Capstone Decision Paper

Clinical Decision in healthcare

Prof. John Hebeler

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Department of Information Systems

University of Maryland Baltimore County

Contents

1. Executive Summary

Health care in the United States is provided by many distinct organizations. According to the World Health Organization (WHO), the United States spent more on healthcare per capita. Many different datasets are needed to portray different aspects of healthcare in the US like disease prevalence, pharmaceuticals, and drugs, Nutritional data of different food products available in the US.

The current inefficiency and unpredictable quality are longstanding problems which are mostly caused by the deficiency of detailed records. The ability to integrate various records, created by effectively using a detailed health record enhances the healthcare professional's ability to provide the reliable and successful knowledge-intensive health care delivery, avoid medical errors, improve quality, enhance efficiency, and have an elevated point of contentment and accomplishment during the proving of healthcare service. Thus by gathering different datasets, we can make a decision that will improve the efficiency of the healthcare industry.((Jalal-Karim, A., and W. Balachandran,2018))

The medical activity requires responsibility not only based on knowledge and clinical skills, but also in managing a vast amount of information related to patient care. It is through the appropriate treatment of information that experts can consistently build a strong policy of welfare. The primary goal of decision support systems (DSSs) is to provide knowledge, models, and data processing tools to help experts make better decisions in several situations. They aim to resolve several problems in health services to help patients and their families manage their health care by providing better access to these services.

This dataset will show you how the price for the same diagnosis and the same treatment and in the same city can vary differently across different providers. It might help you or your loved one find a better hospital for your treatment. You can also analyze to detect fraud among providers.Also, data allows you to compare the quality of care at Medicare-certified hospitals across the country. Thus we contact the appropriate health provider.

2. Business Decision

Healthcare organizations require a system which provides a more efficient and accessible method of complete healthcare reporting so that it could help clinicians to access the required vital segments of electronic patient records at different levels, increase analyst productivity, and gain more visibility and control over the costs and quality of healthcare system operations.(Jalal-Karim, A., and W. Balachandran,2018)

Estimating the importance of various characteristics that go into attributing to improve the healthcare industry. This paper finds various things like how the price for the same diagnosis and the same treatment and in the same city etc.

There are many tools and techniques which use graphs, charts, or models that can be used to make business decisions. So, for our project, we used two datasets which are Hospital rating and Hospital charges statistics and tools to model using different approaches that help us to make decisions on how the price for the same diagnosis and the same treatment and in the same city can vary differently across different providers so that we can decide the best hospital according to rating and type diseases diagnosed more in a particular state so that we can provide medicine according to that in that particular state, etc.

3. Decision Opportunity/Justification

In the case of hospital analysis, it is not the one aspect that the healthcare industry should consider. The broader view of hospital analysis gives the prediction of the number of diagnosed throughout the United States and the number of health problems per state so that it will help the healthcare sector to provide more facilities. For eg., Major Joint Replacement is an extremely common surgery performed in the states of Texas, Florida, and California this leads to deciding as most elder people live there so that we have to give medical service and plans according to that.

For the analysis, we are using Tableau and Datapine. Tableau is a powerful and fastest-growing data visualization tool used in the Business Intelligence Industry. It helps in simplifying raw data into a very easily understandable format. Data analysis is very fast with Tableau and the visualizations created are in the form of dashboards and worksheets.

With Datapine, users have a scalable data analysis software that they can configure easily to help them access their business intelligence. It has an intuitive drag and drop interface, limitless dashboards, and a wide selection of charts that allow them to dig deep into their data and make sense out of everything, even without extensive SQL and database.

4. Decision Context/Background

So to effectively address this problem, in this paper we will perform a basic exploratory analysis to identify any evident patterns relationships between independent variables. In this paper we allowed a reduced form model to conduct regressions and analysis using tableau and datapine tools for getting hospital statistics. We will be using the dataset which is available
https://www.kaggle.com/center-for-medicare-and-medicaid/hospital-ratings
https://www.kaggle.com/speedoheck/inpatient-hospital-charges

Here are some ways to make decisions by the insurance company to determine where to send its customers for surgery to make the process better and a more efficient and increasing number of emergency services in the area where there are fewer services. These datasets help in deciding that in a

particular state the number of people diagnosed with the particular disease so that hospitals can provide more services for that particular disease.

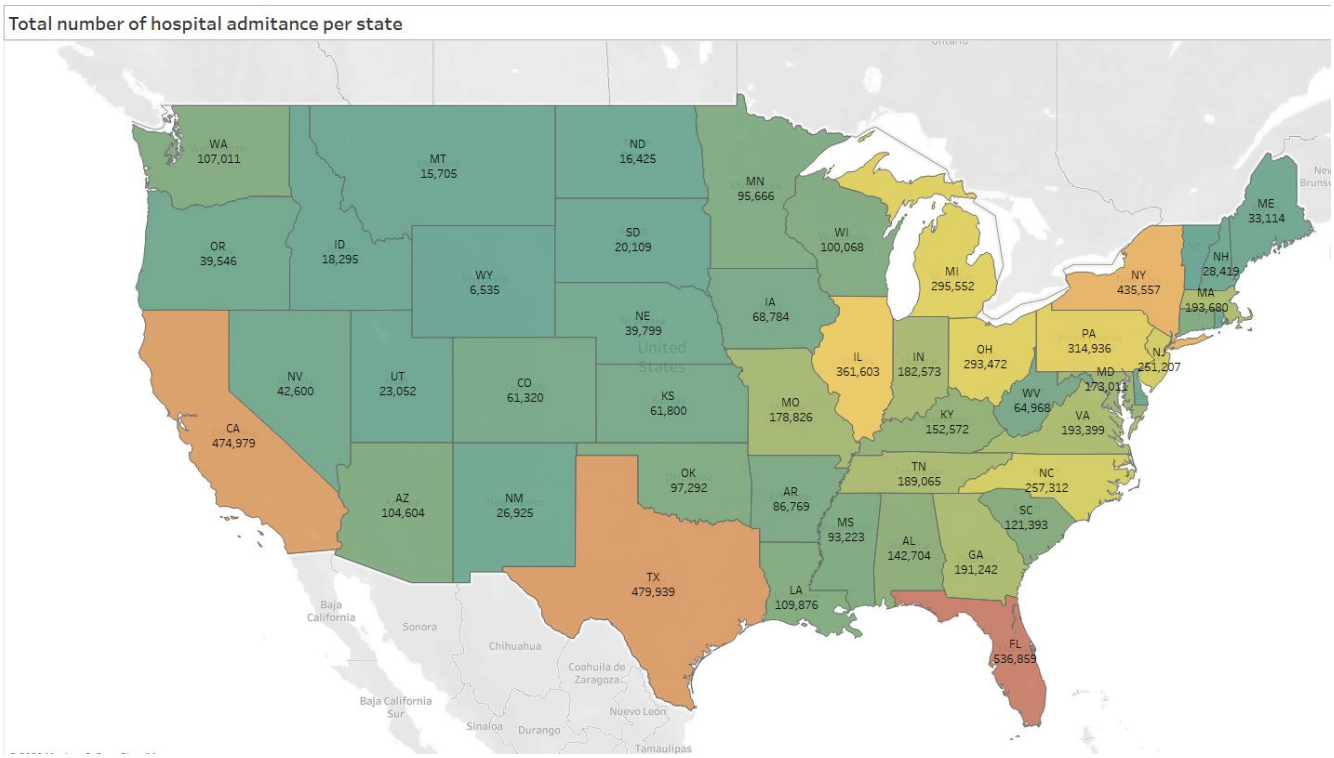
Decision 1

Inpatient Hospital Charges by state

This dataset is composed of 100 different Diagnoses, Provider State, Total number of discharges based on Average Covered Charges, Average Total Payments, and Average Medicare Payments. The most important aspect of the data shows you the number of discharges per state, depending on the average cost that was incurred.

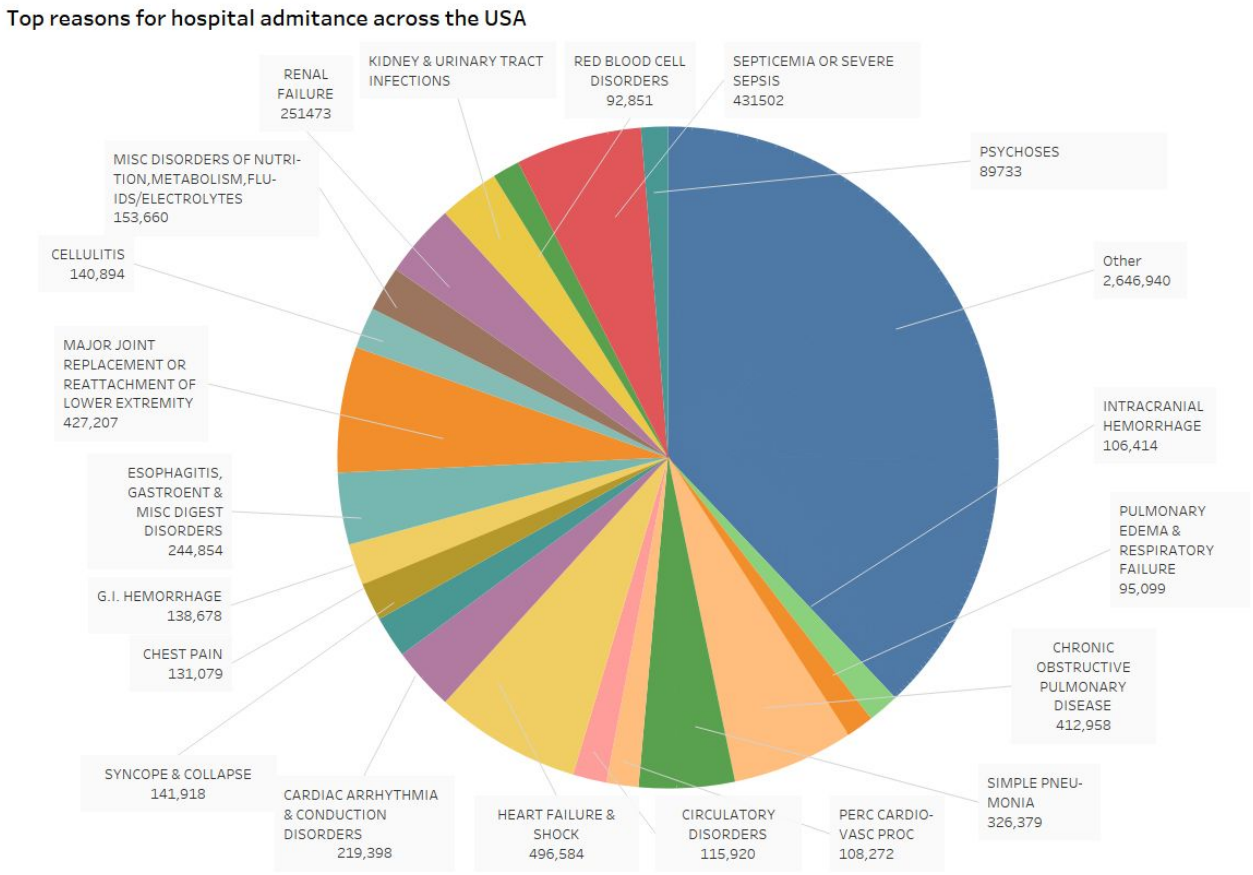
	DRG Definition	Provider State	Total Discharges	Average Covered Charges	Average Total Payments	Average Medicare Payments
2	039 - EXTRACRANIAL PROCEDURES	AL	91	$32,963.07	$5,777.24	$4,763.73
3	039 - EXTRACRANIAL PROCEDURES	AL	14	$15,131.85	$5,787.57	$4,976.71
4	039 - EXTRACRANIAL PROCEDURES	AL	24	$37,560.37	$5,434.95	$4,453.79
5	039 - EXTRACRANIAL PROCEDURES	AL	25	$13,998.28	$5,417.56	$4,129.16
6	039 - EXTRACRANIAL PROCEDURES	AL	18	$31,633.27	$5,658.33	$4,851.44
7	039 - EXTRACRANIAL PROCEDURES	AL	67	$16,920.79	$6,653.80	$5,374.14
8	039 - EXTRACRANIAL PROCEDURES	AL	51	$11,977.13	$5,834.74	$4,761.41

Row 2 through 8 indicate that in the state of Alabama, there were a total of 91 discharges. The average covered charges was $32,963 and the average total payment for this operation was $5,777 and finally the average medicare payments was $4,763. Using this data, we can determine different characteristics of health related issues in each state. For example we can determine that it is cheaper to get a surgery in one state compared to another state.



Inpatient charges throughout the United States:

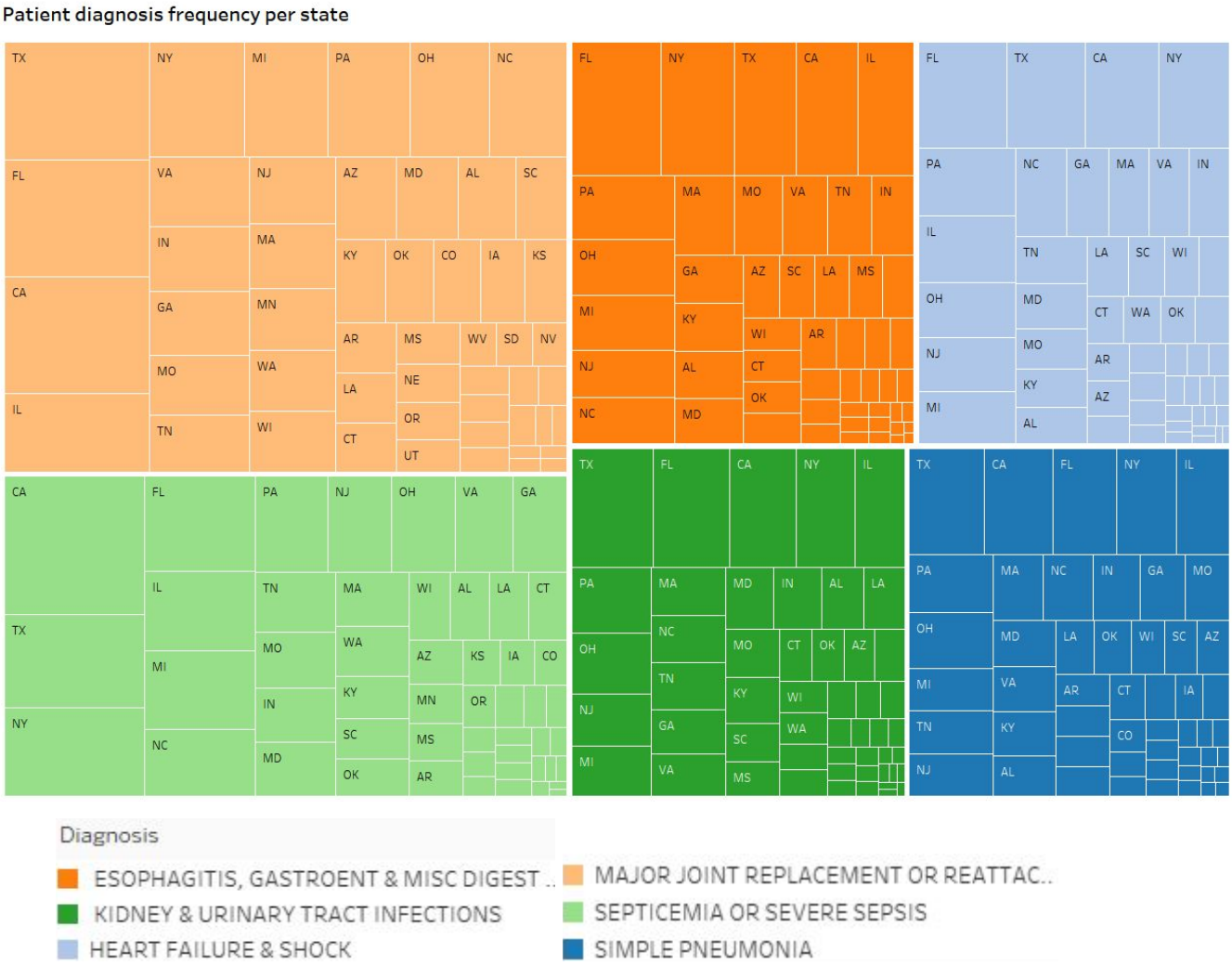
This graph shows the total number of people discharged from hospitals throughout the United State for a variety of medical reasons. The visualization shows a color gradient that is dependent on the total number of hospital visits by state, regardless of what they went to the hospital for. It is clear that certain states like California, Florida, New York and Texas have a higher number of hospitalizations and this is due to their higher population compared to other states like Montana or North Dakoda who have the least number of hospital visits. The differences between hospital visits is dependent on the total population of each state as statistically speaking, more people would visit hospitals if there were more people living in that state.



Top reasons for hospital admittance across the USA

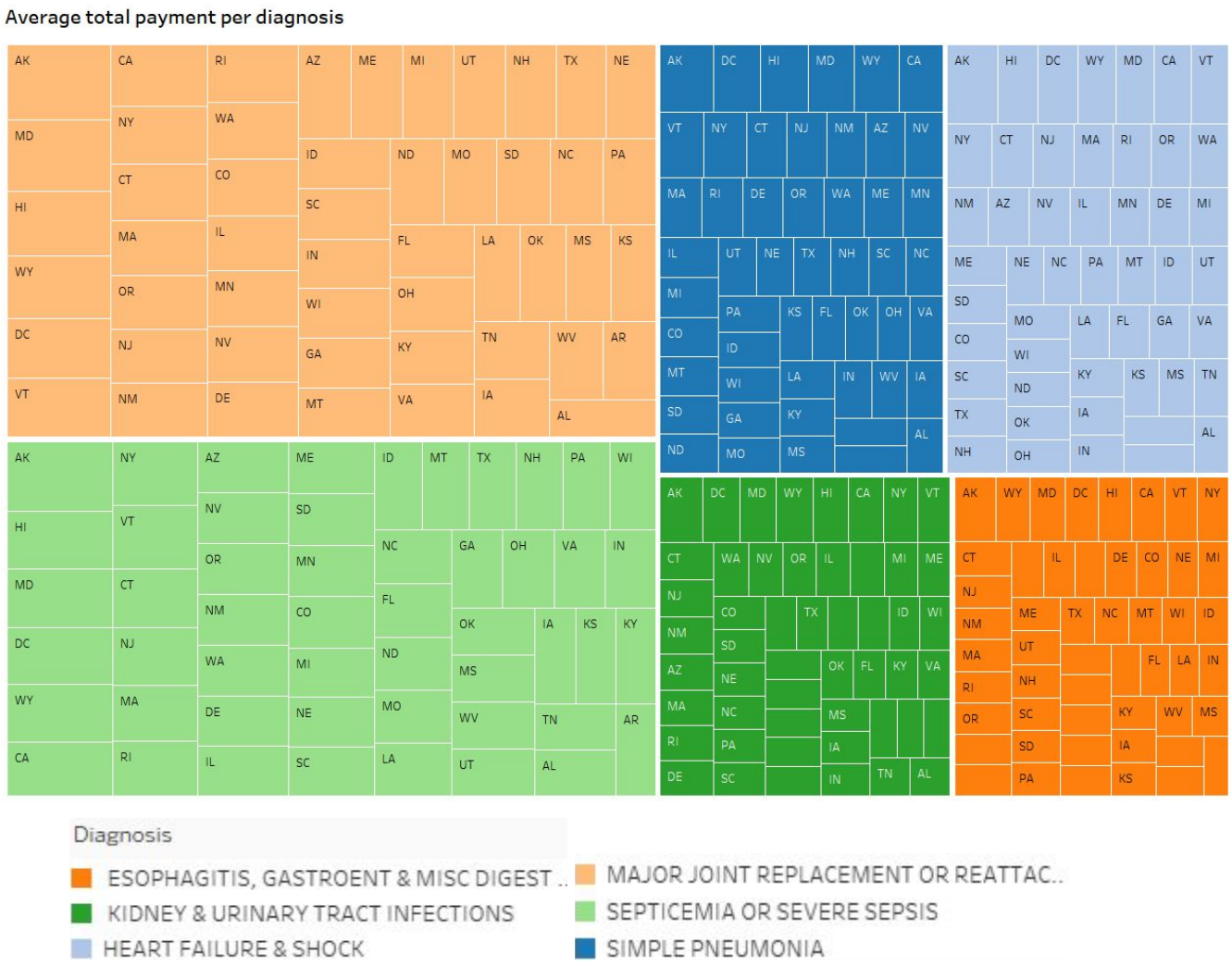
This pie-chart shows the total number of diagnoses throughout the United States which explains the reasons why people visit hospitals. In total there were 6,9753,318 hospital visits. Each of the different diagnoses in each state was compiled and grouped into the pie which gives us the different sections of the pie that indicate the respective number of visits per-diagnosis. The bottom %10 of diagnoses was grouped into another" group to separate it from the more common diagnoses. As can be seen, there are specific health problems that account for a significant majority of hospital visits in the United States. The top 5 reasons are: Esophagitis, Gastroent & misc Digestive disease, Kidney & Tract Infections, Heart Failure & Shock, Major Joint Replacement Surgery, Septicemia & Sepsis, and finally Simple

Pneumonia. These 5 health problems account for the majority of hospital visits throughout the United States.



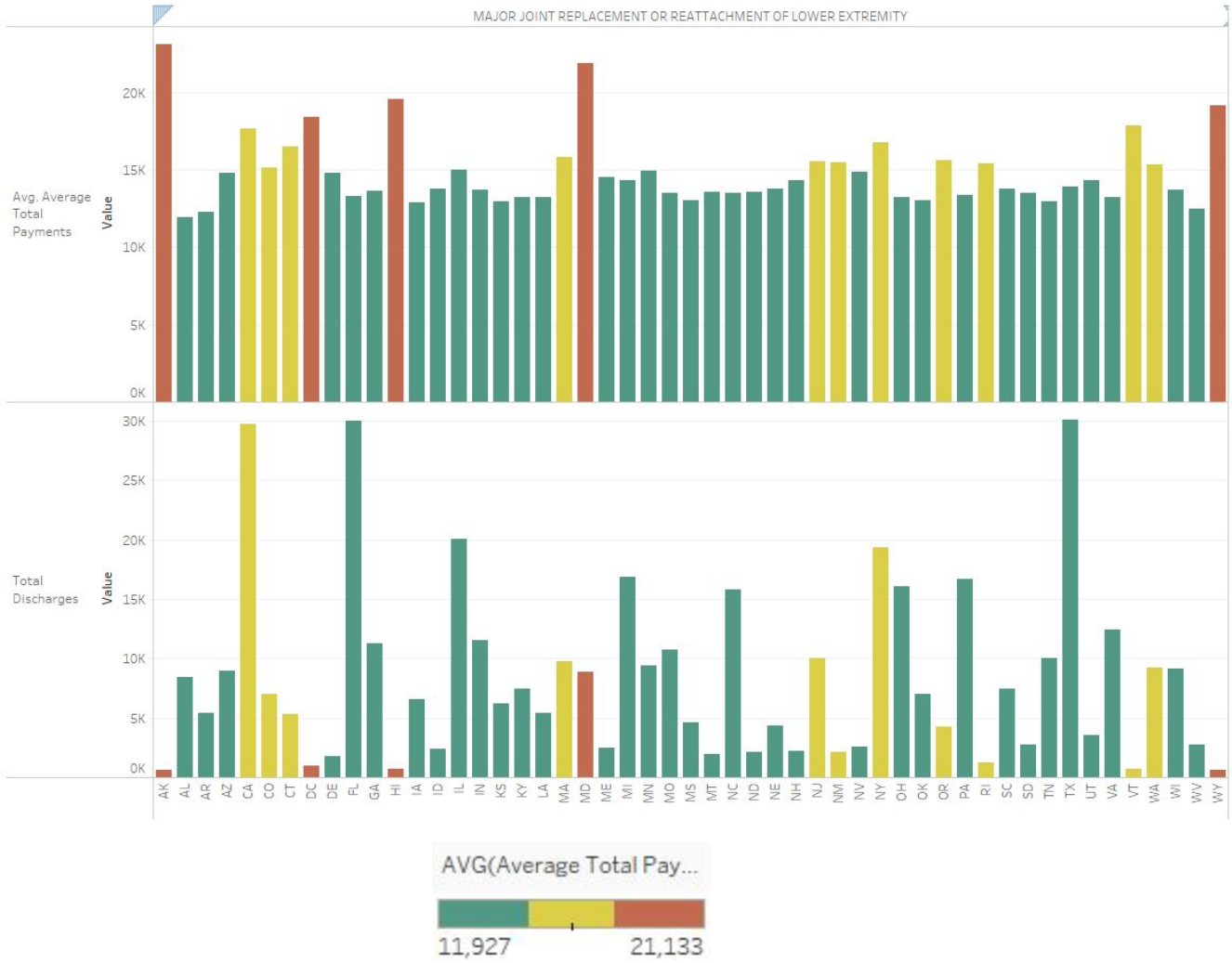
Patient Diagnosis frequency per state:

To analyze these 5 health problems further, we decided to correlate the number of diagnoses to each state. Thus, this three map shows the top 5 diagnoses and which specific state they impact the most. Major Joint Replacement is an extremely common surgery performed in the states of Texas, Florida and California. This leads us to conclude that there is a large majority of elderly living in these states, since that type of surgery is commonly operated on that age population. Comparatively speaking, that same procedure is seldom completed in the state of Alaska numbering at, 648.



Average total payment per diagnosis:

To determine how patients are impacted by their location, we correlated the average total payment for the top 5 diagnoses respective to each state. It can specifically show the average amount that a patient must pay for a surgery depending on where they live. The top surgery as stated before is Major Joint Replacement Surgery throughout the United States. In the states where these surgeries are mostly completed, the patient pays a lower amount compared to states where this surgery is less commonly done. For example, this surgery was most expensive in the state of Alaska, where this surgery was completed 648 times. On the other hand, in the state of Texas, where this surgery was completed the most, the price was extremely low on average. Thus we can create different assumptions and recommendations based on this data.



Major joint replacement cost:

This graph further illustrates the average cost of a Major Joint Replacement overlayed above the number of discharges per state. It is clear that in the states where these procedures are performed the least, that they also cost the most. This is apparent by the Orange colored states.

Decision ONE based on this dataset:

This data can be used by an insurance company to determine where to send its customers for surgery in order to make the process more better and more efficient. For example, while customers who require Major Joint Surgery in the state of California are not going to be paying an above average price for the surgery, it can be said that completing the surgery elsewhere is wiser. Not only will California customers be facing a long que in time since there are thousands of other California customers also require the same surgery, but they might not get the best service because of the fact that hospitals are so crowded. The best decision would be to send the California customers to complete the surgery in Arizona. Arizona is a neighboring state with California, has a very low surgery rate for that specific diagnosis and has a very low cost for the surgery.

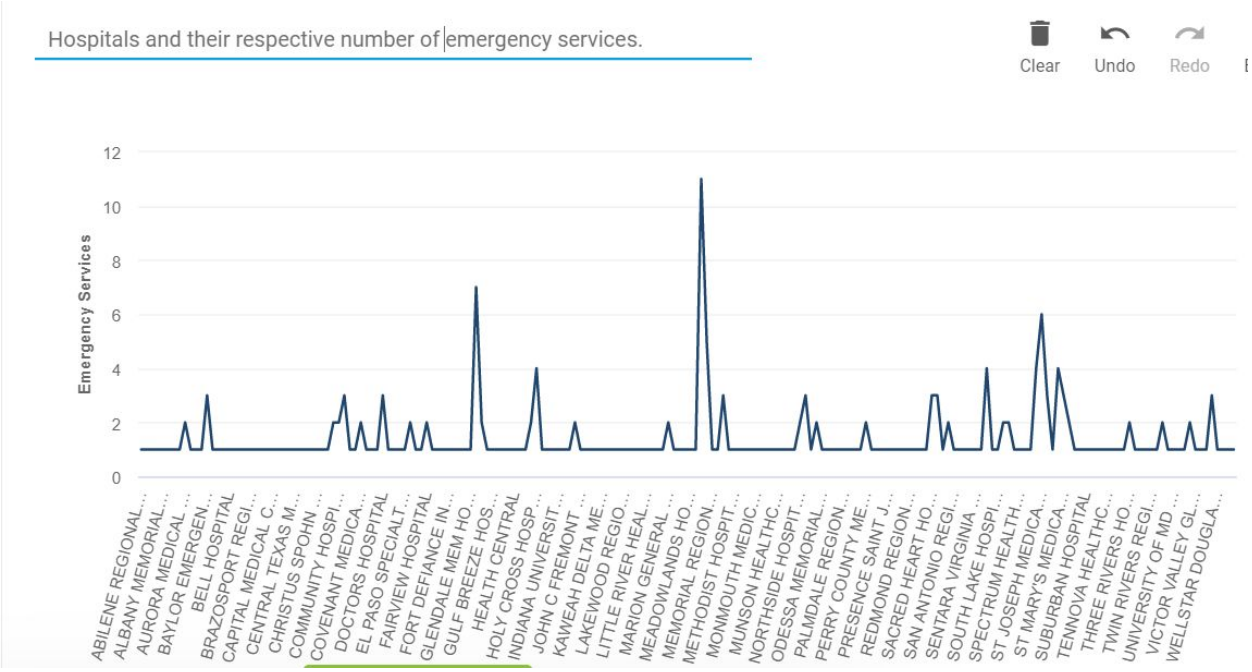
Decision TWO based on this dataset:

Another decision that can be made based on this dataset is on how to allocate different resources. There are several states that have a high demand in regards to services to their patients. These states include California, Floria, Texas and New York. The decision for this should be that more hospitals be built and staff to be employed by the state. In this way, patients in that state do not suffer through long waits or bad service because of overpopulation.

Decision THREE based on a different dataset. (Supporting the concept of decision two with a different dataset.)

A business decision with a health care domain. The decision is to find a county in a state with fewer hospitals and healthcare organizations to build/construct a hospital. The county or states considered for the analysis and visualisation are the states composing of above average population. The states are California, Texas, Florida, New York, Pennsylvania, Illinois, Ohio, Georgia, North Carolina, Michigan, New Jersey, Virginia, Washington, Arizona, Massachusetts, Tennessee, Indiana, Missouri, Maryland, Wisconsin. The dataset consists of attributes like hospital name, county, address, hospital type, emergency services, pincode etcetera. Each attribute has about 4813 entries and inputs.

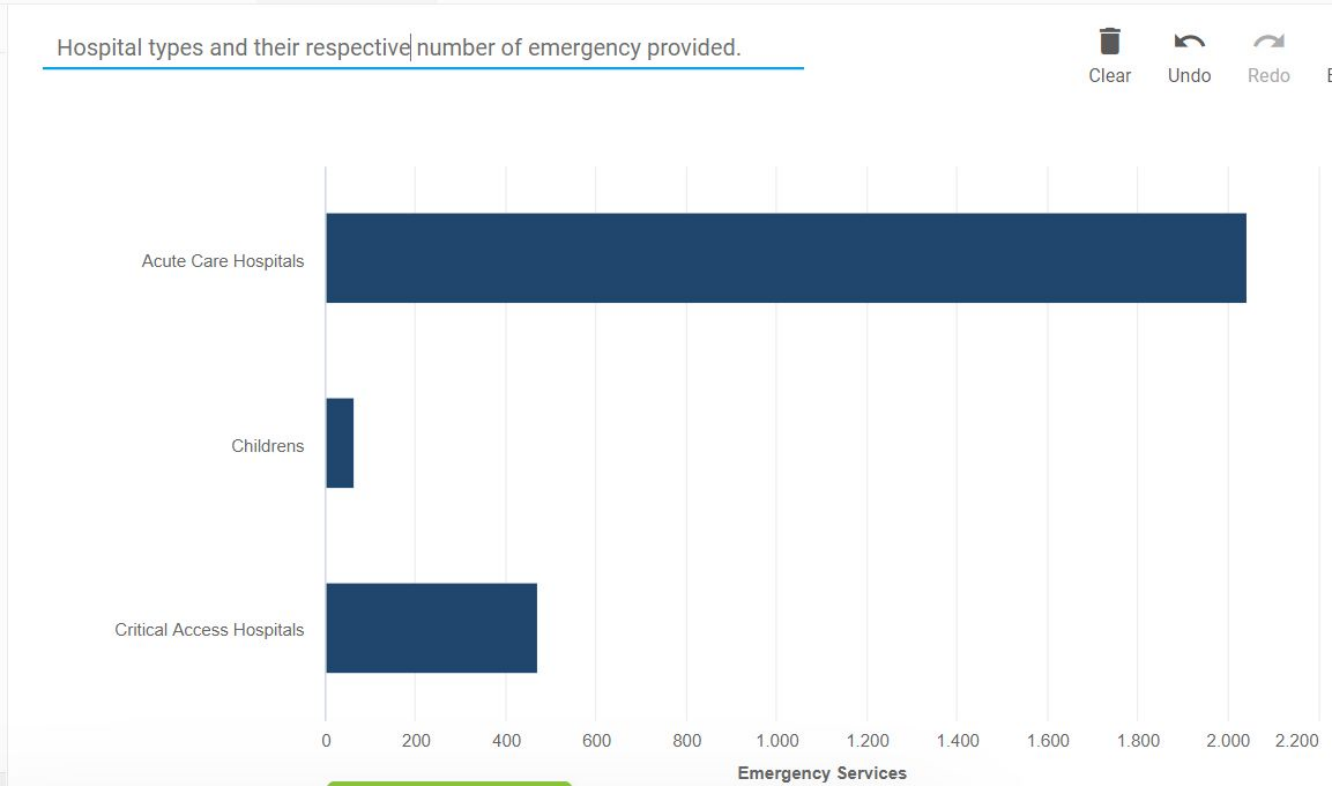
Three visualisations are depicted below. These visualisations are used to derive the supporting factors for the decision. The first visualisation shows the number of emergency services and their respective hospital names filtered by the above mentioned states. From the hospital names which have less emergency services, the state can be identified and a hospital providing more emergency services can be built there. Hence, increasing the possibility of profit. The second visualisation shows the hospital types and the number of services each hospital type provides. We can derive that Children's hospital usually provides less emergency services. So after we select the state to build/construct the hospital we can make a decision through second visualisation that the hospital type should be Children's hospital with more emergency services. Hence, we can decide the hospital type with the help of second visualisation. The third visualisation shows the hospital types and their respective overall ratings. From the visualisation we can see that Children's hospitals have fewer overall ratings when compared to the other two hospital types. Hence, the decision of constructing the hospital in a state/county providing fewer emergency services with the hospital type Children's and making an effort to increase the overall rating can directly reflect in the profits after construction.



Hospitals and their respective number of emergency services:

This line chart depicts the number of emergency services provided by each hospital in the following states: California, Texas, Florida, New York, Pennsylvania, Illinois, Ohio, Georgia, North Carolina, Michigan, New Jersey, Virginia, Washington, Arizona, Massachusetts, Tennessee, Indiana, Missouri, Maryland, Wisconsin. All the remaining visualizations are with respect to these states only.

Through this we can decide which states have hospitals with fewer emergency services and a decision can be made regarding which state should be considered for construction of the hospital providing more emergency services. The state offering fewer emergency services can be considered for construction. In the next diagram we selected all the states which gave information about the number of emergency cases per state.



Hospital types and the number of emergency services provided by each hospital type:

The above bar chart depicts the three types of hospitals namely Children's hospital, Acute care hospitals and Critical Access Hospitals and their respective emergency services.

So, we can decide which hospital type has fewer emergency services and can start constructing that type of hospital. In this case it is a children's hospital. It can be observed that Children's hospital has fewer emergency services and the hospital types to be constructed can be Children's hospital.

Hospital types and the count of overall ratings for each hospital type:

The above line chart depicts the types of hospital and their respective overall ratings.

Overall ratings of each hospital type can be observed and this can support the decision of constructing the hospital. The decision of which hospital type should be constructed with respect to the overall ratings can be made. Through this visualisation the Children's hospital has lower overall rating. This supports our main decision of constructing a hospital and helps us decide the hospital type for construction.

The above visualizations include the measures to be considered while implementing the business decision. These visualizations help in providing minimum knowledge and inputs about the construction of hospitals. The data mining methodologies and techniques help in the visualization and analysis process. Hence, the visualizations ease the effort contributed by each individual with a business decision.

5. Decision Assumptions

The cost of the hospitalization is based on the location of the hospital and the charges are different in different hospitals the treatment level also affects the cost. The tax on the healthcare department also varies from state to state. Maybe the tax is low in Arizona compared to California. States like New York have higher inpatient records the data shows the population is the reason for higher inpatient record, but we do not know about the habits and daily activities of the people of New York we need to consider this data also not being hygiene is also a reason for health issues. Building hospitals and making them affordable to people is based on state income if the GDP of the state is good then the

government has a chance to give tax benefits to the healthcare industry. There are lots of things that affect the total cost while going out from a hospital: the medicine, ICU charges, inpatient stay charges for all these segments charges changes based on location, hospital, and company.

6. Decision Factors Explanation and justification

Quality of care Across the Country

A government needs to maintain a record of data to verify the quality of care. This data provides clear information about the best hospitals in the country state wise. For instance if anyone is suffering with heart related issues when they decide to go for treatment they have a chance to find a best hospital and doctor in cardiology.

Variation in treatment charges

Treatment cost is varies from state to state and hospital to hospital there are a lot of factors which effects cost of the treatment any one tries to figure out the best hospital with lower charges for their treatment this data gives information about the treatment charges in different hospitals in different locations people have chance to find out which one suites them. This all created by considering average discharges,average cost,average medicare payments.

7. Decision Method

We have taken two different types of decision methods one by using tableau and another one by using datapine both are data visualization tools used to analyze the data by selecting different types of factors. In both tableau and datapine we have a chance to plot in different styles based on users interest.
We used different types of plots with different factors to analyze the data. In the first chart we considered total discharges, total costs , states and drg definition to analyze number of discharges and average cost. In the next diagram we have shown the number of cases in different states across the country. The pie chart shows the different types of reasons for admission in hospitals. Most of the people admitted in hospital because of heart failures are 498564 members admitted with heart related issues. Then we divided all states based on average payment and discharge rate.
Datapine is the finest tool to analyze the data. We used datapine in our third decision. In the first plot we selected hospitals in x axis and emergency services in y axis to see which one is providing more and better emergency services. Next to that we selected acute care,children, and critical care access hospitals to see in which there highest admits of emergency services. We considered rating the hospital also to check the rating of the hospital based on their service we accessd the three different types of hospitals rating it’s based on their response to patients .

8. Risk Factor

Decision 1 risks

Risk can be occured while selecting the hospital in another state. There can be many risks associated with hospital selection. Let's take one scenario, If the patient has selected to do a joint replacement surgery in Arizona state, and he is living in California state. And as per the visualization the waiting time is high where the cost is low, it might be possible that the patient needs to wait so long. So this is going to be a time consuming procedure. The second risk is hospital expense. For the replacement surgery, the patient needs maximum bed rest. If the insurance company does not cover all the expenses of the hospital charges like medicine, surgery cost and room charges and so on. And also the patient needs to stay at the hospital for a very long time, then surgery in another state, end up having such a huge amount of charges of staying at the hospital and other charges as travelling back to home is not recommended for the patient after the surgery.

Decision 2 risk

If they decide to construct the new building for the emergency ward at a children's hospital, then the risks are the location and the funds for constructing the new hospital. Consider a situation where the hospital wants to construct a new ward for an emergency for children. In this situation they need to consider the doctors and other staff who are specialized in the children. If they start a new service, do they have extra space to start within a hospital. Will they manage the other emergency services and funds needed for the construction of the new building?

9. Decision confidence with supporting justification

With the use of an analysis model, the usual way of finding the hospital- in terms of surgery performed and the cost by the hospital- is reflected in the estimated equation. We also extend the analysis to evaluate the hospital's success rate of the treatment performed in the previous years and estimates the overall charges and the money covered by the insurance company. Also for the second decision, analyzed the profit of constructing new buildings for children emergency service. The estimated models are checked for robustness by incorporating the results of the hospital and feedback records.

10. Conclusion

This paper examines and tries to estimate the value of various characteristics that go into selecting a hospital for the specific health problems and which states or counties need to construct more hospitals with specific types of services. Here the hospital and the state is selected by the price of the surgery and the maximum number of cases handled by the hospital in every state. The analysis suggests that the hospital charges are based on the location, the state healthcare taxes, other medicine charges and so on.

The number of patients is dependent on the population, also age of living people in the state. In addition to these variables, it appears that people prefer to do surgery where the rates are low. By considering the second dataset, it is analyzed what hospital type is needed in the state or county based on overall ratings.

A real world experience has revealed prices of the charges and patients vary by state according to their age, their hygiene and habits of living life. Our results have revealed that some states offer treatment at a very affordable price. Also analyzed the top reasons for hospital admittance across the USA. By considering the joint replacement surgery, we have derived that Texas, California, Florida provide the best treatment, that means there are more older people living in these states. Derived the average treatment cost state wise.

11. Reference

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