HealthCare Capstone Project

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Agenda

1. Problem Statement
2. Business Objective
3. Root Causes Analysis using Issue Tree Framework
4. Dataset Selection & Hospital Compare(website)
5. Coding Process
6. Insights, Findings & Visualizations
7. Conclusions & Recommendations

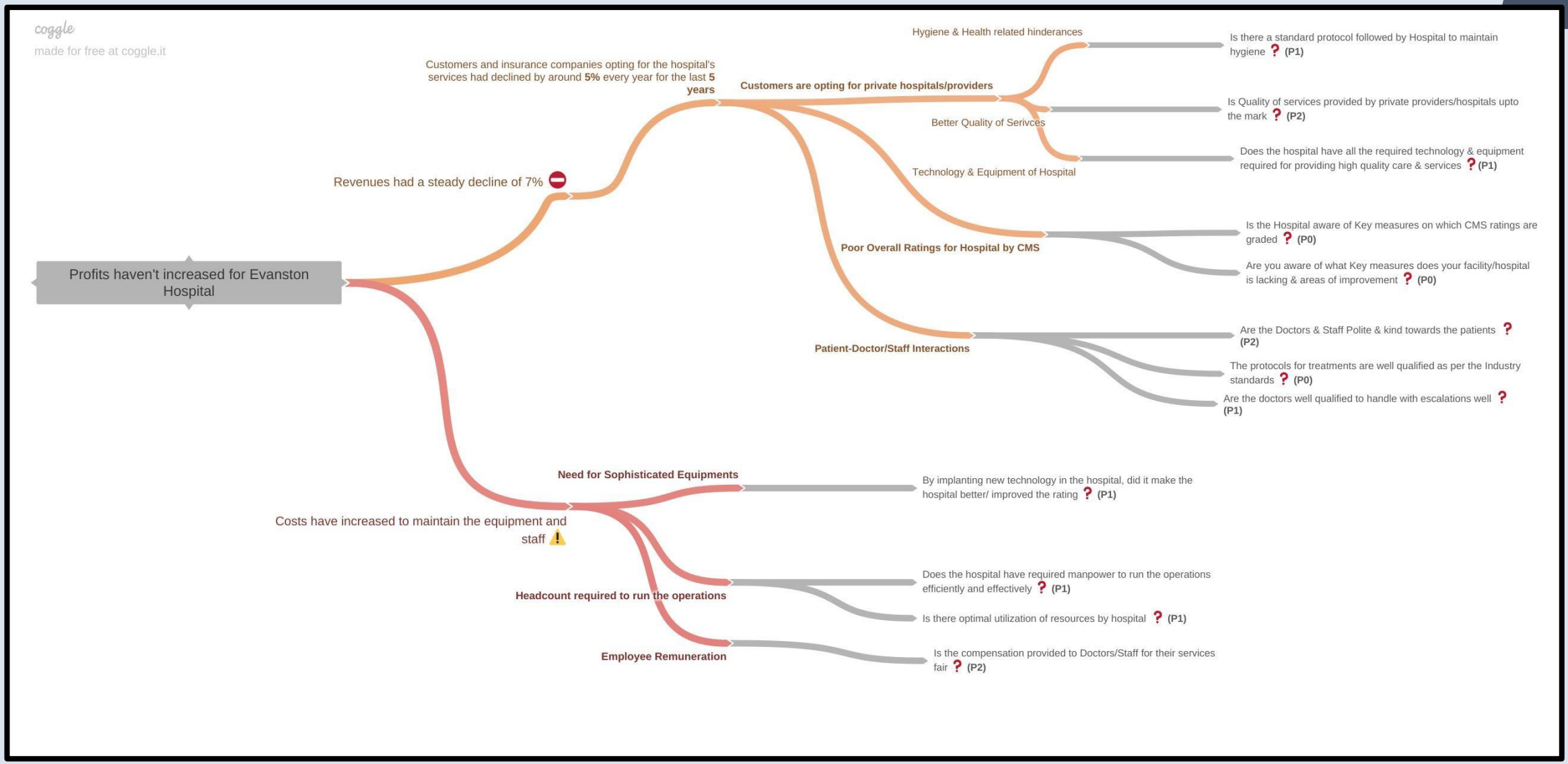
Problem Statement

- Evanston Hospital is an Acute care hospital which is have a significant problem of reduced hospital rating of 3 out of 5 for past 5 years leading to decline in revenues.
- These ratings directly influence the choice of consumers looking for healthcare providers.
- Till now hospital have spend a significant amount of resources on improvising their services despite that there were no major improvements in overall hospital rating.

Business Objective:

1. Identification of Root Cause for declining hospital ratings
2. Conducting various sorts of analysis to identify keep measures impacting hospital
   ratings
3. Diving deep to predict significant measures impacting Hospital rating especially for Evanston Hospitals
4. Determining Areas of improvements amongst top measures for Evanston Hospitals.

Root Cause Analysis Using Issue Tree Framework



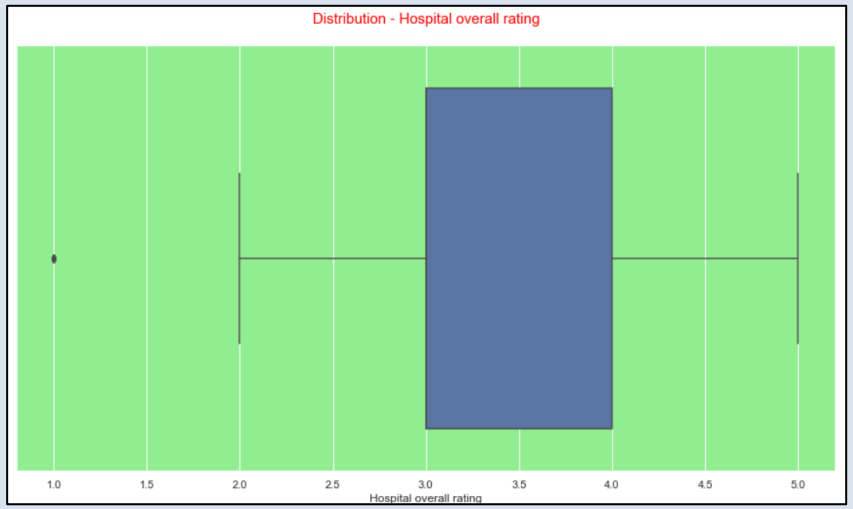
Hospital Compare & Dataset Selection

- Hospital Compare is a customer-focused website that offers details on how effectively hospitals treat patients with the required care.
- There was a document that helped us determine which datasets are important and it was “Overall Hospital Quality Star Ratings on Hospital Compare Methodology Report(v2.0)”
- We observed that there were 62 measures divided into 7 groups, which contribute towards the calculation of the overall Star Rating by the CMS. They were
  - Mortality
  - Readmission
  - Safety of Care
  - Timeliness of Care
  - Effectiveness of Care
  - Patient Experience
  - Outpatient Imaging Efficiency

Coding Process

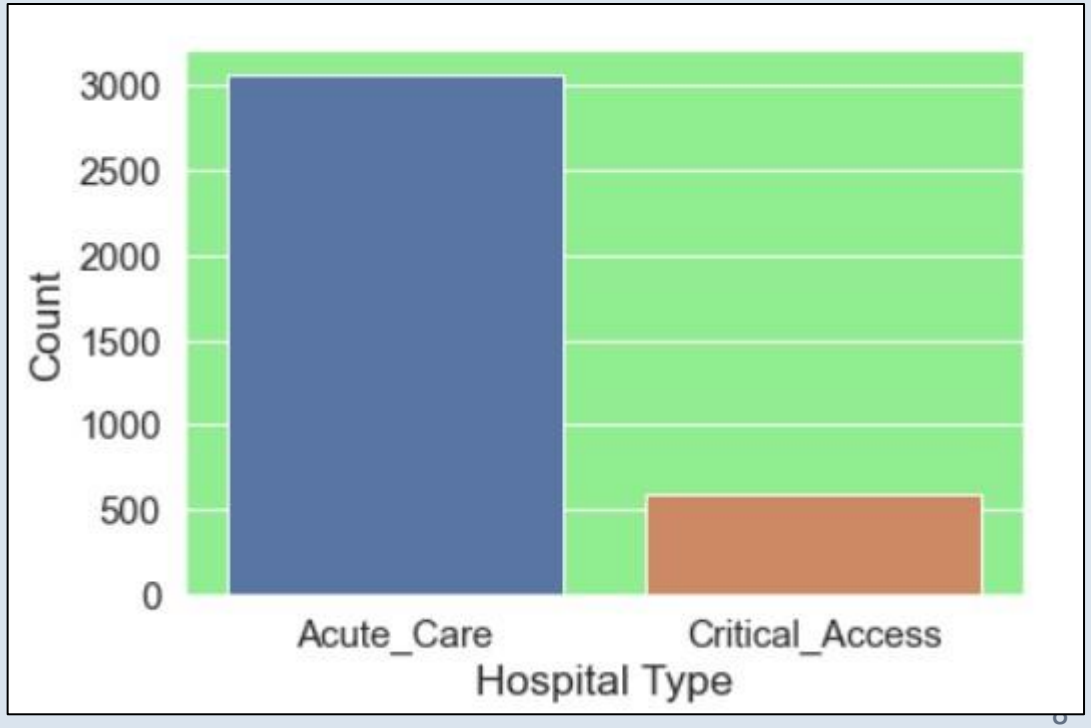
1) Based on given flat files finalized 7 datasets that had data with regards to give measures.
2) Conducted Basic data cleaning, EDA & Other sorts of analysis.
3) Post EDA Conducted Univariate/Bivariate & Multivariate analysis
4) Data preparation for modelling
5) Conducted Modelling using 4 models alongside Hyperparameter tuning & Stratified K- fold cross validation on all the models.
    - Linear Regression
    - Logistic Regression
    - Decision Tree
    - Random Forest
6) Identified Best model based on precision and accuracy and ran the best estimator of the best model for Evanston Hospital , used eli5 library to determine top measures for Evanston Hospitals to focus on.

Insights, Findings & Visualizations

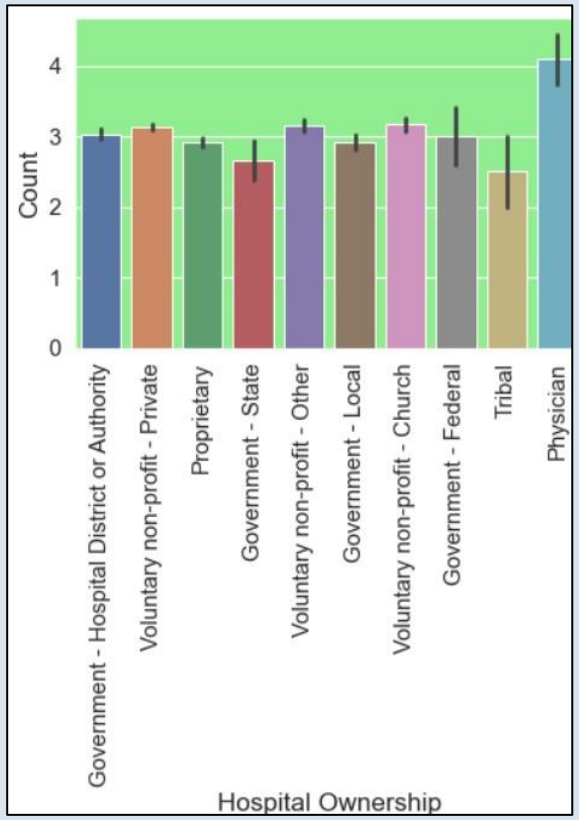


Majority of Hospital ratings lie between 2 & 5
& Median rating stands at 3.5

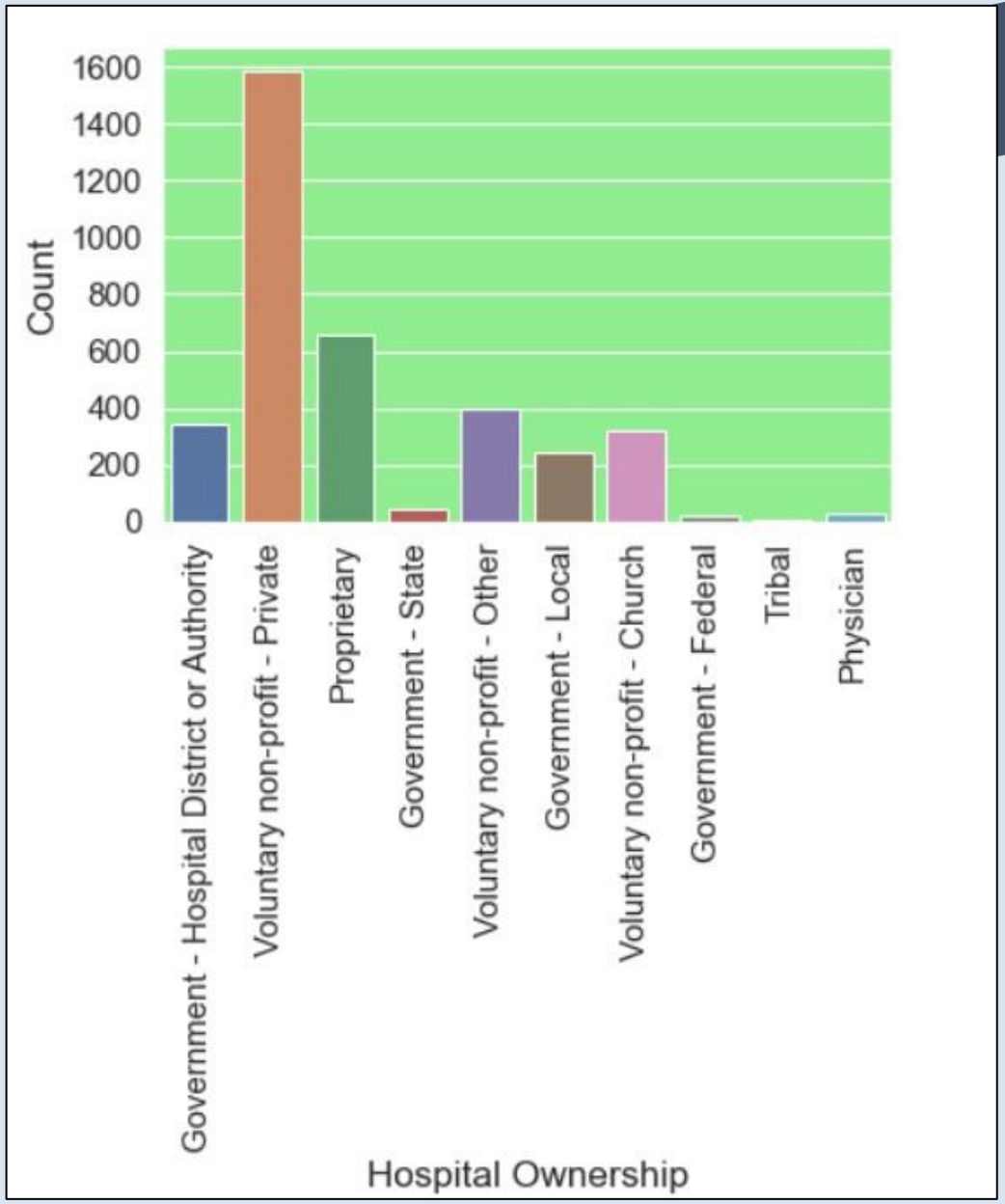
Majority Hospitals are “Acute_Care” just like Evanston Hospitals



Insights, Findings & Visualizations



'Physician' provider type were most highly rated compared to other provider types



Majority Hospitals are owned by "Voluntary non-profit – Private"

Insights, Findings & Visualizations

Inferences from Bivariate analysis :

- Medical Imaging has ratings between 0 and 3 only , majority of ratings match the national average levels
- Safety of care has maximum rating of 3.5 which is for above the national average level
- Mortality & Timeliness of care has maximum rating of 3.2
- Patient Experience has maximum rating of 3.7 where majority of providers are above national average levels
- Effectiveness of care has maximum rating of 3.1 & Readmission has maximum rating of 3.5 which has above national avg levels
- Acute_Care hospitals have ratings as high as 3 but Critical_care hospitals have max rating of 3.4
- Physians are given the highest rating of 4 followed by that are non-profit private hospitals with maximum rating of 3.2
- Providers with non-emergency services tend to have higher rating(3.7) compared to Providers with emergency services(3.0)

Inferences from Multivariate analysis :

- Majority of providers are above national average levels interms of readmission scores
- Most of the providers have mortality scores above the national average levels except local govt hospitals, state govt hospitals and Physician
- Most of the providers/hospitals are having same or above national average levels in terms of Timeliness of care
- Except for Voluntary non-profit type hospitals where scores are above national average, Rest of the providers have more or less same national average level scores in terms of Effectiveness of care
- Except Physician & Tribal providers rest all are above national average levels in terms of outpatient imaging efficiency

Conclusions & Recommendations

	Model Name	Accuracy	Precision	Recall	F1 Score
0	Linear Regression	78.08	-	-	-
1	Logistic Regression	74.14	77.48	59.77	65.35
2	Logistic Regression with hyper parameter tuning	74.58	79.12	63.65	68.89
3	Decision Tree Classifier	62.82	38.49	35.0	35.17
4	Random Forest With Hyperparameter Tuning	74.28	81.1	53.87	59.48

Based on Model Scores we decided Random Forest was best fit model based on consistent accuracy & Precision Scores

Weight	Feature
0.0998 ± 0.0551	PatientExperience_H_CLEAN
0.0613 ± 0.0341	Readmissions_READM_30_COPD
0.0521 ± 0.0932	PatientExperience_H_HSP_RATING
0.0456 ± 0.0292	Mortality_MORT_30_PN
0.0431 ± 0.0417	Readmission national comparison_Below
0.0423 ± 0.0317	Safetyofcare_HAI_2_SIR
0.0386 ± 0.0753	PatientExperience_H_COMP_2
0.0364 ± 0.0947	Patient experience national comparison_Below
0.0361 ± 0.0517	Patient experience national comparison_Same
0.0348 ± 0.0643	Effectivenessofcare_MORT_30_AMI
0.0332 ± 0.0235	Mortality_MORT_30_HF
0.0329 ± 0.0700	PatientExperience_H_QUIET_HSP
0.0299 ± 0.0442	Safety of care national comparison_Below
0.0294 ± 0.0253	Timelinessofcare_ED_2b
0.0282 ± 0.0573	PatientExperience_H_COMP_5
0.0260 ± 0.0243	Timelinessofcare_OP_18b
0.0258 ± 0.0204	Emergency Services
0.0245 ± 0.0218	Medical_Imaging_OP_10
0.0238 ± 0.0184	Safetyofcare_PSI_90_SAFETY
0.0230 ± 0.0189	Medical_Imaging_OP_11
	… 30 more …

Top Features based on results from eli5 & best estimator

All the analysis redirected us to 4 measures that Evanston hospitals need to improvise on:

1) Safety of Care

2) Patient Experience

3) Mortality Rates

4) Readmission Rates & Procedures

Conclusions & Recommendations

Suggestions to Evanston Hospitals on 4 Measures of Improvement

1) Safety of Care

- It's one of areas where the Evanston Hospital is consistently performing bad as compared to National standards.
- Complications from the patient's multiple illnesses are one of the key factors. The Catheter Associated Urinary Tract Infection is the most prevalent and significant one. Patients who receive a catheter typically experience this while they are confined to a bed. In order to prevent the use of an infectious catheter on a patient, the hospital staff should be in charge of maintaining the cleanliness of the catheter instruments and devices. One of the simplest areas where the hospital can improve is this.

2) Patient Experience

- By adhering to good cleaning procedures, you can keep the location where you are and the areas around it clean and healthy. The hospital ought to take the lead on this. Here, too, there is inadequate doctor-patient communication. To communicate with patients in a more courteous and professional manner, doctors could be required to complete communications training. The hospital should examine all the areas where the patient interacts or is actively involved on a regular basis because the overall patient experience rating (previous ratings) matters. They all need to be enhanced.

Conclusions & Recommendations

3) Mortality Rates

- One of the obvious places where the hospital falls short is here. It is experiencing significant rates of mortality. The following illnesses and conditions have death rates. a)Heart Failure 30 days mortality rate. b) Pneumonia 30 days mortality rate. c) Acute Myocardial Infarction (Heart Attack) 30 days mortality rate.

4) Readmission Rates & Procedures

- Although the Hospital's overall Readmission Score is on par with the National Average, there is still room for improvement. For chronic obstructive pulmonary disease, the 30-day readmission rate is greater. When a patient has this sickness, the hospital should make sure they are recovering according to the best practices.

Thank You