TEAM ID	**PNT2022TMID19527**
PROJECT TITLE	**Analytics for Hospital Health-Care Data**

Analytics for Hospital Health-Care Data Report

1.INTRODUCTION

1.1 PROJECT OVERVIEW

Recent Covid-19 Pandemic has raised alarms over one of the most overlooked areas to focus: Healthcare Management. While healthcare management has various use cases for using data science, patient length of stay is one critical parameter to observe and predict if one wants to improve the efficiency of the healthcare management in a hospital. This parameter helps hospitals to identify patients of high LOS-risk (patients who will stay longer) at the time of admission. Once identified, patients with high LOS risk can have their treatment plan optimized to minimize LOS and lower the chance of staff/visitor infection. In addition, prior knowledge of LOS can aid in logistics such as room and bed allocation planning. What if I have been hired as Data Scientist of Health Man – a not for profit organization dedicated to manage the functioning of Hospitals in a professional and optimal manner. The goal is to accurately predict the Length of Stay for each patient on case by case basis so that the Hospitals can use this information for optimal resource allocation and better functioning. The length of stay is divided into 11 different classes ranging from 0-10 days to more than 100 days.

1.2 PURPOSE

Healthcare data analytics refers to the process of working on raw datasets related to healthcare and analyzing them to find hidden patterns,trends,etc.,thus paving a way for further improvements at patient-level as well as business-level.

2.LITERATURE SURVEY

2.1 EXISTING PROBLEM

S.NO	TITLE	AUTHOR	DESCRIPTION
1	Data-driven Methods for Typical Treatment Pattern Mining	Chonghui Guo and jingfeng Chen	A huge volume of digitized clinical data is generated and accumulated rapidly since the widespread adoption of Electronic Medical Records [EMRs]

2	Big Data in Supply Chain Management	Aniket Nargundkar and J.Kulkarni	A robust model is designed to help hospital administration to predict patient's Length Of Stay [LOS] to resolve the issues faced by hospital
3	A Systematic Mapping study	Anil Pandit and Sharvari Shukla	The current study performs a Systematic Literature Review (SLR) to synthesise prior research on thee applicability on Big Data Analytics (BDA) in healthcare

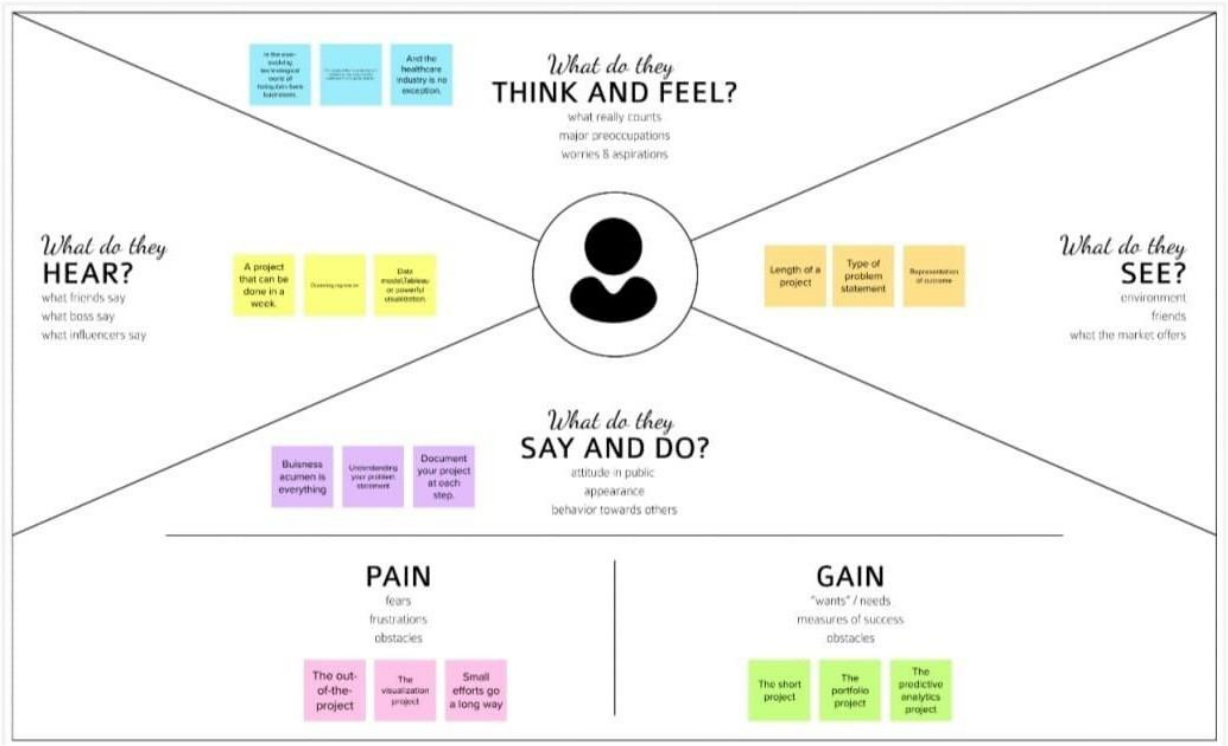
2.2 REFERENCE

2.3 PROBLEM STATEMENT

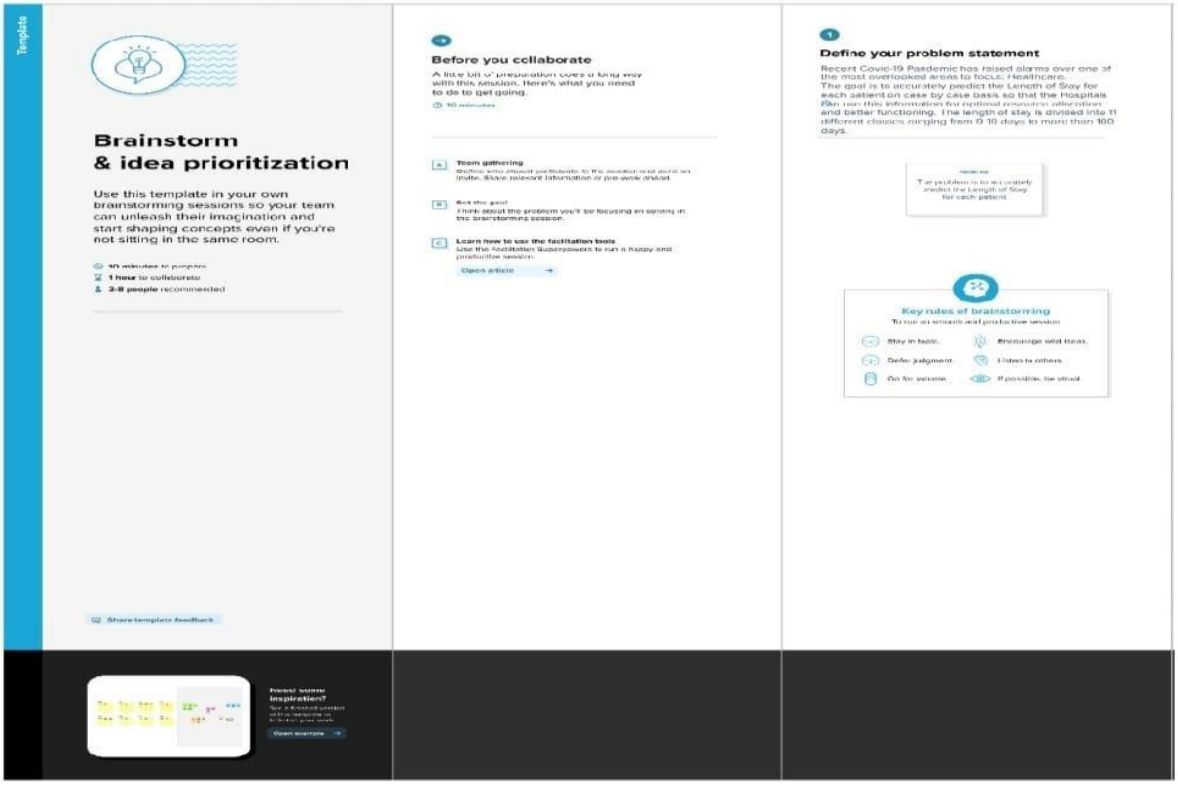
Create a problem statement to understand your customer's point of view. The Customer Problem Statement template helps you focus on what matters to create experiences people will love. A well-articulated customer problem statement allows you and your team to find the ideal solution for the challenges your customers face. Throughout the process, you'll also be able to empathize with your customers, which helps you better understand how they perceive your product or service.

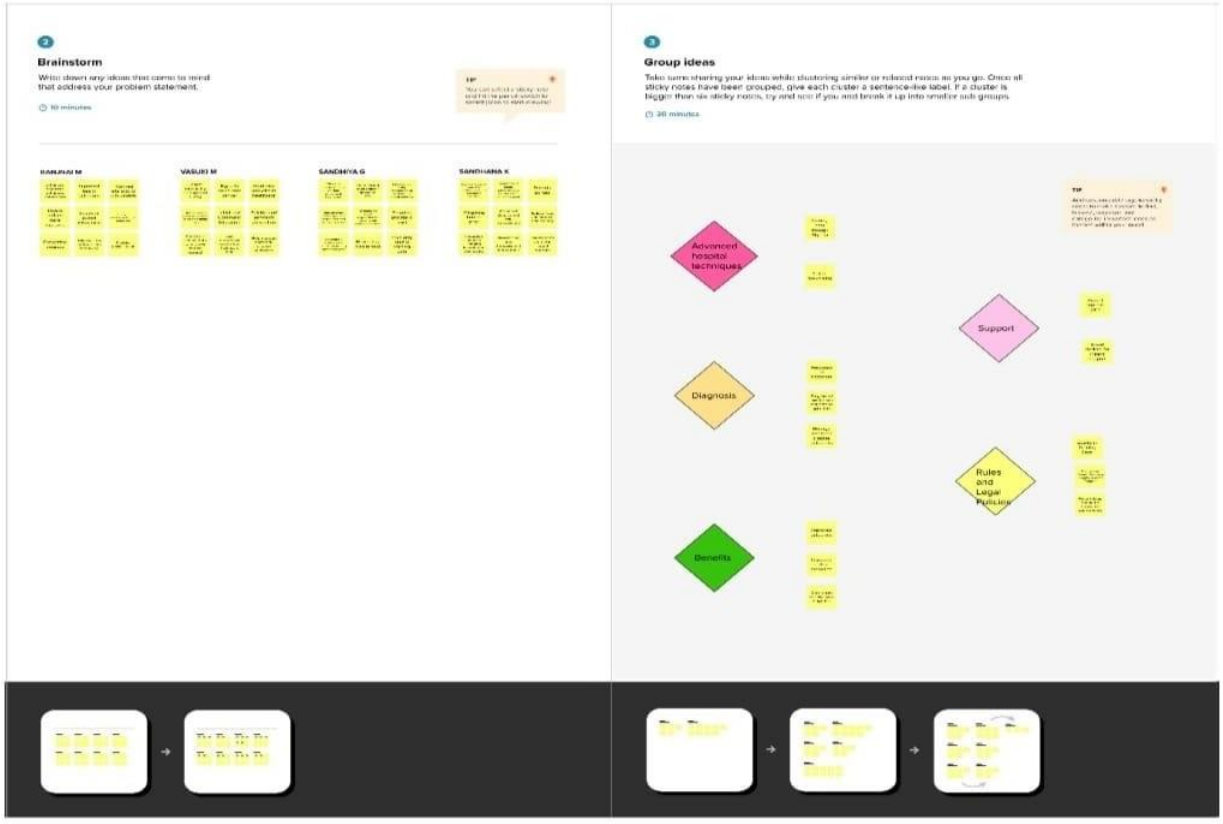
3. IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION AND BRAINSTORMING


Template
Brainstorm
& idea prioritization
Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.
10 minutes to prepare
1 hour to collaborate
2-8 people recommended
Share template feedback
Before you collaborate
A little bit of preparation goes a long way with this session. Here's what you need to do to get going.
10 minutes
Team gathering
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.
Set the goal
Think about the problem you'll be focusing on solving in the brainstorming session.
Learn how to use the facilitation tools
Use the Facilitation Superpowers to run a happy and productive session.
Open article
Define your problem statement
Recent Covid-19 Pandemic has raised alarms over one of the most overlooked areas to focus: Healthcare. The goal is to accurately predict the Length of Stay for each patient on case by case basis so that the Hospitals can use this information for optimal resource allocation and better functioning. The length of stay is divided into 11 different classes ranging from 0-10 days to more than 100 days.
Notes
The problem is to accurately predict the Length of Stay for each patient.
Key rules of brainstorming
To run an smooth and productive session
Stay in topic.
Encourage wild ideas.
Defer judgment.
Listen to others.
Go for volume.
If possible, be visual.
Need some inspiration?
Open example

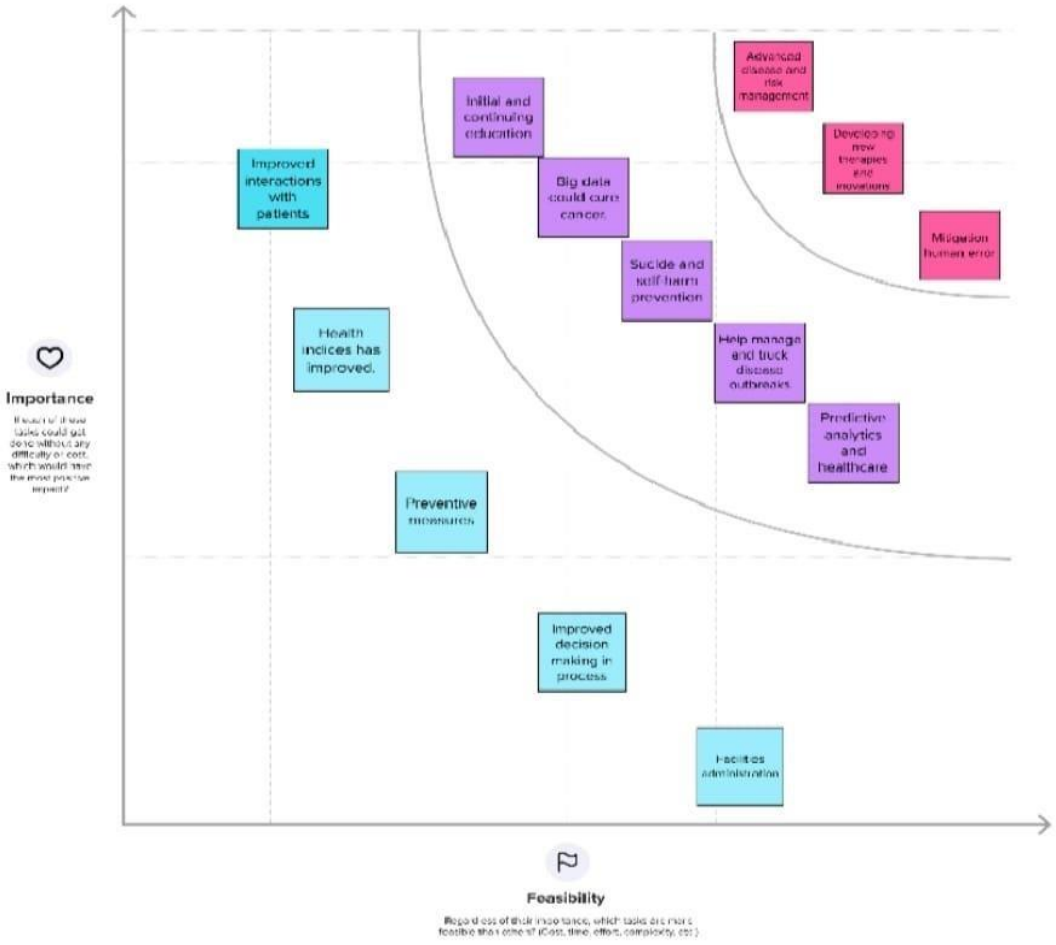

2
Brainstorm
Write down any ideas that come to mind that address your problem statement.
10 minutes
TIP
RANJANI M
VASUKI M
SANDHIYA G
SANTHANA K
3
Group ideas
Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub groups.
20 minutes
TIP
Advanced hospital techniques
Support
Diagnosis
Rules and Legal Policies
Benefits

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

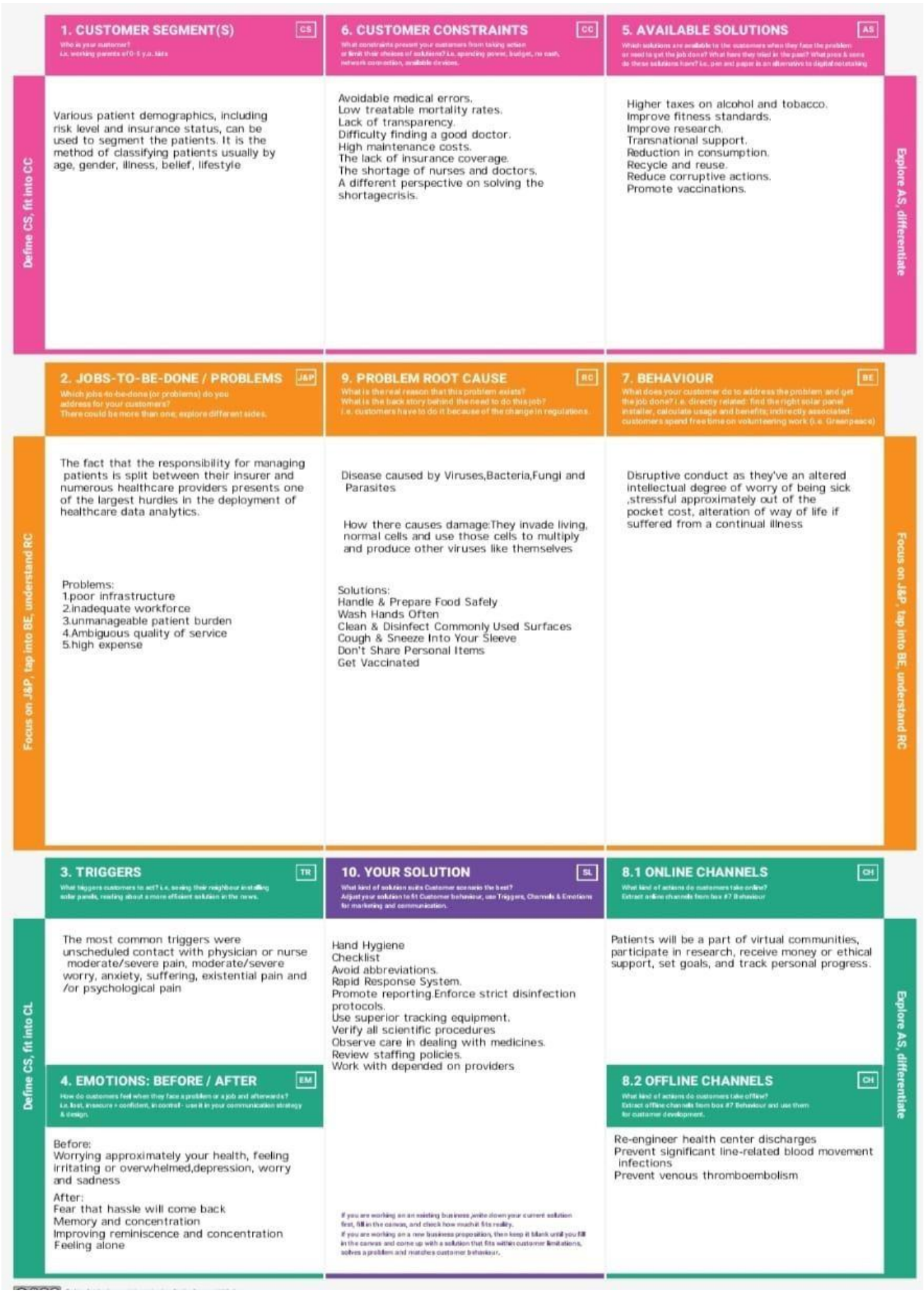
20 minutes



3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	EHR data matched patient-reported data in 23.5 percent of records in a study at an ophthalmology practise. Patients' EHR data did not agree in any way when they reported having three or more eye health complaints.
2.	Idea / Solution description	Predictive analytics can create patient journey dashboards and disease trajectories that can lead to effective, and result-driven healthcare. It improves treatment delivery, cuts costs, improves efficiencies, and so on.
3.	Novelty / Uniqueness	Healthcare data frequently resides in several locations. from various departments, such as raciology or pharmacy, to various source systems, such as EMRs or HR software. The organisation as a whole contributes to the data. This data becomes accessible and usable when it is combined into a single, central system, such as an enterprise data warehouse (EDW).
4.	Social Impact / Customer Satisfaction	Enhanced diagnosis Improved medical treatment Improved health results Improved relationships with patients More positive health indicators
5.	Business Model (Revenue Model)	The two factors that have the biggest negative effects on hospital income are claim denials and patient incapacity to pay their part. 90% more uncollectible claim denials were written off by hospitals and healthcare systems in 2017 compared to the preceding six years.
6.	Scalability of the Solution	A variety of institutions must store, evaluate, and take action on the massive amounts of data being produced by the health care sector as it expands quickly. India is a vast, culturally varied nation with a sizable population that is increasingly able to access centralised healthcare services.

3.4 PROBLEM SOLUTION FIT



4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form
FR-2	User Confirmation	Confirmation via OTP
FR-3	Database	Every patient has some necessary data like phone number, their first and last name, personal health number, postal code, country, address, city, 'patient's ID number, etc
FR-4	Report Generation	The Hospital Management System generates a report on every patient regarding various information like patients name, Phone number, bed number, the doctor's name whom its assigns, ward name, and more. The Hospital Management system also helps in generating reports on the availability of the bed regarding information like bed numbers unoccupied or occupied, ward name, and more.
	Check Out	The staff in the administration section of the ward can delete the patient ID from the system when the patient checkout from the hospital. The Staff in the administration section of the ward can put the bed empty in the list of beds available.
	Adding Patients	The Hospital Management enables the staff at the front desk to include new patients in the system.

4.2 NON-FUNCTIONAL REQUIREMENTS

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The effectiveness, efficiency and satisfaction with which specific users can achieve a specific set of tasks in a particular environment.
NFR-2	**Security**	This process of protecting data from unauthorized access and data corruption throughout its lifecycle
NFR-3	**Reliability**	A highly reliable system has a lower risk of errors and process failures that can cause patients harm
NFR-4	**Performance**	performance measurements include: • Quality and efficiency of patient care • Cost of healthcare services • Disparities in performance • Care outcomes
NFR-5	**Availability**	inpatient, outpatient, pharmacy, and enrollment
NFR-6	**Scalability**	The ability of a health intervention shown to be efficacious on a small scale and/or under controlled conditions to be expanded under real world conditions to reach a greater proportion of the eligible population, while retaining effectiveness.

5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS

5.2 SOLUTION AND TECHNICAL ARCHITECTURE

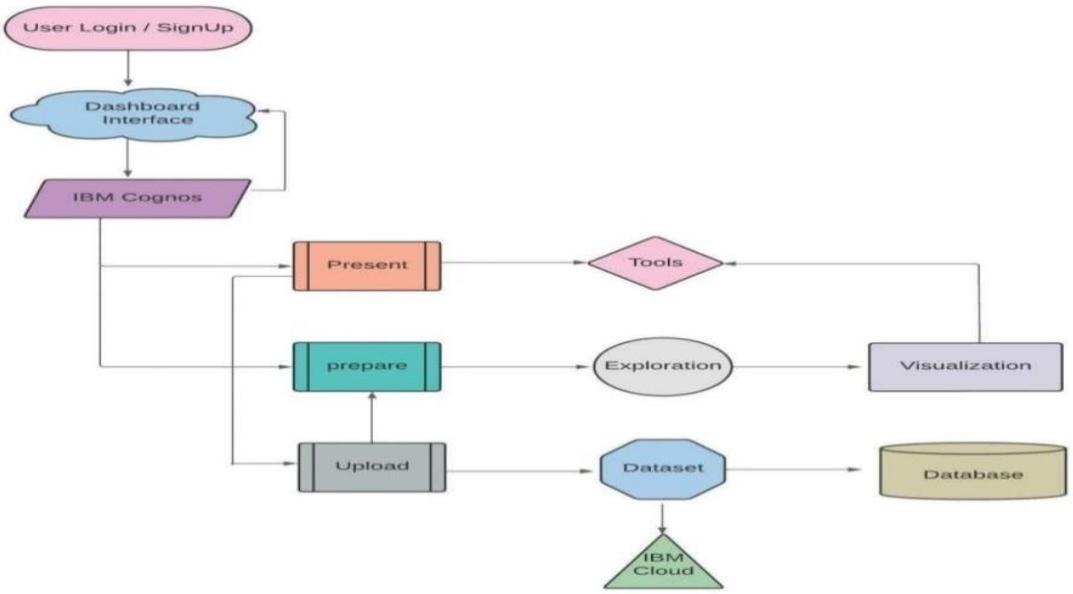


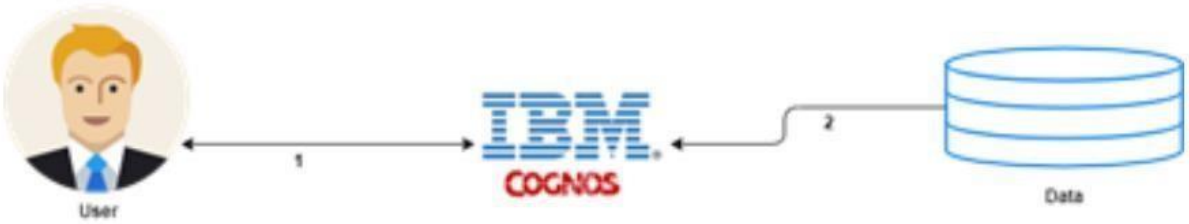
TABLE 1:COMPONENTS & TECHNOLOGIES

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	HTML, CSS, JavaScript
2.	Application Logic-1	Logic for a process in the application	Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson STT service
4.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
5.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8.	External API-1	Purpose of External API used in the application	IBM Weather API, etc.
9.	External API-2	Purpose of External API used in the application	Aadhar API, etc.
10.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	Local, Cloud Foundry

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Technology of Opensource framework
2.	Security Implementations	List all the security / access controls implemented, use of firewalls etc.	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc.
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Technology used
4.	Availability	Justify the availability of application (e.g. use of load balancers, distributed servers etc.)	Technology used
5.	Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc.	Technology used

SOLUTION ARCHITECTURE:



5.3 USER STORIES

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	The User needs a complete data about the patients admitted in the hospital and a dataset should beprepared.	20	Medium	RANJANI M, VASUKI M
Sprint-1	Data Exploration	USN- 2	As a user, I need nicely visualized dashboard ofnumber of beds occupied and number of free beds in hospital.	10	High	Sandhana k, sandhiya G
Sprint-2	Track of patient visit of Hospital	USN-3	Tracking a patient Health care over years ofvisit and Screening of data they have in hospital.	10	Medium	Sandhiya G, Ranjani M
Sprint -2	Dashboard	USN - 4	As a user, I want the interactive dashboard toanalyse the data. Have the data in terms of Graph.	20	High	Ranjani M, vasuki M,Sandhiya G
Sprint-3	Detailed EHR's of patient	USN-5	Provided greater details in the EHR's of individual patient with clear idea of what to do.	10	Medium	vasuki M,Sandhiya G
Sprint- 3	Story Creation	USN-6	As a user, I need the story animation of thedata set with insights	20	High	Sandhana k, sandhiya G
Sprint-4	Predict LOS	USN-7	As a user, I want the flawless system to predictthe length of stay of the patients	10	High	Ranjani M, Vasuki M
Sprint-4	Using ML algorithm for Prediction	USN-8	As a user, I need prior knowledge of LOS can aid in logistics such as room and bed allocationplanning.	20	High	Ranjani M, vasuki M,Sandhiya G, Sandhana K

6. PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

Velocity:
Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

6.2 SPRINT DELIVERY SCHEDULE

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
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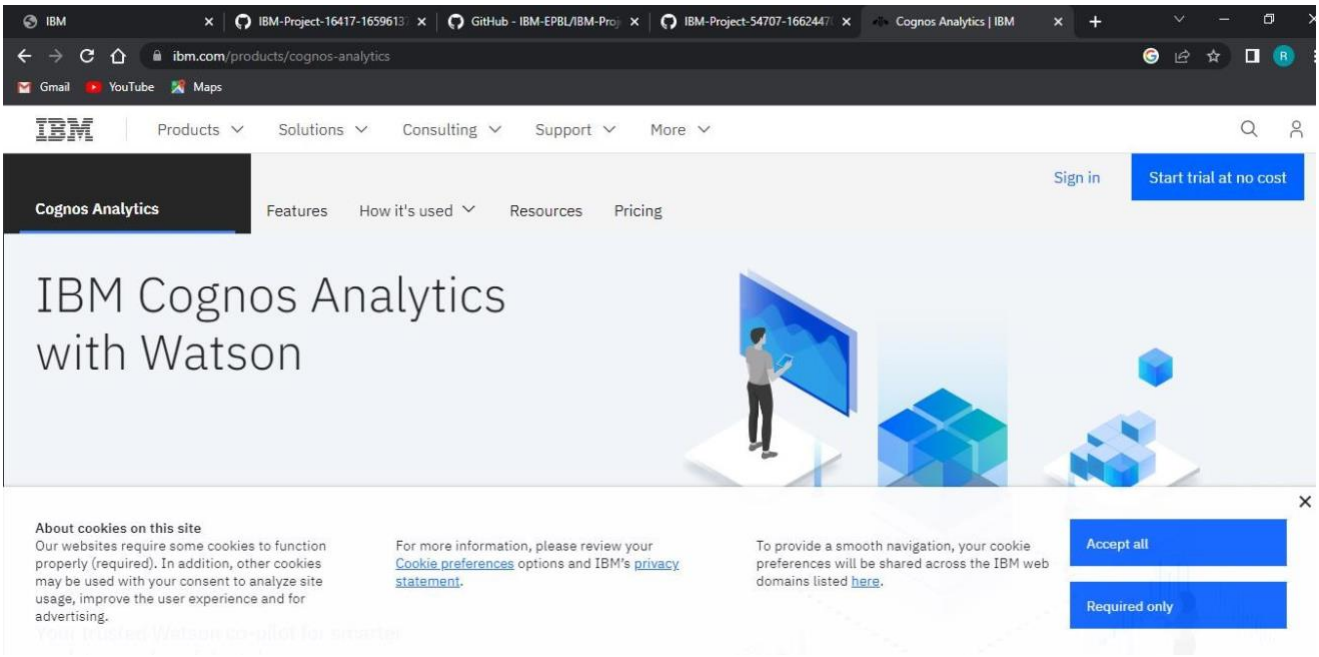
7. SOLUTIONING

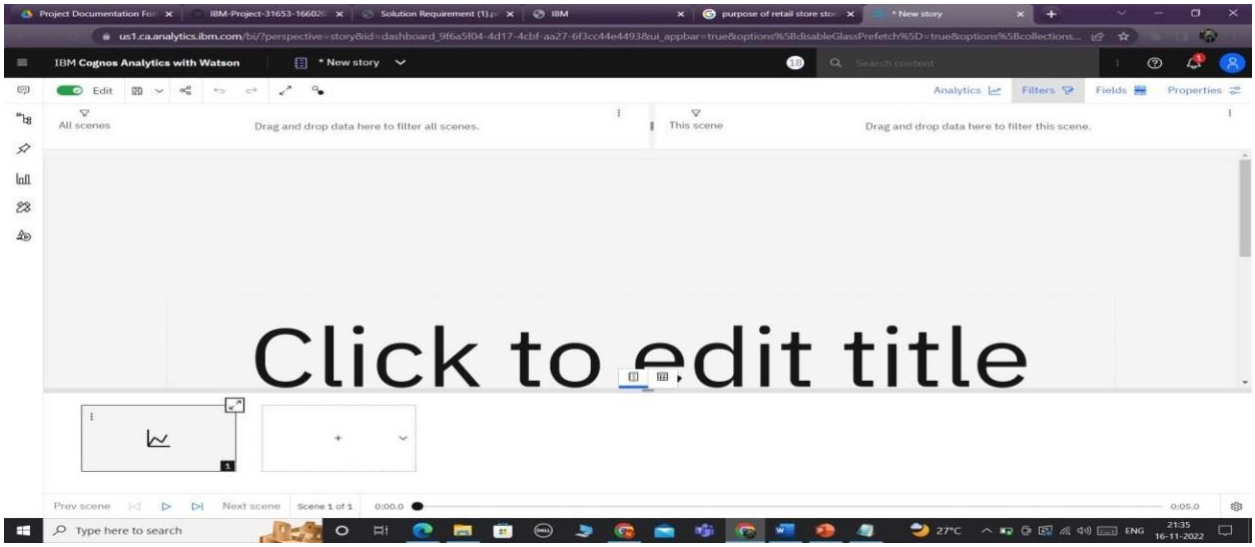
7.1 FEATURE 1

DASHBOARD AND REPORT:



7.2 FEATURE 2

STORY OF THE DATASET:

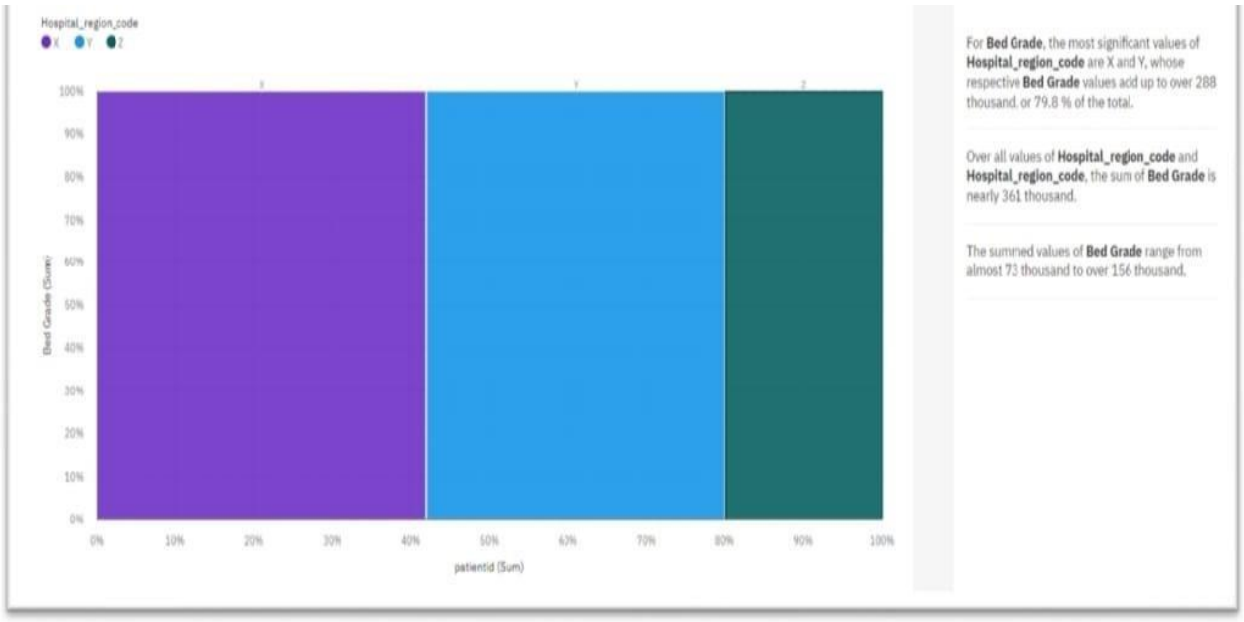


8. TESTING

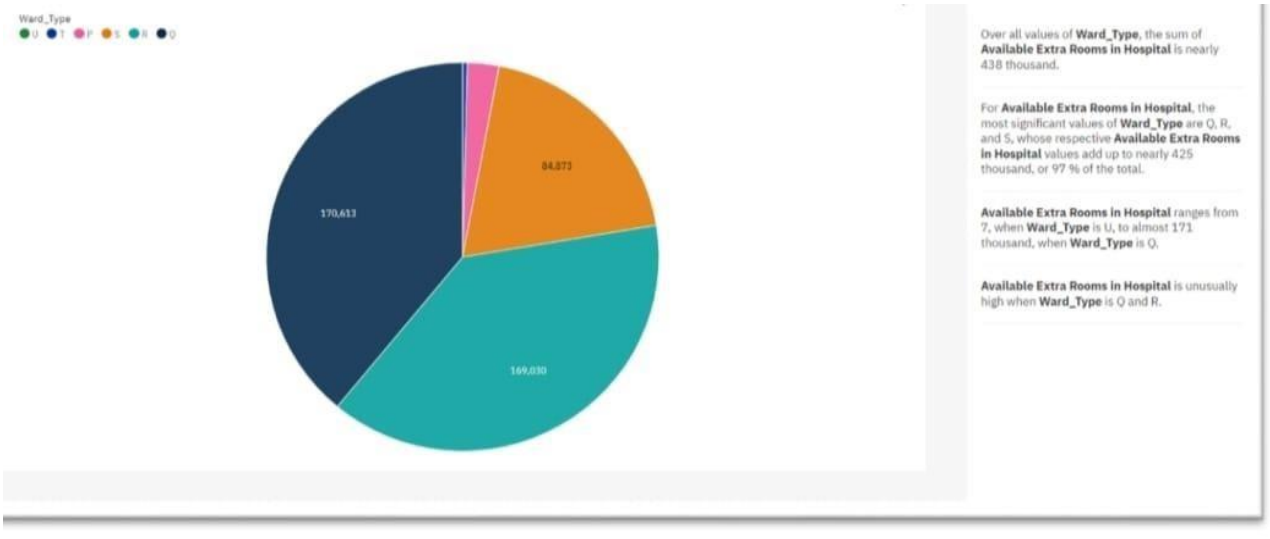
8.1 TEST CASES

1. EXPLORATION OF DATA

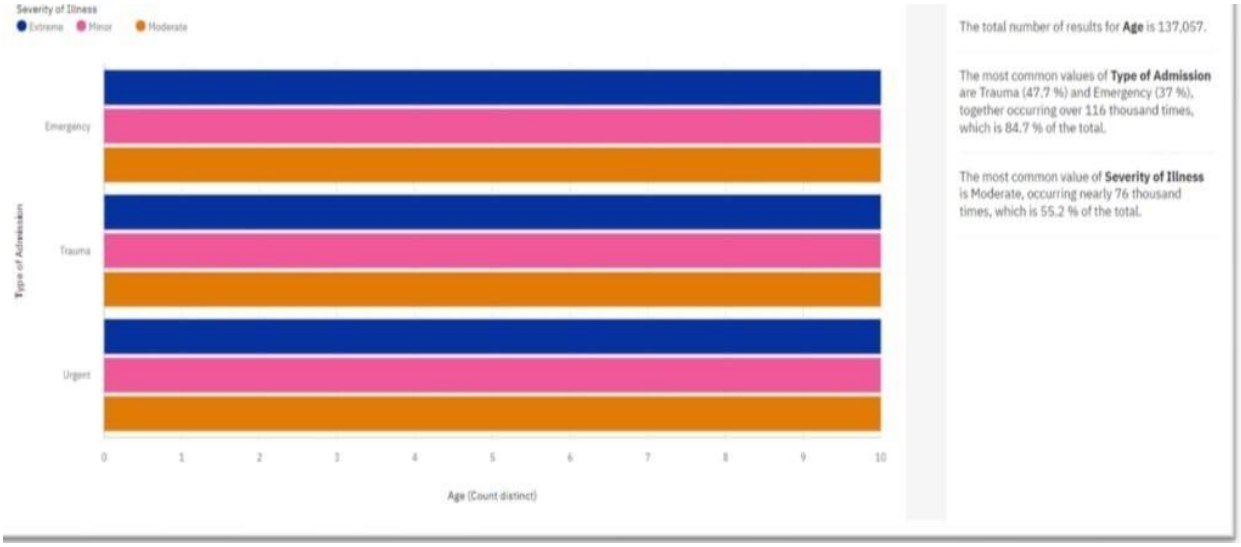
2.Bed Grade and Patient for Hospital_region_code coloured by Hospital_region_code



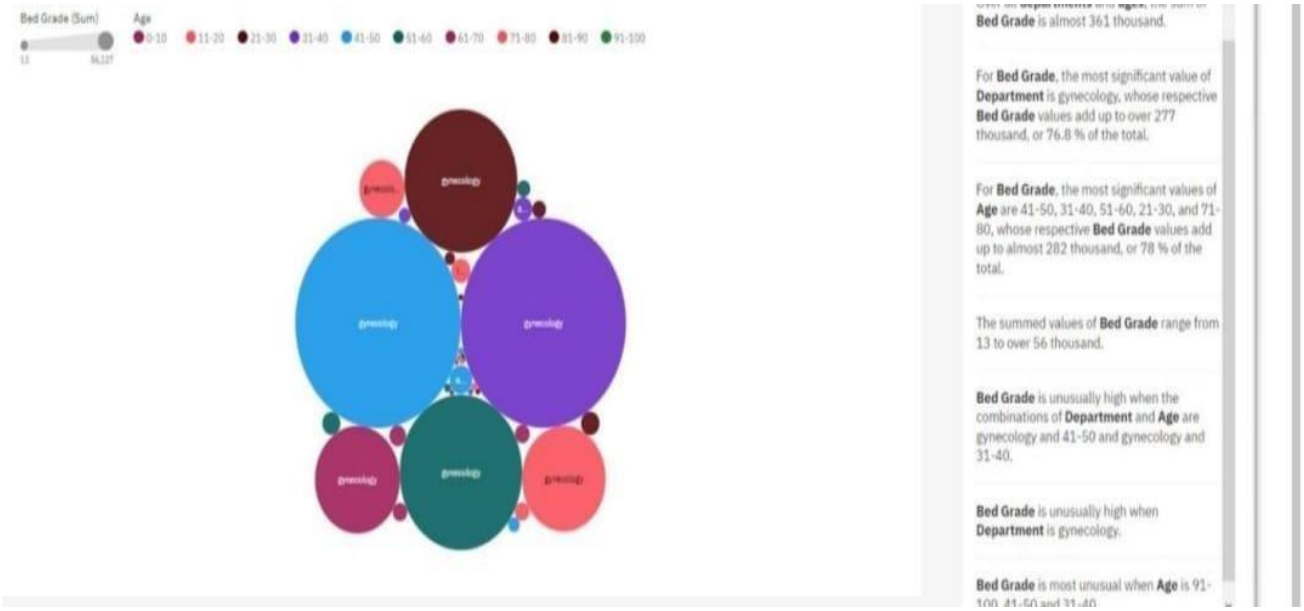
3.Available Extra Rooms in Hospital by Ward_Type



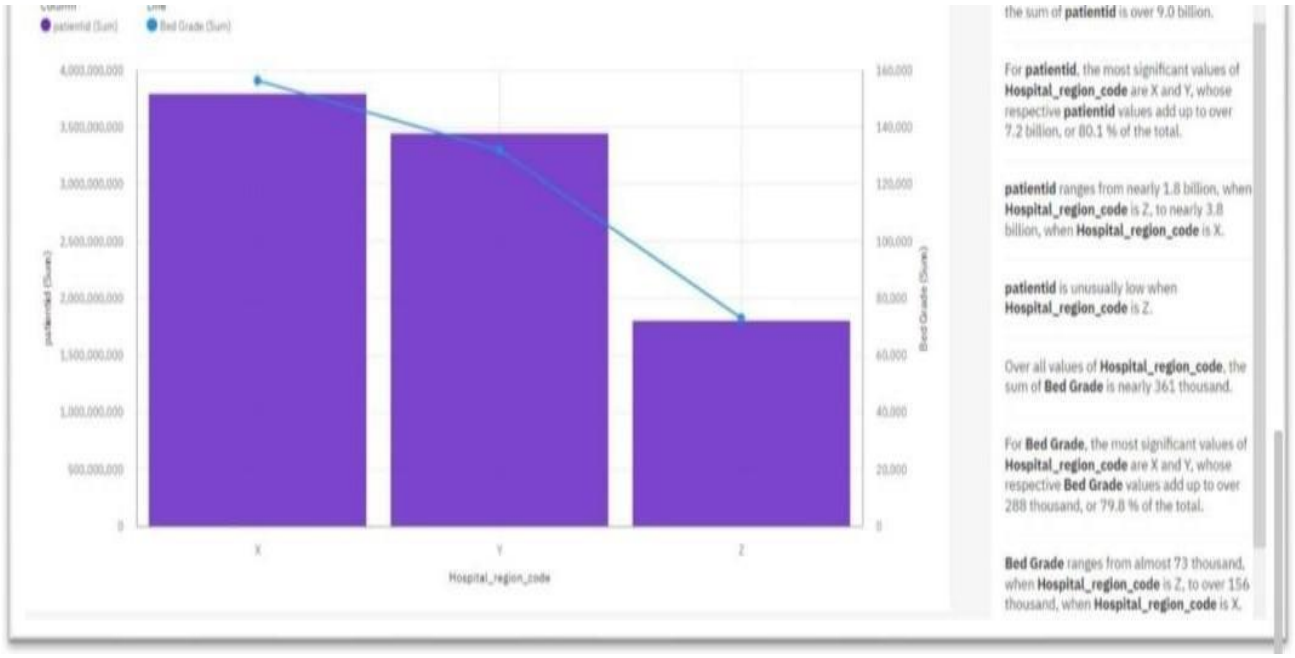
4.Department coloured by Age sized by Bed Grade



5.Age by Type Admission coloured by Severity of Illness



6. Bed Grade and Patient by Hospital_region_code



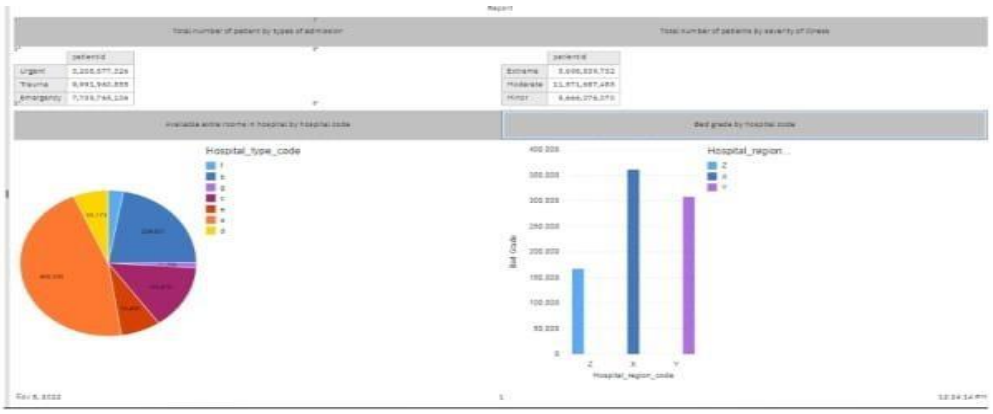
9. RESULTS

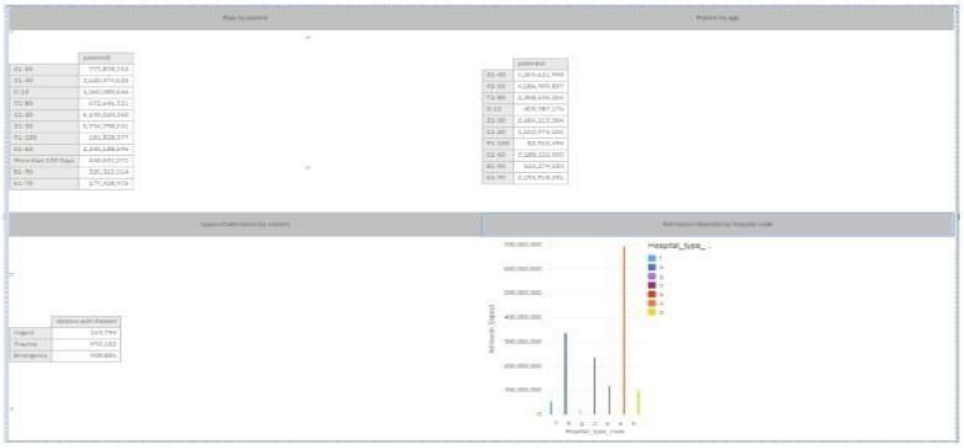
9.1 PERFORMANCE METRICS DASHBOARD:

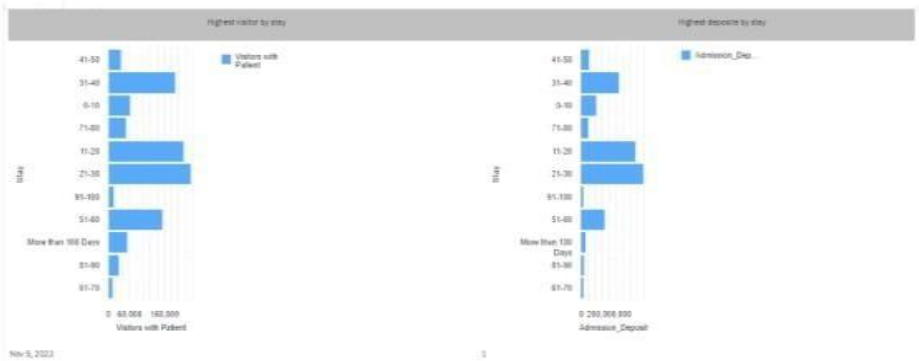

Tab 1
Tab 2
Tab 3
Tab 4
Tab 5
Tab 6
Tab 7
Age by Stay
Stay by Age
patientid by Stay
Severity of Illness by Severity of Illness colored by Severity of Illness


Tab 1
Tab 2
Tab 3
Tab 4
Age by Age colored by Age
patientid by Age
Type of Admission compared to patientid by Type of Admission colored by Type of Admission
Type of Admission by Age colored by Type of Admission

REPORT:


Report
Total number of patient by types of admission
patientid
Urgent 3,205,577,326
Trauma 6,991,940,885
Emergency 7,739,746,104
Total number of patients by severity of illness
patientid
Extreme 3,696,824,752
Moderate 11,871,687,483
Minor 6,668,276,370
Available ambulance in hospital by hospital code
Hospital_type_code
Bed grade by hospital code
Hospital_region...
Bed Grade
Hospital_region_code
Nov 5, 2022
1
12:04:14 PM


Stay by severity
Patient by age
patientid
Visitors with Patient
Admission Deposit
Hospital_type_...


Highest visitor by stay
Highest deposite by stay
Visitors with Patient
Admission_Dep...
Stay
More than 100 Days
0 60,000 120,000
Visitors with Patient
0 200,000,000
Admission_Deposit
Nov 5, 2022
1

STORY:

10. ADVANTAGES:

Cost Reduction Improves Data Security Less paperwork Better Collaboration and Communication Error-free administration Improved Clinical decision -making

DISADVANTAGES:

- Cybersecurity Risks.
- Patient Isolation .
- Frustation with poor Implementation.

11. CONCLUSION

In hospital health care management , we need a healthy lifestyle to build up a healthy immune system and to avoid diseases.

12. FUTURE SCOPE

The goal is to accurately predict the Length of Stay for each patient on case by case basis so that the Hospitals can use this information for optimal resource allocation and better functioning. The length of stay is divided into 11 different classes ranging from 0-10 days to more than 100 days.

13. APPENDIX

Github project link - https://github.com/IBM-EPBL/IBM-Project-31813-1660205338