Analytics for Hospital's Health Care Data

IBM–DOCUMENTATION

UNDER THE GUIDANCE OF

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ELECTRONICS AND COMMUNICATION ENGINEERING

VELALAR COLLEGE OF ENGINEERING AND TECHNOLOGY

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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. Also, prior knowledge of LOS can aid in logistics such as room and bed allocation planning.

Suppose you 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.

1.2 PURPOSE

The purpose is to accurately predict using the given dataset, we plan to create various graphs and charts to highlight the insights and visualizations.

a) Length of stay for each Case of Patients.
b) Stay by patient ID using Column Chart.
c) Severity of illness by Patient-ID using Tree Map.
d) Age, Department wise patient using Table.
e) Room availability by Pie Chart.
f) Dashboard Creation.
g) Department wise no. of Admissions by Waterfall Chart.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

The most and common problems faced by every hospital organization is collecting the right data, cleaning the data, data storage, securing patients data, querying the data. The most existing problem is to update real time data.

2.2 REFERENCES

"Development of the Health Information Analytics Dashboard Using Big Data Analytics"

The development of digital technology has the impact on healthcare facilities in Indonesia, one of which is the digitization of medical records. This will generate abundant clinical data from various sources including electronic medical records. Therefore, a large infrastructure is needed to store data from various sources that can facilitate the process of data aggregation to then be processed into information. Health Information Analytics Dashboard is the solution to get accurate, complete, and real-time insight from big data in healthcare. Data collection is carried out from various sources of health service facilities in Indonesia that are integrated into the system. With a user-friendly display, the analytic dashboard can be used to create monitoring reports with just one click. The method of this study uses big data analytics. The data analysis results are visualized through display charts/graphs that make it easier for users to understand the data analysis results and interpretation. This dashboard is useful to facilitate decision making so that stakeholders can find out more quickly to be able to respond appropriately and also improve the quality of health services so as to improve the degree of public health.

Reference link:

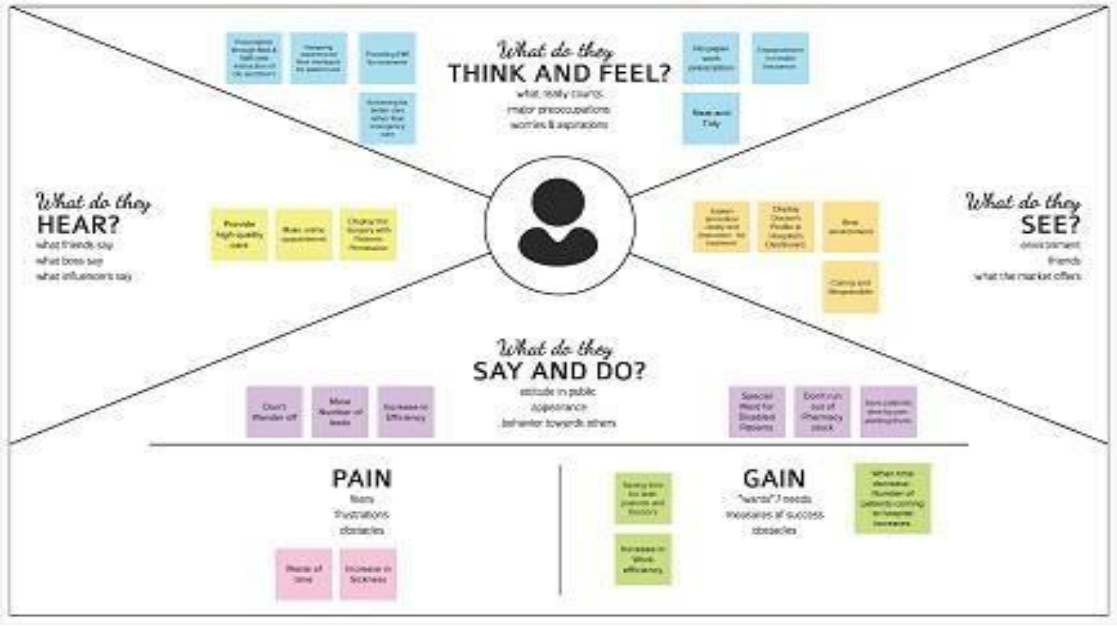
https://www.researchgate.net/publication/348834045_Development_of_the_Health_Information_Analytics_Dashboard_Using_Big_Data_Analytics

2.3 PROBLEM STATEMENT DEFINITION

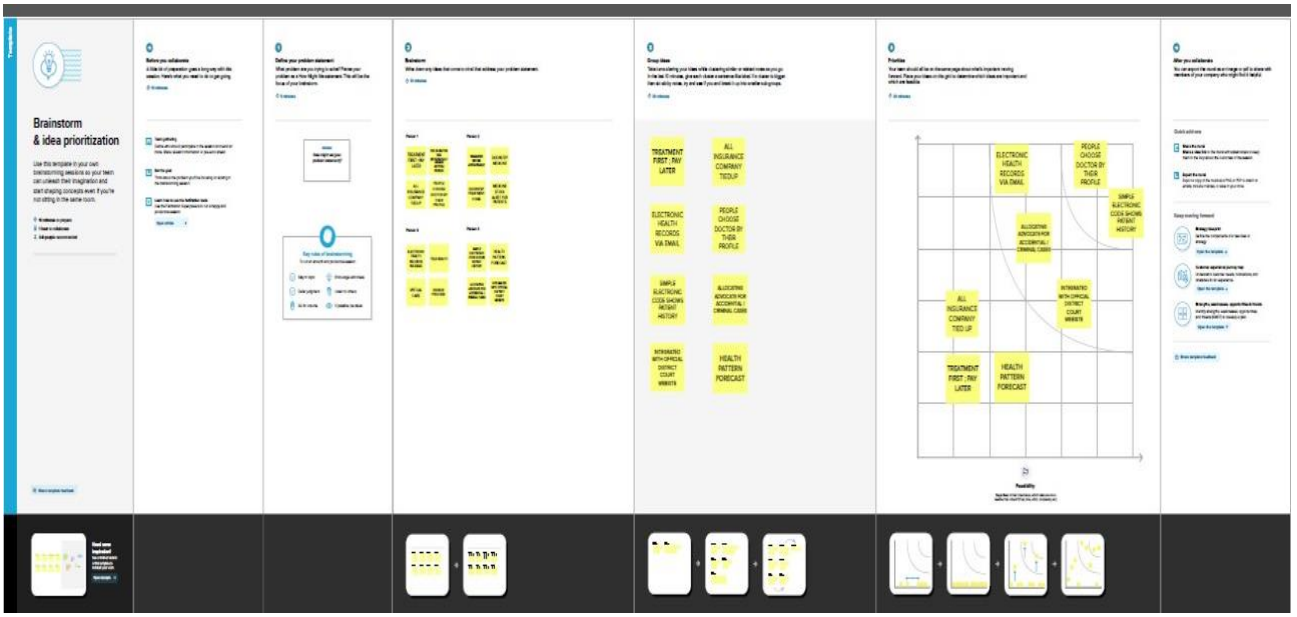
1. A Patient is a Customer who needs a better treatment because they don't need to suffer.
2. A Patient is a Customer who needs doorstep treatment because it's helpful for the patients, who are aged and can't able to travel.
3. A User needs a way to do something that addressed to the respective patients so that the patient benefits directly.
4. A Patient needs a way to analyze and choose Doctor by their profile because of their experience and comfortable.

3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION & BRAINSTORMING



3.3 PROPOSED SOLUTION

S. No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	A Patient needs a way to analyze and choose Doctor by their profile because of their experience and comfortable.
2.	Idea / Solution description	Instead of assigning Doctor to the patient by the hospital, Patient tend to select the doctor by themselves with experience of Doctor.
3.	Novelty / Uniqueness	Instead of displaying Doctor's name and designation in their cabin, The Uniqueness is to display Doctor's profile in the Hospital's Dashboard.
4.	Social Impact / Customer Satisfaction	Patient can easily analyze and select the respective doctor by their point-of-view.
5.	Business Model (Revenue Model)	Here, Salary for 10 doctors reduced to the ratio of 10:7.
6.	Scalability of the Solution	The Proposed solution may be inflate by scheduling doctor by Hospital behest for the patient's demand.

3.4 PROBLEM SOLUTION FIT

1. CUSTOMER SEGMENT

Who is your customer?

A people who was infected or need medical help is our customer.

2. JOBS-TO-BE-DONE/PROBLEMS

Which jobs-to-be-done (or problems) do you address for your customers?

Open to all, to book their appointment using website.

3. TRIGGERS

What triggers customers to act?

Fear of fitness.

4. EMOTIONS: BEFORE / AFTER

How do customers feel when they face a problem or a job and afterwards?

- Before : Patients feel hereafter they don't need to continue, lose faith, Feel insecure.
- After : Patients were satisfied by selecting their desired doctor and got well by quality treatment.

5. AVAILABLE SOLUTIONS

Which solutions are available to the customers when they face the problem or need to get the job done?

Pre-appointed schedule for both patient and doctor, Appointing their comfortable doctor with their profile and fee structure.

6. CUSTOMER CONSTRAINTS

What constraints prevent your customers from taking action or limit their choices of solutions?

Spending time in waiting, fear of bill, availability of doctors or not.

7. BEHAVIOUR

What does your customer do to address the problem and get the job done?

Updating them that, Your appointment has x-time left, because the remainder through mails or texting.

8. CHANNELS Of BEHAVIOUR

8.1 ONLINE

What kind of actions do customers take online? Extract online channels from #7

Instead of interacting with a doctor in physical mode, Patient can consult the doctor in online mode in an emergency situation.

8.2 OFFLINE

What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.

In Spite of consulting the doctor in online mode, a patient can interact with the doctor would be more adequate.

9. PROBLEM ROOT CAUSE

What is the real reason that this problem exists? What is the back story behind the need to do this job?

Not having friendly conversation and care with patient. Waiting time for doctor gets patient antagonize.

Reason:

Receptionist may handle up to limited number of patients in a day but a machine don't have that limitation. So patient can register their appointment through the respective website.

10. YOUR SOLUTION

A Patient needs a way to analyze and choose a Doctor by their profile because of their experience and comfort.

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through website
FR-2	User Confirmation	Confirmation via Email Confirmation via Message
FR-3	Data Cleaning	We clean the data because there are many potential for data to be duplicated or incorrectly labeled when merging multiple data sources
FR-4	Reliability	Users may utilize this dashboard in an effective, efficient, and reliable manner since it is consistent and reliable for them.
FR-5	Accuracy	Dashboard accurately predicts the patient's health risks based on the length of their stay.

4.2 NON-FUNCTIONAL REQUIREMENTS

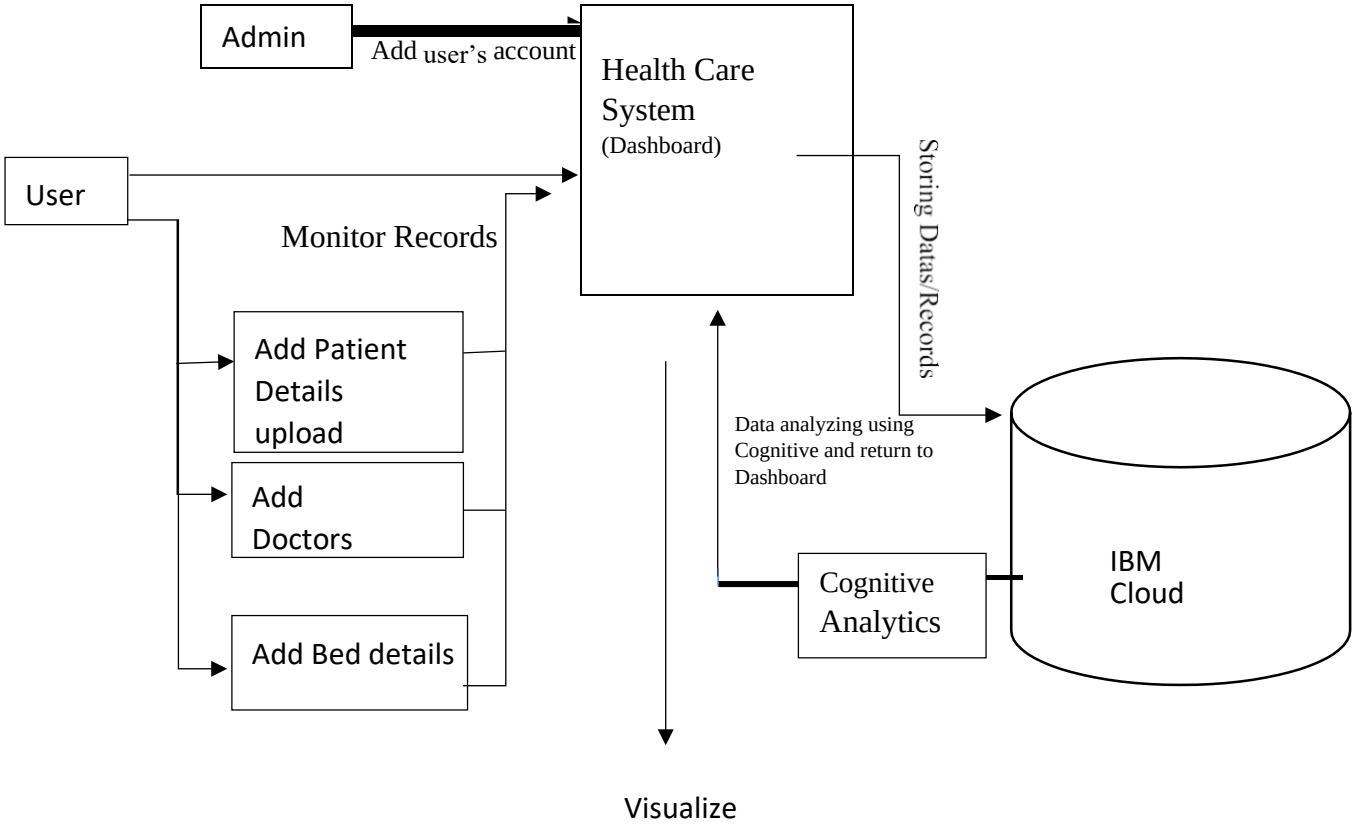
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	In order to provide a clear understanding of the patient's Length Of Stay, this dashboard makes use of data visualization techniques including charts and graphs.
NFR-2	**Security**	Only users who have the password can access the website. High degrees of security are provided through the use of encryption techniques to secure the database.
NFR-3	**Reliability**	Users will find this dashboard to be constant and dependable, assisting them in using it effectively, efficiently, and dependably.
NFR-4	**Performance**	The project must respond quickly to the user's actions or even if the user has to wait the waiting period must be short.
NFR-5	**Availability**	The project is independent of platforms. On practically every platform, it functions flawlessly.
NFR-6	**Scalability**	The project enables concurrent usage of the data by several people. Because adding features and improving the website is simple, it is very scalable.

5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS

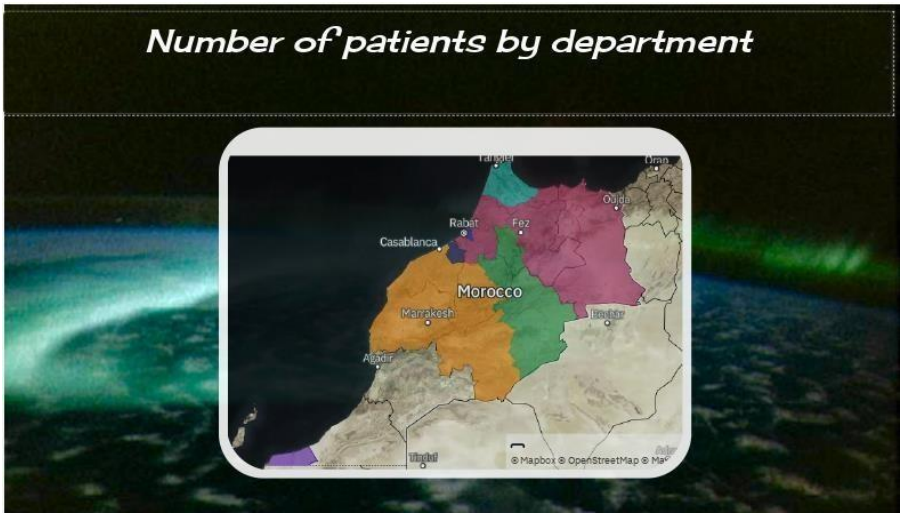
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



1. Patients Based on age
2. Number of Patients
3. Number of Beds

5.2 SOLUTION & TECHNICAL ARCHITECTURE

5.3 USER STORIES



6. PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION

MILESTONES	TASKS
MILESTONE – 1	Data Collecting process (Datasets)
MILESTONE – 2	Required Datasets are uploaded on the IBM Cognitive Platform.
MILESTONE – 3	Data Exploration and Data Visualization
MILESTONE - 4	To Create a Interactive Dashboard.
MILESTONE - 5	Display the Insights in the Dashboard
MILESTONE - 6	Construct a Standardized Data Set and use the needed data with the Assistance of a Python Program
MILESTONE - 7	Use of different algorithm with Google Colab to achieve the desired result with more accuracy.
MILESTONE - 8	Making the output simpler to understand and more efficient.
MILESTONE - 9	Deployed in the Github

6.2 SPRINT DELIEVERY SCHEDULE

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Register	USN-1	Data Collecting process (Datasets) Required Datasets are uploaded on the IBM Cognitive Platform	10	Medium	Ravi Kumar M
Sprint-1	Login	USN-1	Data Exploration and Data Visualization	20	High	Renuga V
Sprint-2	Dashboard	USN-2	To Create a Interactive Dashboard. Display the Insights in the Dashboard	10	High	Kaviya R
Sprint-2	Dashboard	USN-3	Construct a Standardized Data Set and use the needed data with the Assistance of a Python Program	10	High	Nikitha E
Sprint-3	Dashboard	USN-4	Use of different algorithm with Google Colab to achieve the desired result with more accuracy.	20	High	Ravi Kumar M
Sprint-4	Virtualizes	USN-5	Making the output simpler to understand and more efficient. Deployed in the Github.	20	High	Renuga V

PROJECT TRACKER, VELOCITY & BURN DOWN CHART

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)

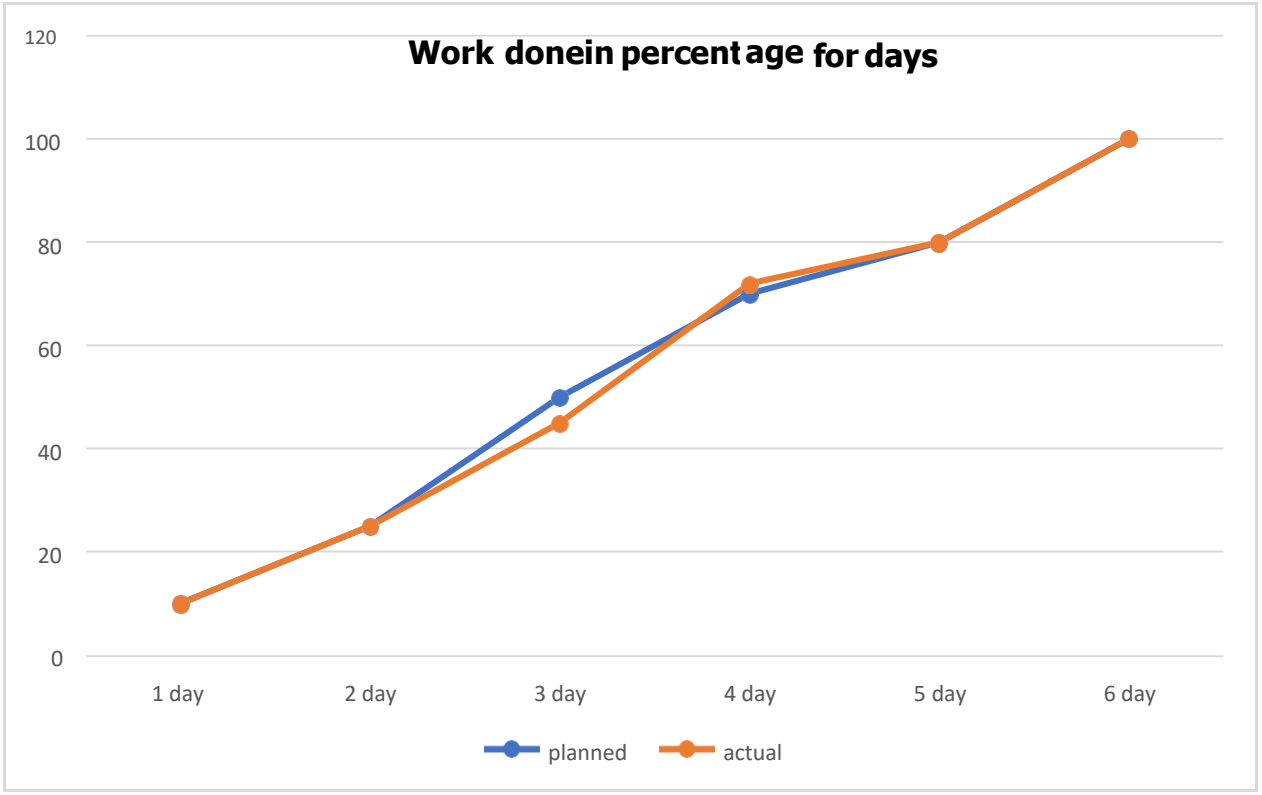
$$AV = \frac{\text{SPRINT DURATION}}{\text{VELOCITY}}$$

$$= \frac{20}{2}$$

$$= 10$$

Burn down Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile_software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



7. TESTING

7.1 TEST CASES

This report shows the number of test cases that have passed, failed, and untested.

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	0	0	0	0
Client Application	0	0	0	0
Security	0	0	0	0
Outsource Shipping	0	0	0	0
Exception Reporting	0	0	0	0
Final Report Output	0	0	0	0
Version Control	0	0	0	0

7.2 USER ACCEPTANCE TESTING

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	5	5	3	0	13
Duplicate	0	0	0	0	0
External	7	5	1	0	13
Fixed	11	8	7	5	31
Not Reproduced	1	0	0	0	1
Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	24	18	11	5	58

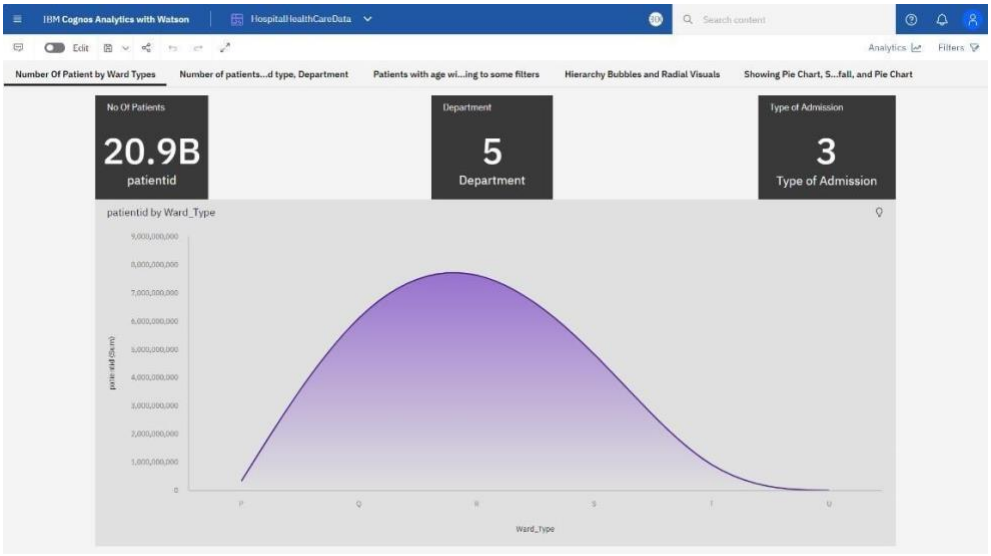
8. RESULT

8.1 PERFORMANCE METRICS

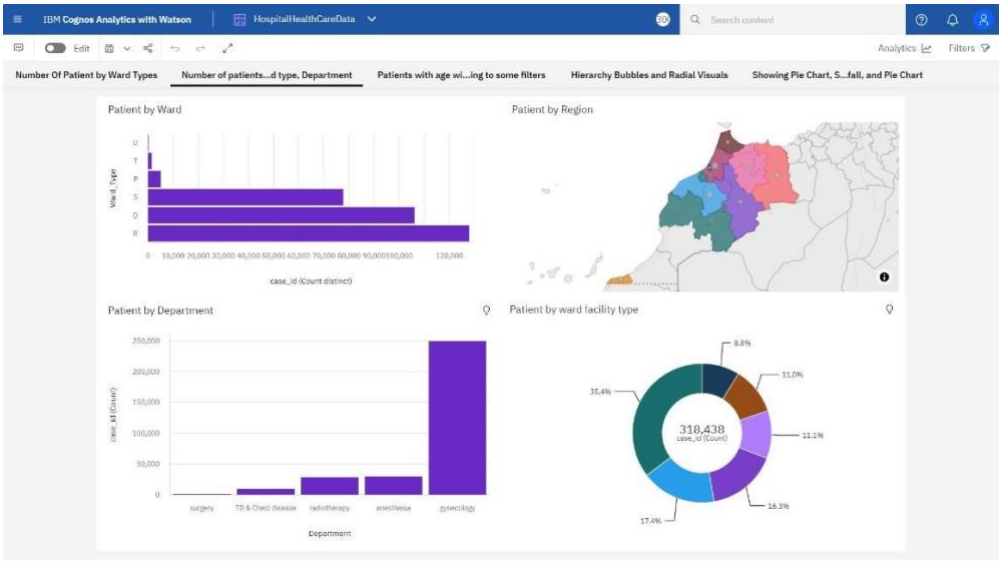
Project team shall fill the following information in model performance testing.

S. No.	Parameter	Screenshot / Values
1.	Dashboard design	17 / 5
2.	Data Responsiveness	The final output from IBM Cognos With Watson further converted into PDF or Story file, So it can be viewed by all devices.
3.	Amount Data to Rendered (DB2 Metrics)	0 KB.
4.	Utilization of Data Filters	The Utilization of data Filters like Ascending , Descending, Format and so on.
5.	Effective User Story	12
6.	Descriptive Reports	17 / 5

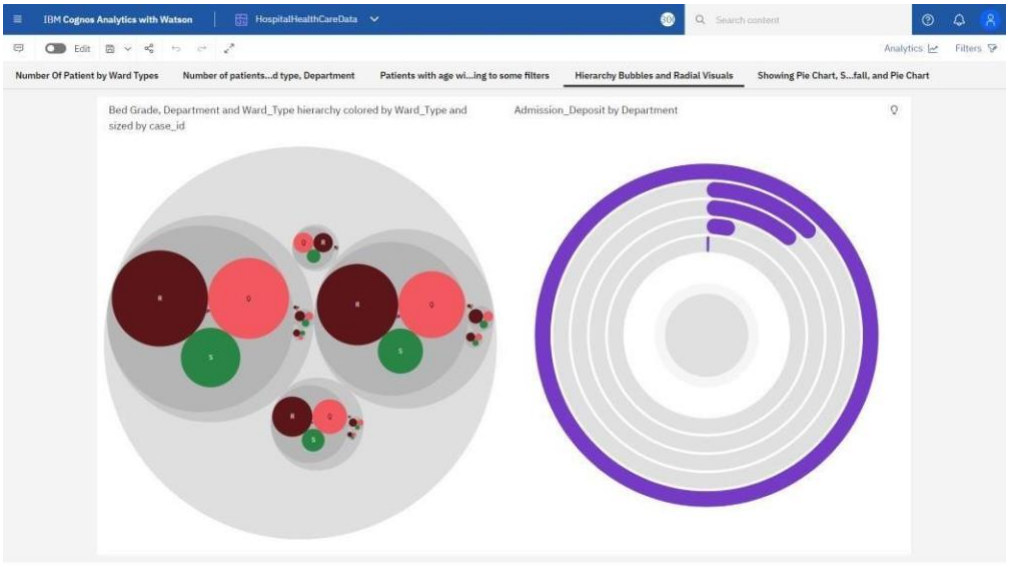
- Number Of Patient by Ward Types



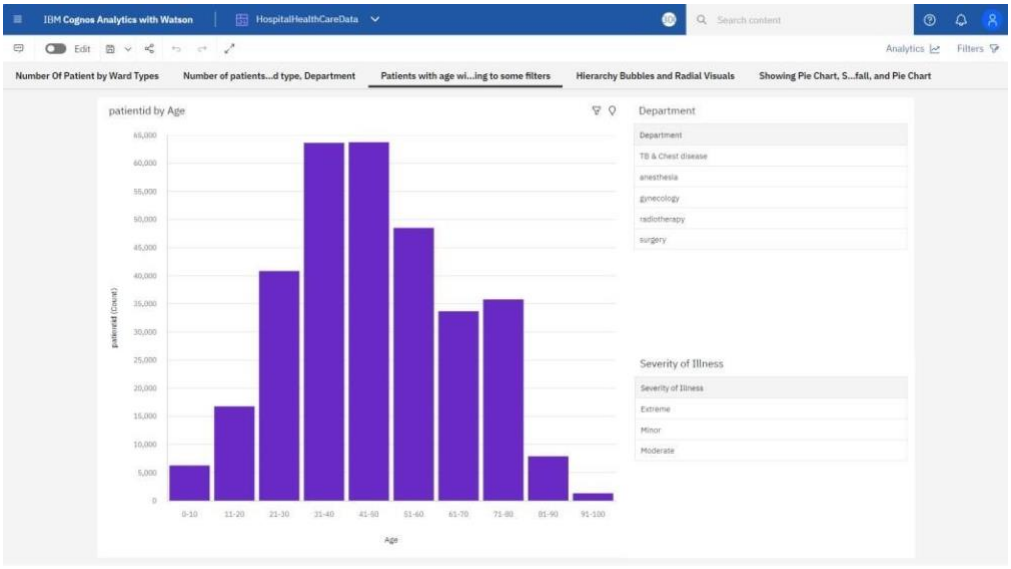
- Number Of Patient by Ward Facility Type, Region, Department



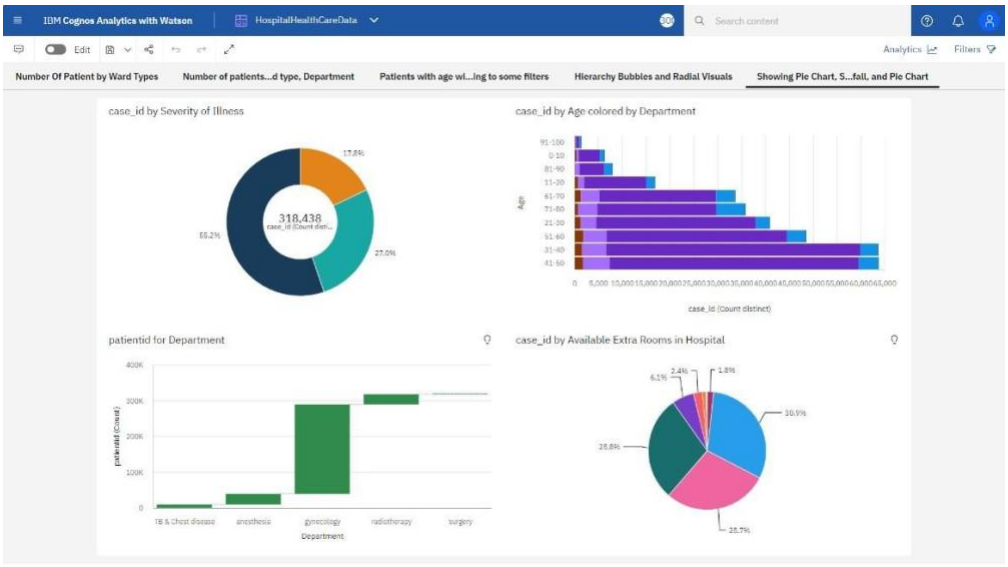
- Age Wise Patients With Department And Severity Filters



- Dashboard With Hierarchy Bubble And Radial Visuals



- Dashboard Showing Pie, Stacked Bar, Waterfall And Pie Charts



9. ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Helps an organization to make a better decision
- Increase the efficiency of the work
- The analytics keeps you updated of your customer behavioral changes.
- Personalization of hospital details.
- Improving quality of service and health care.

DISADVANTAGES:

- Lack of alignment within teams
- Lack of commitment and patience
- Low quality of data
- Privacy Concerns
- Complexity and Bias

10. CONCLUSION

Data analytics in health care is vital. It helps health care organizations to evaluate and develop Number of patients by ward, Age wise patients with department details, Various types of visualizations to analyze the hospital's datasets and hence predict outbreaks in illness, Data analytics can also lower costs for health care organizations and boost business intelligence.

11. FUTURE SCOPE

While every fact of the industry stands to be changed by data analytics in healthcare, data has significantly improved healthcare in three areas: conducting medical studies, understanding the cost of medical tests and health insurance, and making preventative recommendations to patients.

Hospital Healthcare data analytics helps in analyzing the patient details via hospital that the availability of doctors and number of beds to the patients and hence, it reduce the man power and time of the respective Hospital.

12. APPENDIX

12.1 GitHub Link

- Our GitHub Repository Direct Link
  https://github.com/IBM-EPBL/IBM-Project-36103-1660292814