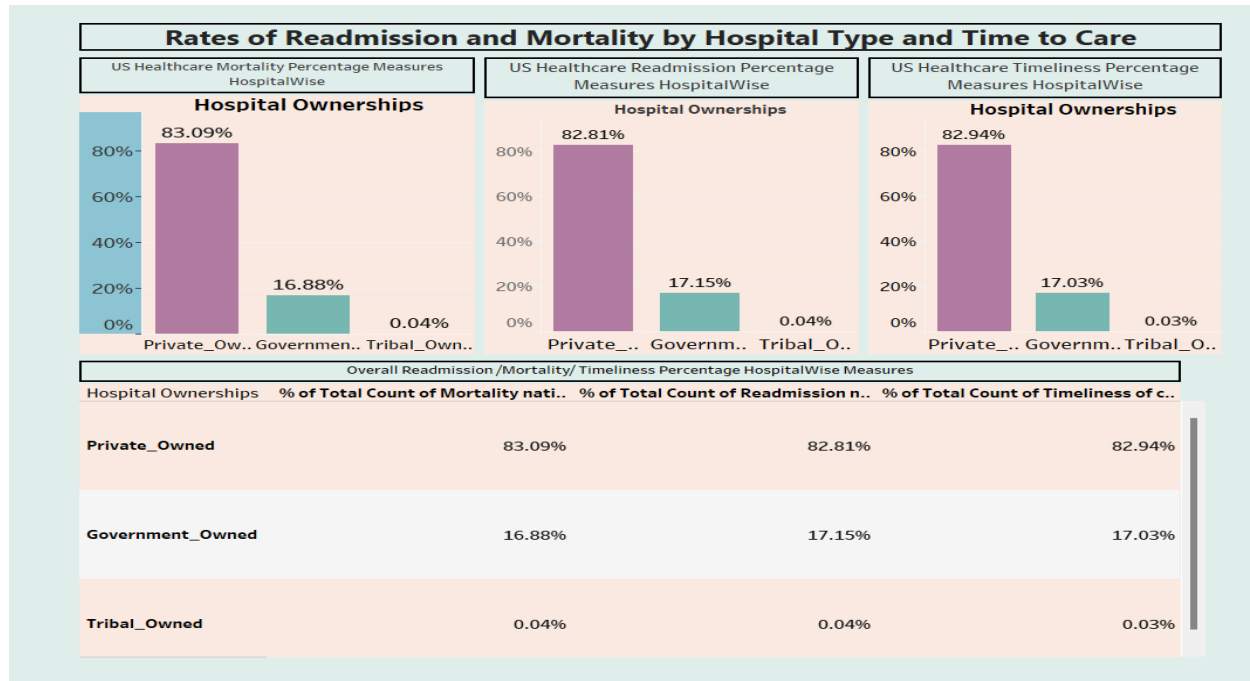


DASHBOARD1 INSIGHTS:

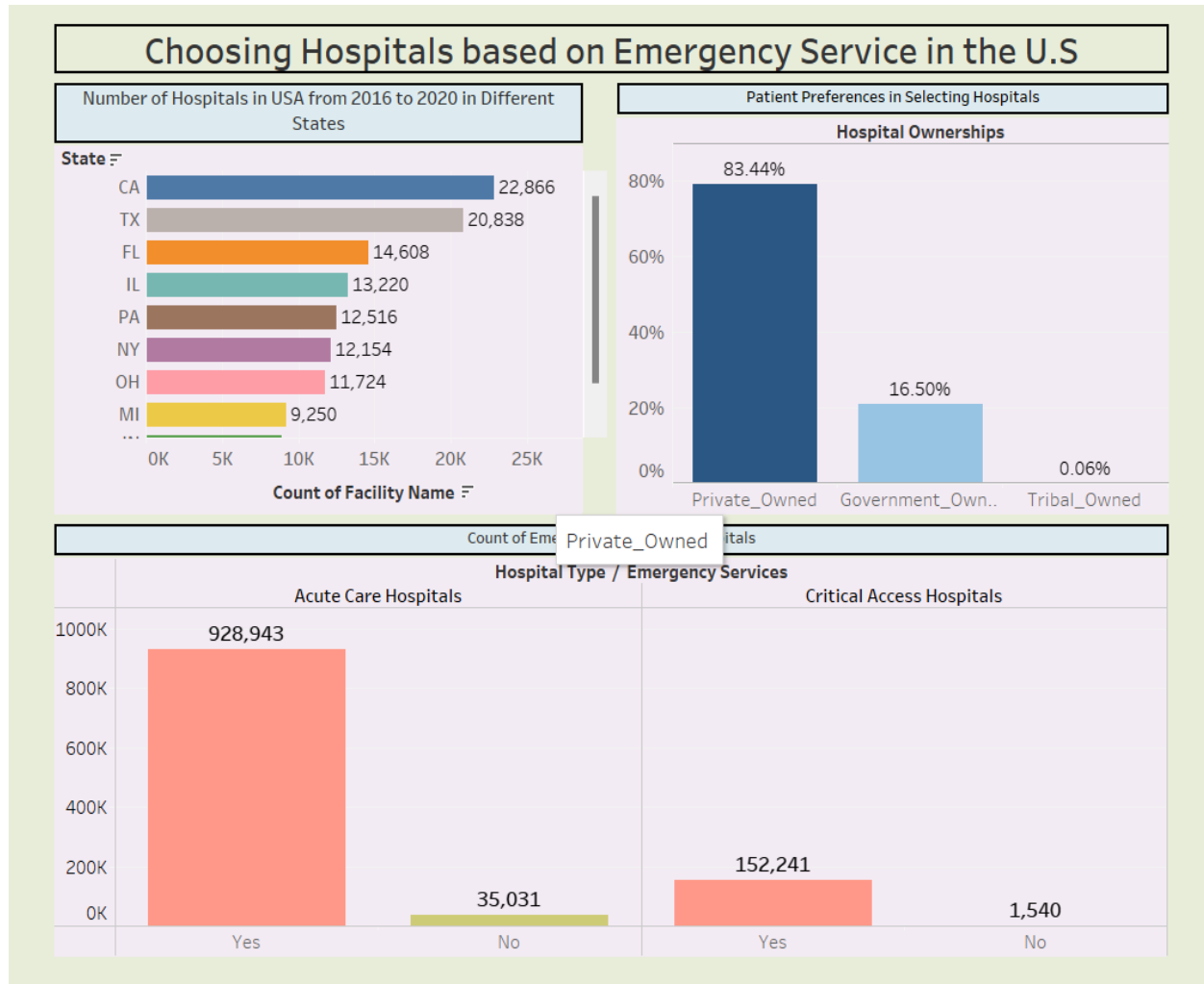
- In the United States, most hospitals have a rating of 3 or 4
- In the United States, we have three types of hospitals: governmental, private, and tribal. Privately owned hospitals have the highest average rating of 3.07, whereas tribal hospitals have the lowest average rating of 2.16.
- The third visualization provides us with an average rating for all the hospitals in that state

DASHBOARD2: RATES OF READMISSION AND MORTALITY BY STATE AND TIME TO CARE**DASHBOARD2 INSIGHTS:**

- This shows the mortality, readmission and timeliness percentages of the top 10 hospitals in the United States, with California & Texas having the highest %'s and Georgia coming in last.

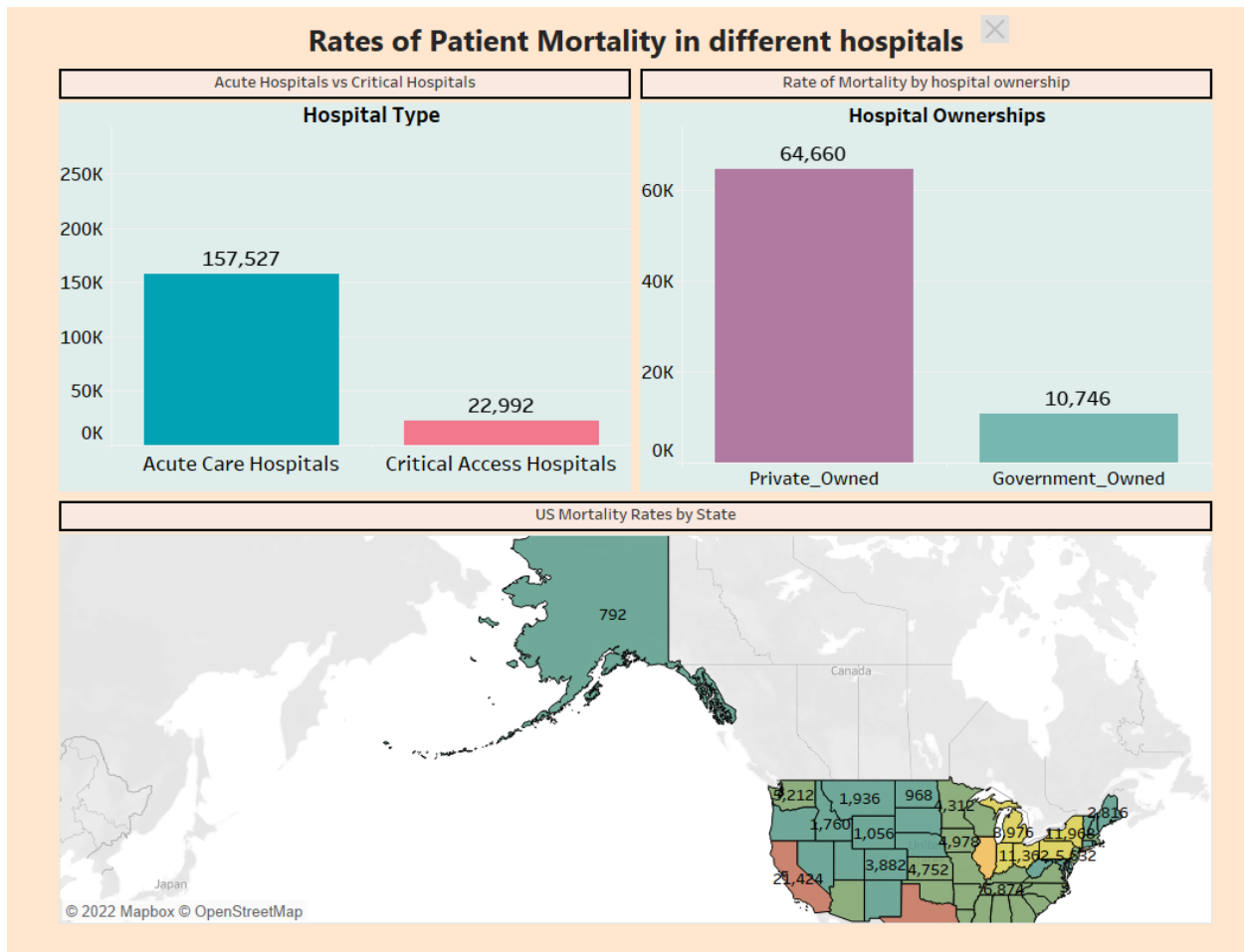
DASHBOARD 3: RATES OF READMISSION AND MORTALITY BY HOSPITALS AND TIME TO CARE**DASHBOARD3 INSIGHTS:**

- This dashboard illustrates readmission rates, mortality rates, and timeliness of care at different levels of care including government, private, and tribal hospitals, and shows that private care has the highest admission rates and mortality rates of over 80%, which means that the right treatment isn't being given.

DASHBOARD 4: CHOOSING HOSPITALS BASED ON EMERGENCY SERVICES IN THE U.S**DASHBOARD4 INSIGHTS:**

- Among US states, California & Texas have the most hospitals with over 20K beds
- There is a preference among Americans for private hospitals across all states, while tribal hospitals were the least preferred.
- An acute care hospital is one that provides the highest number of emergency services, while a critical care hospital provides the least amount of emergency services.

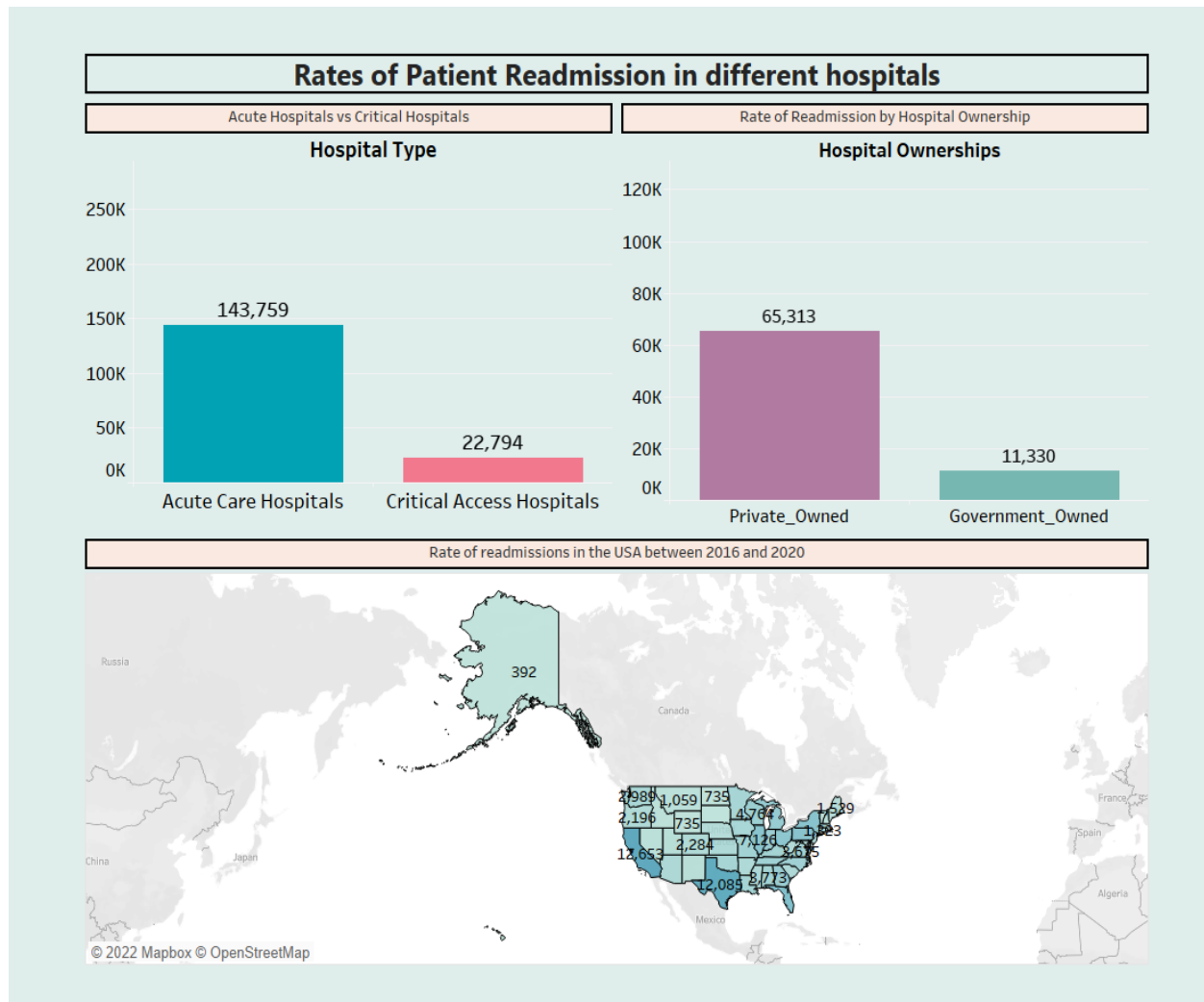
DASHBOARD 5: RATES OF PATIENT MORTALITY IN DIFFERENT HOSPITALS



DASHBOARD5 INSIGHTS:

- The Dashboard shows us the mortality rate in acute & critical care hospitals, indicating that acute care hospitals have the highest mortality rates.
- The mortality rate for private hospitals is 64,660, which is five times the mortality rate for government-owned hospitals.
- California and Texas have the highest mortality rates in the United States, with roughly 20K deaths.

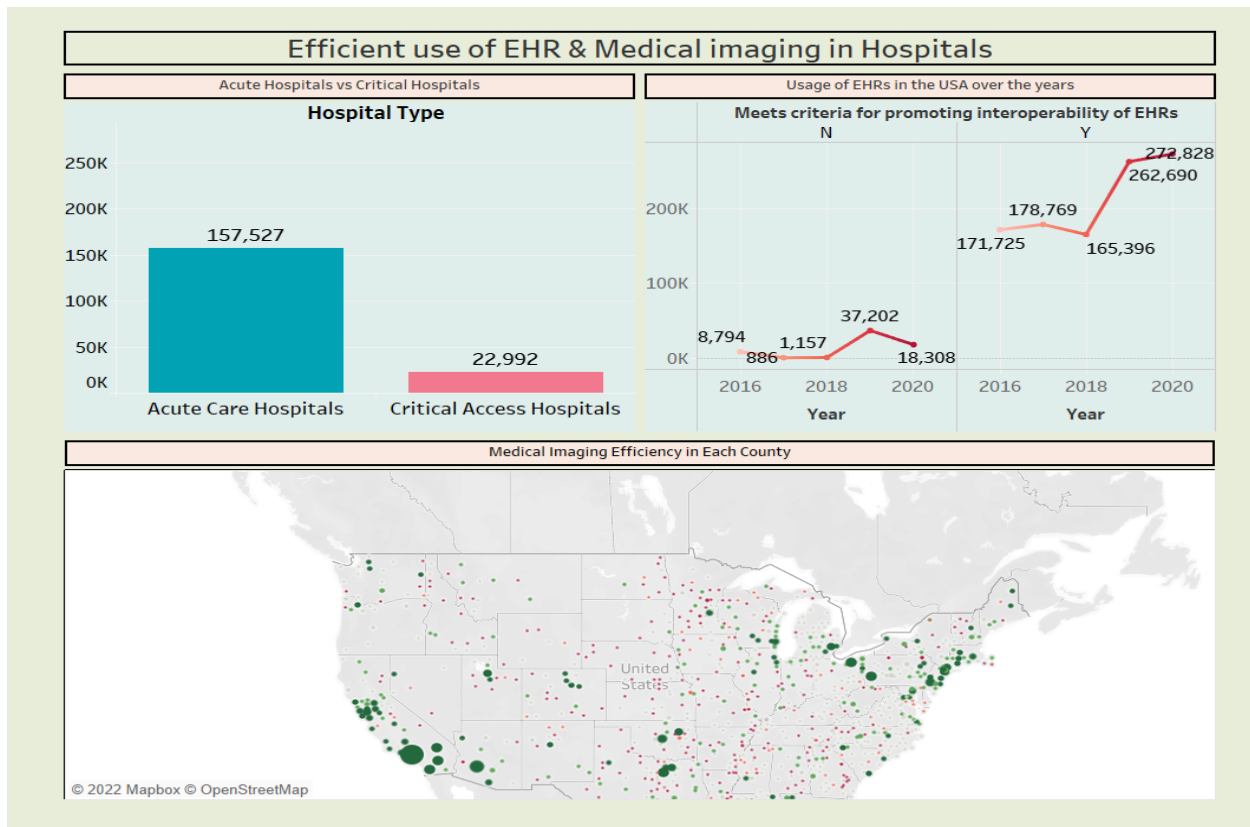
DASHBOARD 6: RATES OF PATIENT READMISSION IN DIFFERENT HOSPITALS



DASHBOARD 6 INSIGHTS:

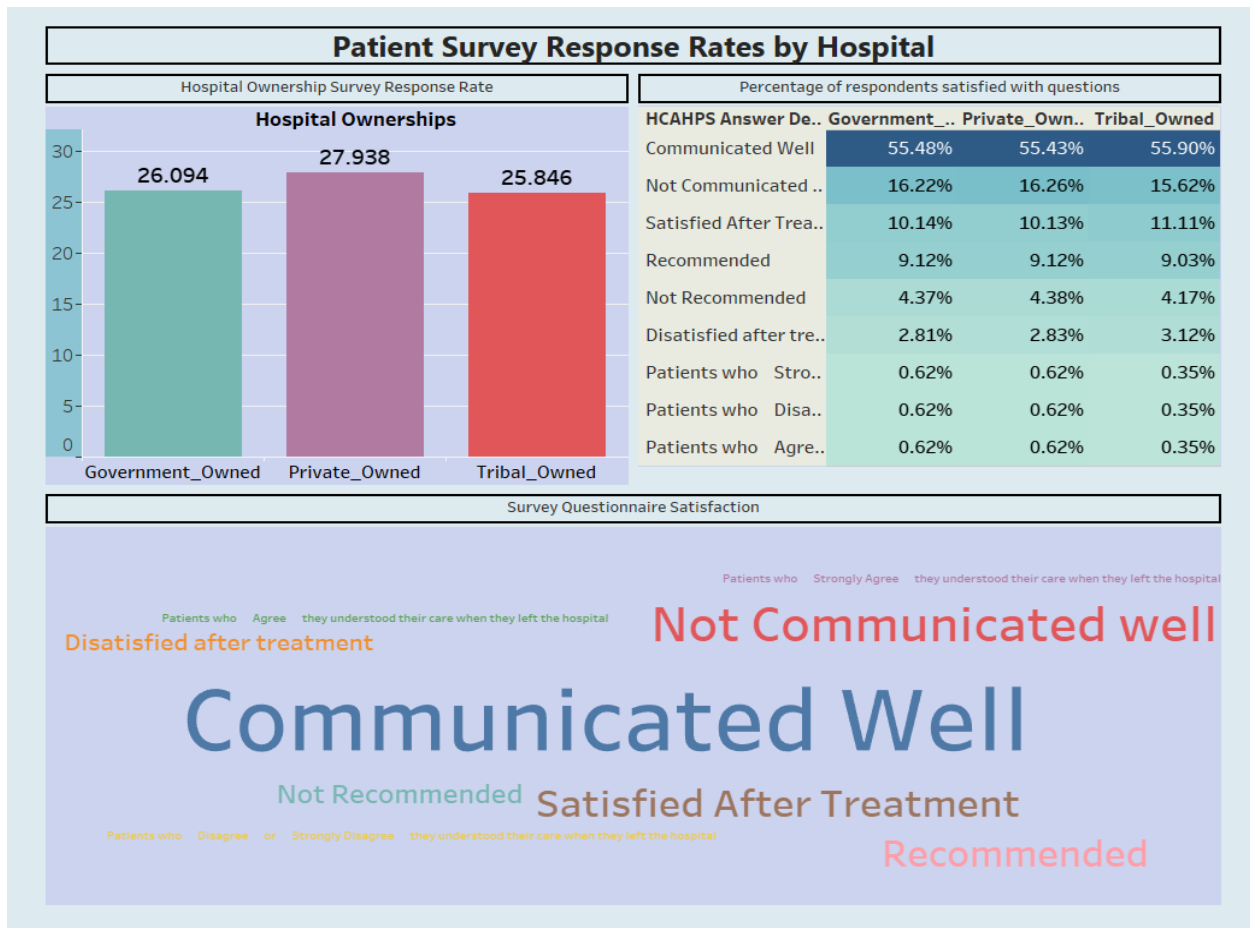
- The Dashboard shows us the readmission rate in acute & critical care hospitals, indicating that acute care hospitals have the highest readmission rates.
- The readmission rate for private hospitals is 65,313 which is five times the readmission rate for government-owned hospitals.
- California and Texas have the highest mortality rates in the United States, with roughly above 10K readmission rates.

DASHBOARD 7: EFFICIENT USE OF EHR & MEDICAL IMAGING IN HOSPITALS



DASHBOARD 7 INSIGHTS:

- A dashboard shows how efficiently the hospitals are using the Electronic Health Records, with nearly 87% of hospitals using EHR in acute care hospitals, while some critical care hospitals don't employ EHR.
- The number of hospitals using EHR efficient over the years has increased over the years with 1,71,725 hospitals using EHR in 2016 and 272,828 hospitals using EHR in 2020 which is a 62% jump from 2016 to 2020.
- In Los Angeles all the hospitals are efficiently using medical imaging.

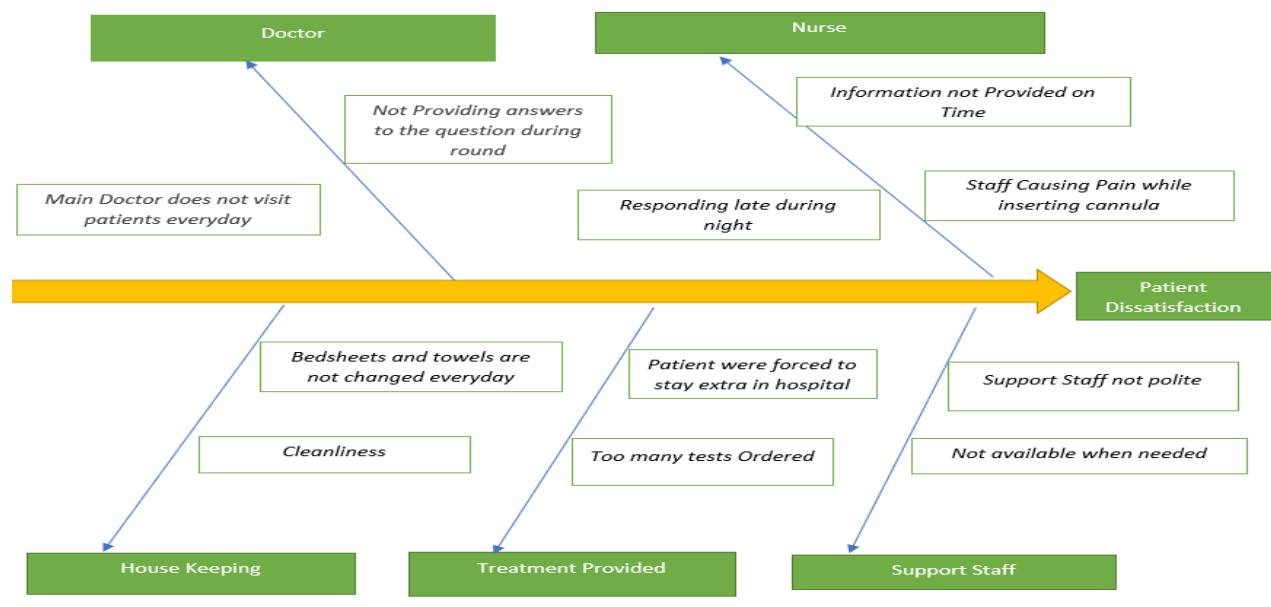
DASHBOARD 8: PATIENT SURVEY RESPONSE RATES BY HOSPITAL**DASHBOARD 8 INSIGHTS:**

- Above dashboard depicts the Patient survey response rate by hospital. Survey responses were slightly high in the private hospitals as compared to government and tribal owned hospital.
- Approximately 55% of patient responded in survey that doctor and nursing staff communicated well.
- To conclude, patient preferred mostly private hospitals to their treatment as they were satisfied with the staff with respect to clearing their queries and concerns.
- All Hospitals in United States should focus on other survey questions where they got the less response from the patient.

9. PRESCRIPTIVE ANALYSIS AND RECOMMENDATION

Prescriptive analysis provides us with options and identifies the best possible solution in terms of selecting the hospitals by patient. How hospitals can satisfy the patient by providing them the best service. Prescriptive analytics, on the other hand, provides you with a deep insight into those maintenance-related issues. We are representing below the fish bone diagram to identify why patient are dissatisfied with the hospital services and what are the possible ways hospitals can improve their services to satisfy the patient.

Identify Root Cause



- There are five factors that can contribute to the satisfaction of patients that we have identified.
- Providing timely information is crucial when communicating with the patient, and hospitals should have the appropriate staff trained to treat pain.
- It is important that hospital rooms are cleaned and disinfected at least twice a day.
- Providing the prescribed treatment to the patient should be the doctor's responsibility
- Whenever a patient need assistance; support staff should be polite and available.

Scale of Importance for Patient Satisfaction

Most Important	Less Important
Staff cared	Wait time before doctor
Doctor concern for comfort	Nurse courtesy
Doctor explained	Nurse concern for privacy
Information to care for self at home	Staff permitted family and friends to be with patient
Doctor kept patient informed	Cleanliness
Nurse kept patient informed	Helpfulness of first person asking about condition
Information about delays	Wait time for radiology
Family and friends kept informed	Comfort during blood draw
Nurses attention to needs	Wait time before treatment area
Doctor listened	Comfort during radiology
Pain control	Personal insurance privacy
Doctor courtesy	Radiology staff courtesy
Respect for privacy	Waiting area comfort
Nurses listened	Ease to provide insurance
Courtesy to family and friends	Courtesy taking insurance
	Wait time of staff notice

10. CONCLUSION

- Most hospitals receive three-star ratings.
- In the US, Texas & California had the highest mortality & readmission rates
- Hospitals owned by private companies have the highest mortality and readmission rates
- Hospitals were found in California to be the most numerous
- The majority of patients preferred to be treated in private hospitals
- The maximum number of emergency services were available in acute care hospitals.
- In the past few years, EHRs and medical interoperability have improved
- Doctors and nurses communicated well during their treatment, which resulted in a higher response rate to the survey
- In comparison to other hospitals, the private owned hospitals had a higher patient response rate

11. CONTRIBUTIONS

Name	Contribution
Nishi Shrivastava (0770047)	<ul style="list-style-type: none"> • Performed the EDA • Worked on Dashboard 3 • Prepared the Fish Bone Diagram • Worked on the Project Report • Worked on the Presentation
Gorantla Hemant Chowdary (0788804)	<ul style="list-style-type: none"> • Merged the 5 years (2016, 2017, 2018, 2019 and 2020) csv files into one file using Python Programming language. • Performed the EDA (Data Cleaning) • Worked on the Dashboard 1 • Worked on the Dashboard 2 • Worked on Project Report
Prayas Baliyan (0754457)	<ul style="list-style-type: none"> • Worked on the creating the baseline for the for some of the columns and guided the team. • Worked on the Dashboard 8 • Worked on the Project Proposal
Muhammad Haleem Burney (0755577)	<ul style="list-style-type: none"> • Working on the changing the long description text to short performed the task in SQL. • Worked on the Dashboard 7 • Worked on the Presentation
Mohammad Mazhar Noor (0756090)	<ul style="list-style-type: none"> • Helped in removing the large number of "Not available" & "NA" from our dataset using SQL and Python. • Worked on the Dashboard 5 • Worked on the Dashboard 6

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<https://www.hcahpsonline.org/>