

Visualizing And Predicting Heart Diseases With An Interactive Dash Board

Define Problem/Problem Understanding

Define Problem Statement: Visualizing and Predicting Heart Diseases with an Interactive Dashboard

Business Requirements: The health care industry produces a huge amount of data. This data is not always made use to the full extent and is often underutilized. Using this huge amount of data, a disease can be detected, predicted or even cured. The business requirements for analyzing the Heart Disease in world include identifying patterns and comparing factors of heart disease, creating interactive dashboards and reports, identifying areas for improvement, making data-driven decisions, comparing to the current situation and creating forecasting models for future performance. The ultimate goal is to gain insights and improve performance through data visualization techniques.

Literature Survey: A literature study is necessary for a project that uses an interactive dashboard to visualize and forecast heart illness. It covers pertinent studies on data visualization for heart disease, predictive modeling, interactive dashboard design, and user experience in healthcare applications. In order to guide the creation and use of a successful heart disease prediction dashboard, the survey attempts to uncover best practices, predictive models, visualization strategies, and ethical considerations from previous research and initiatives.

Social or Business Impact:

Social Impact: Analyzing heart disease has profound social impacts, ranging from individual-level health outcomes to community empowerment and public health initiatives. By promoting awareness, prevention, equitable healthcare access, and research advancements, heart disease analysis plays a crucial role in improving the well-being of individuals and society as a whole. Business

Model/Impact: Analyzing heart disease has substantial business impacts across various sectors, including healthcare, medical technology, pharmaceuticals, digital health, insurance, research, workplace wellness, and consumer products. It creates market opportunities, drives innovation, and influences policy and advocacy efforts in the fight against heart disease.

Data Collection and Extraction from Database

Downloading the Dataset: Heart_new2 dataset is downloaded for making visualizations.

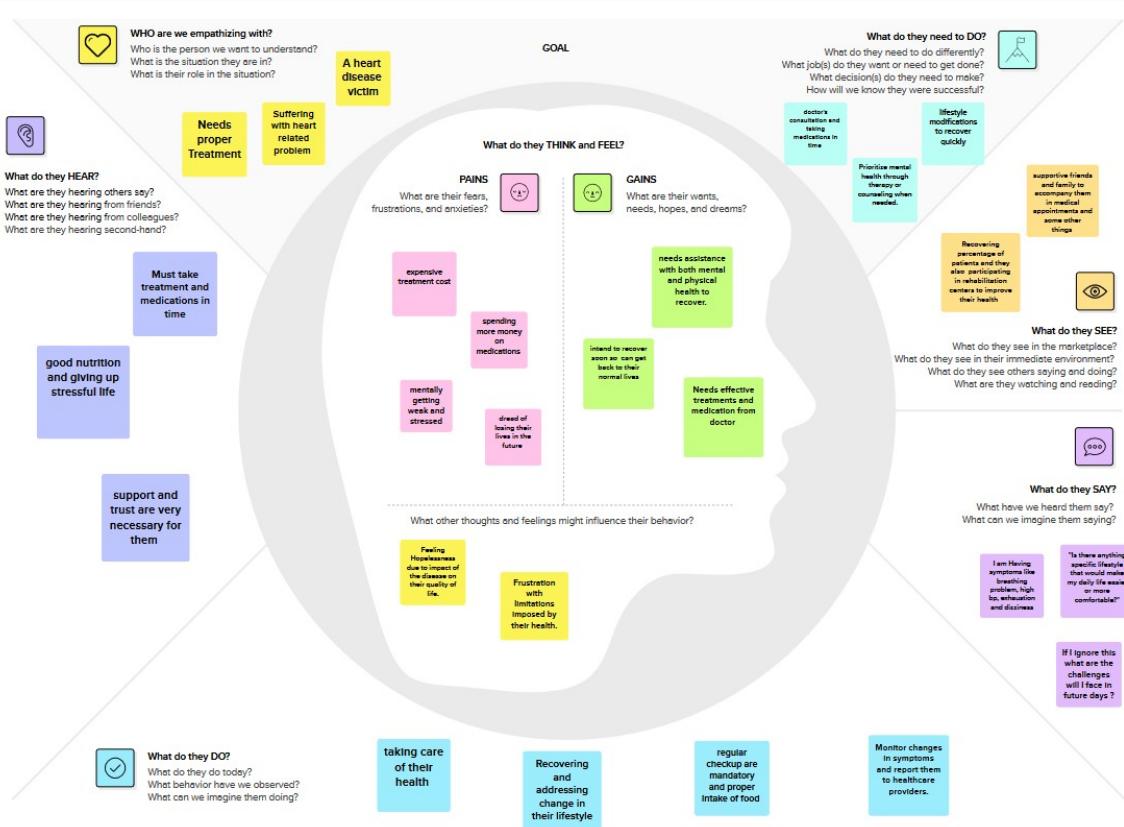
Column Description of the Dataset:

1. HeartDisease - target trait.
2. BMI – A value that allows you to assess the degree of correspondence between a person's mass and his height, and thereby indirectly judge whether the mass is insufficient, normal or excessive. It is important in determining the indications for the need for treatment.
3. Smoking: It is a major risk factor for cardiovascular disease. When smoke from a cigarette is inhaled, the reaction of the cardiovascular system immediately follows: within one minute, the heart rate begins to rise, increasing by 30% within ten minutes of smoking. The bad habit also increases blood pressure, fibrinogen and platelet levels, making blood clots more likely.
4. AlcoholDrinking - alcohol causes not only temporary disturbances in the functioning of the heart, but also permanent ones. Heart pain after alcohol is not the only health problem associated with alcohol consumption.
5. Stroke - Ischemic stroke occurs 4 times more often than hemorrhagic. One of the leading causes of this suffering is heart disease, which impairs its functioning, as a result of which the blood flow in the arteries is disturbed and the blood supply to the brain is reduced. Another cause of stroke in heart disease is thromboembolism, when clots form in the cavities of the heart (most often with heart failure) - blood clots.
6. PhysicalHealth - how many days in a month did you feel poor physical health.
7. MentalHealth - how many days in a month did you feel poor mental health.
8. DiffWalking - difficulty climbing stairs.
9. Sex - gender of a person.
10. AgeCategory - age category of the subjects.
11. Race- Race is a complex social construct that categorizes people into distinct groups based on certain physical and genetic characteristics

12. Diabetic – Person suffering from Diabetes
13. PhysicalActivity - adults who reported doing physical activity or exercise during the past 30 days other than their regular job
14. GenHealth - well-being.
15. SleepTime - number of hours of sleep.
16. Asthma- Asthma is a chronic respiratory condition due to breathing Issue
17. KidneyDisease – Disease related to Kidney
18. Skin Cancer – People suffering from Skin Cancer

IDEATION AND PROPOSED SOLUTION

EMPATHY GRID



BRAIN STORMING

1

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

⌚ 5 minutes



2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

⌚ 10 minutes

TIP:
You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

Kesavarshini Appikatla

Tummala Priyanka

Vakkapatla Samyata

Nunna Charan Sai

- Conducting surveys and campaigns which brings awareness.
- Get a device which continuously monitors heart health.
- Show the risk factors using 3D technology so that it would be more effective.
- Feedback from old patients so that it would be more helpful.
- Show all the tasks to be completed every day and make the patient follow the tasks on time.
- Create an online website which asks some questions related to their lifestyle and provides a certain solution for their problem.
- In kind of any emergency keep a tracker and guide the patient.
- Develop an AI tool that gives update on their health condition and provides advices and motivation if needed.
- Using modern technology for improving treatment

Person 5

Person 6

Person 7

Person 8

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 semi-transparent label. If a cluster is bigger than an sticky notes, try and see if you and break it up into smaller sub-groups.

⌚ 20 minutes

Tools and websites for testing and changing lifestyle

- Build an AI tool for analyzing ECG test.
- Develop an AI tool that gives update on their health condition and provides advices and motivation if needed.
- Create an online website which asks some questions related to their lifestyle and provides a certain solution for their problem.

Guiding patient

- Get care takers for getting day-to-day update, if patient have weak family background.
- In kind of any emergency keep a tracker and guide the patient.

Sharing experiences

- Conducting surveys and campaigns which brings awareness.
- Feedback from old patients so that it would be more helpful.

Using current technology for better results

- Using modern technology for improving treatment
- Show the risk factors using 3D technology so that it would be more effective.
- Feedback from old patients so that it would be more helpful.
- Show all the tasks to be completed every day and make the patient follow the tasks on time.
- Conducting surveys and campaigns which brings awareness.

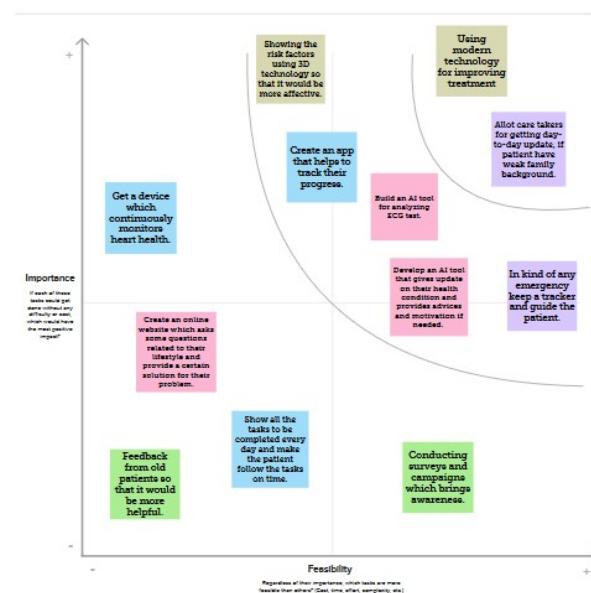
4

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

Participants can use their phones to point at where they are on the grid. The facilitator can sort the spots by using the arrow keys or the H key on the keyboard.



Functional Requirements

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	HTML, CSS, JavaScript/Angular Js/React Js etc.
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 Watson Health API, etc.
9.	External API-2	Purpose of External API used in the application	Health Data API, etc.

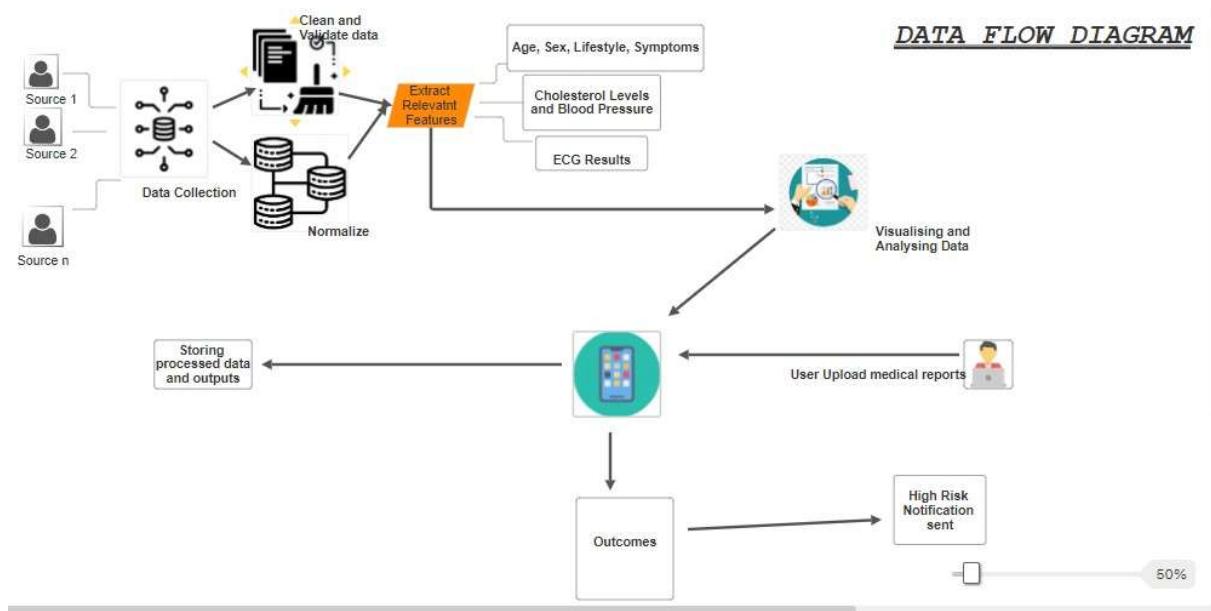
10.	Machine Learning Model	Purpose of Machine Learning Model	Provide accurate and data-driven insights, etc.
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	Local

Table-2: Application Characteristics:

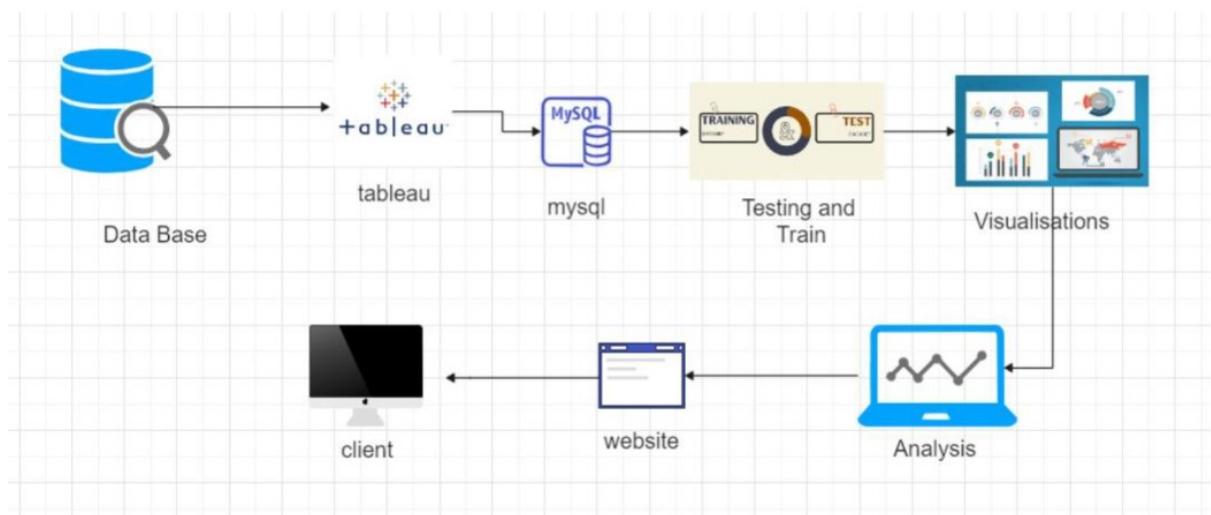
S.N o	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Tableau Public, R packages, Python framework, etc.
2.	Security Implementations	List all the security / access controls implemented, use of firewalls etc.	Encryptions, Authentication, API Security, etc.
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	NoSQL, Micro-services, etc.

S.N o	Characteristics	Description	Technology
4.	Availability	Justify the availability of application (e.g. use of load balancers, distributed servers etc.)	Load balancers, Content Delivery Networks, etc.
5.	Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc.	API Optimization, Load Balancing, CDN, etc.

Data flow model



Solution architecture and use case stories



User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Patient (Mobile user)	Registration	USD-1	As a patient, I can upload my past health information and test results during the registration process.	I can access my uploaded medical records	High	Sprint-1
		USD-2	As a patient, I can create an account by entering my name, age, gender, and contact details.	I can see my health information after registration	High	Sprint-1
	Login	USD-3	As a patient, I can log into my account using my email and a secure password.	I can securely login to my account.	High	Sprint-1
	Dashboard	USD-4	As a patient, I can view my customized health dashboard, which includes vital signs and suggested treatments.	I can view the data on the ECG, blood pressure, and heart rate in real-time which is displayed by dashboard.	High	Sprint-2
Doctor (Web user)	Registration	USD-5	As a doctor, I can sign up by submitting information about my medical license and contact data.	I can access the patient records.	High	Sprint-1
	Login	USD-6	As a doctor, I can log in using my email and a secure password.	I can securely login to my account.	High	Sprint-1
	View Patient Records	USD-7	As a doctor, I can view a patient's medical history and diagnostic data for analysis.	I can view patient data, including ECG reports and medical history.	High	Sprint-2

Project planning scheduling architecture

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a patient, I can upload my past health information and test results during the registration process.	2	Medium	Kesavarshini, Priyanka
Sprint-1		USN-2	As a patient, I can create an account by entering my name, age, gender, and contact details.	4	High	Kesavarshini, Priyanka, Samyata, Charan Sai

Sprint-1	Login	USN-3	As a patient, I can log into my account using my email and a secure password.	4	High	Kesavarshini, Priyanka, Samyata, Charan Sai
Sprint-2	Dashboard	USN-4	As a patient, I can view my customized health dashboard, which includes vital signs and suggested treatments.	2	Medium	Samyata, Charan Sai
Sprint-1	Registration	USN-5	As a doctor, I can sign up by submitting information about my medical license and contact data.	4	High	Kesavarshini, Priyanka, Samyata, Charan Sai
Sprint-1	Login	USN-6	As a doctor, I can log in using my email and a secure password.	4	High	Kesavarshini, Priyanka, Samyata, Charan Sai
Sprint-2	View Patient Records	USN-7	As a doctor, I can view a patient's medical history and diagnostic data for analysis.	3	High	Kesavarshini, Priyanka, Samyata
Sprint-1	User Management	USN-8	As an administrator, I can manage user accounts by adding, modifying, or deleting user profiles.	2	Low	Priyanka, Samyata
Sprint-2	Access Control	USN-9	As an administrator, I can access controls that	1	Low	Charan Sai

Storing Data in DB and Perform SQL Operations:

The screenshot shows the MySQL Workbench interface. The top section displays the "Welcome to MySQL Workbench" message, which includes a brief description of the tool's features: design, browse schemas, work with objects, insert data, run SQL queries, and migrate data from other vendors. Below this, there are links to "Browse Documentation >", "Read the Blog >", and "Discuss on the Forums >".

The main area is titled "MySQL Connections" and shows a connection to "Local instance MySQL80" with the user "root" and host "localhost:3306".

The bottom half of the screenshot shows a query editor window for the database "heartdiseaseprediction". The current schema is "heart_new2". The SQL pane contains the following four queries:

```
1 USE `tableau-project`;
2 SELECT * FROM heart_new2;
3 SELECT HeartDisease, Diabetic FROM heart_new2;
4 SELECT * FROM heart_new2 ORDER BY AgeCategory;
```

The Results Grid pane displays a table of data with columns: HeartDisease, BMI, Smoking, AlcoholDrinking, Stroke, PhysicalHealth, MentalHealth, DiffWalking, Sex, and Age. The data consists of 14 rows, each representing a patient's health profile.

HeartDisease	BMI	Smoking	AlcoholDrinking	Stroke	PhysicalHealth	MentalHealth	DiffWalking	Sex	Age
No	29.01	No	No	No	4	4	No	Male	16
No	25.83	No	Yes	No	0	15	No	Male	16
No	22.67	No	No	No	0	7	No	Female	16
No	22.83	No	No	No	0	0	No	Female	16
No	23.3	No	No	No	0	0	No	Female	16
No	21.79	No	No	No	7	7	No	Female	16
No	26.5	No	No	No	0	0	No	Male	16
No	24.39	No	No	No	2	0	No	Male	16
No	22.46	Yes	Yes	No	0	30	No	Female	16
No	?? .4	No	No	No	0	?	No	Female	16

Connect DB with Tableau:

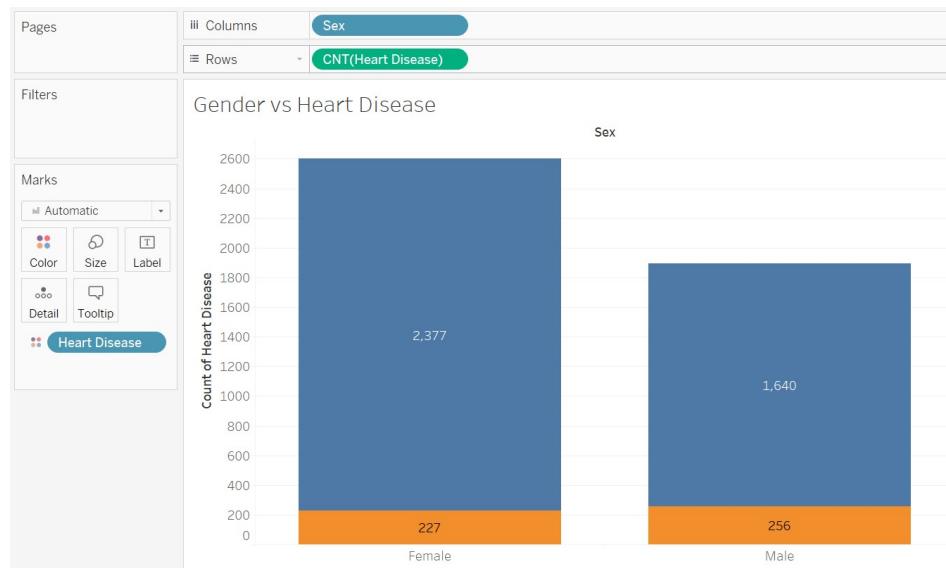
The screenshot shows the Tableau Data Source interface. On the left, the 'Connections' pane lists 'localhost MySQL' and the 'Database' pane shows 'tableau-project'. Under 'Table', 'heart_new2' is selected. The main workspace displays the 'heart_new2' table with 18 fields and 4500 rows. A message at the top right says 'Need more data?' and 'Drag tables here to relate them. [Learn more](#)'. The bottom navigation bar includes tabs for 'Heart Disease', 'General Health vs Heart Disease', 'Physical Activity vs Heart Disease', 'Age vs BMI vs Diabetic', 'People got Stroke suffering fro...', 'Dashboard 1', 'Dashboard 2', 'Story 1', and other icons.

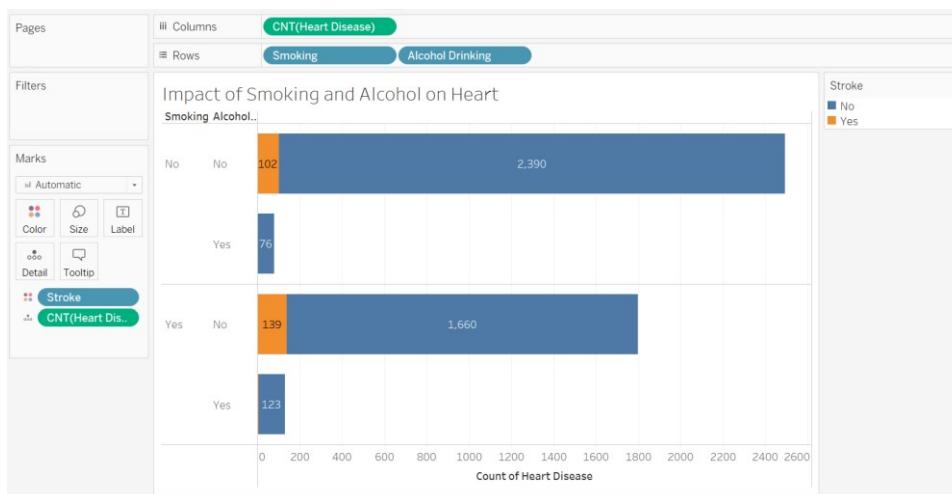
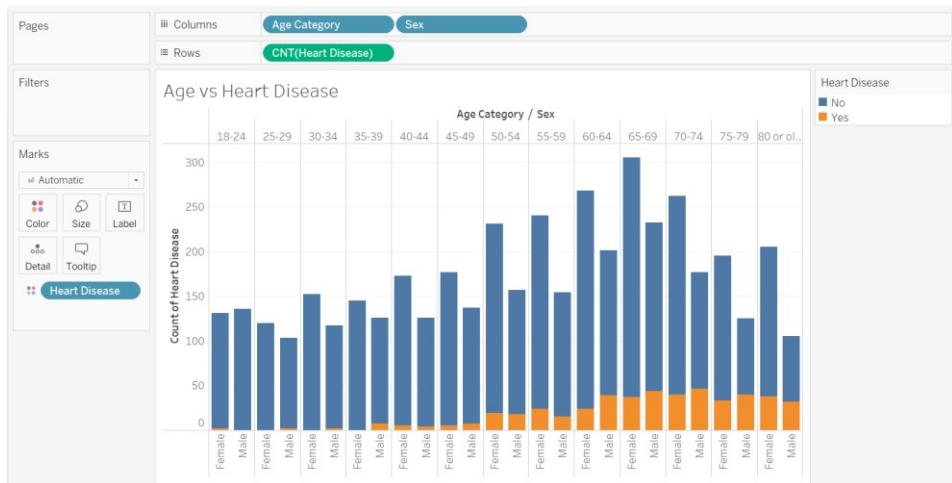
Data Preparation

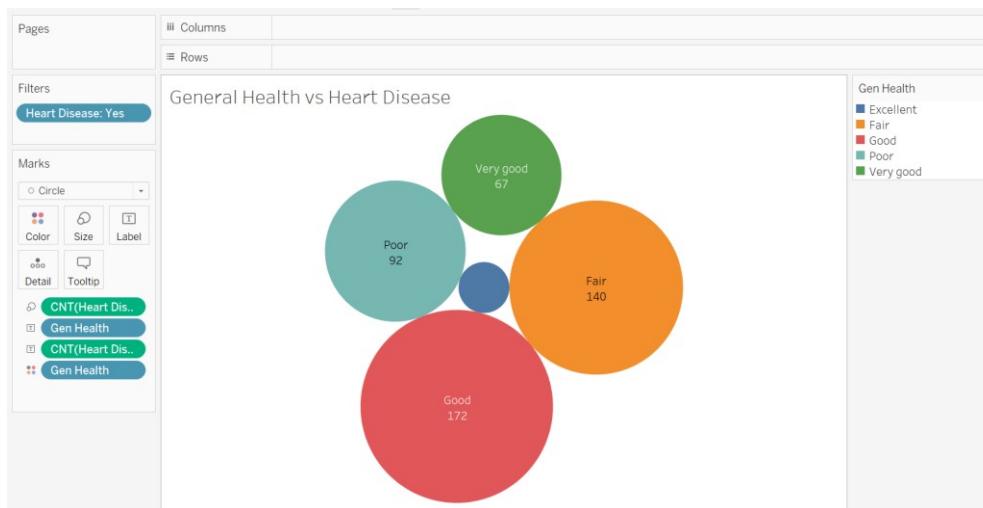
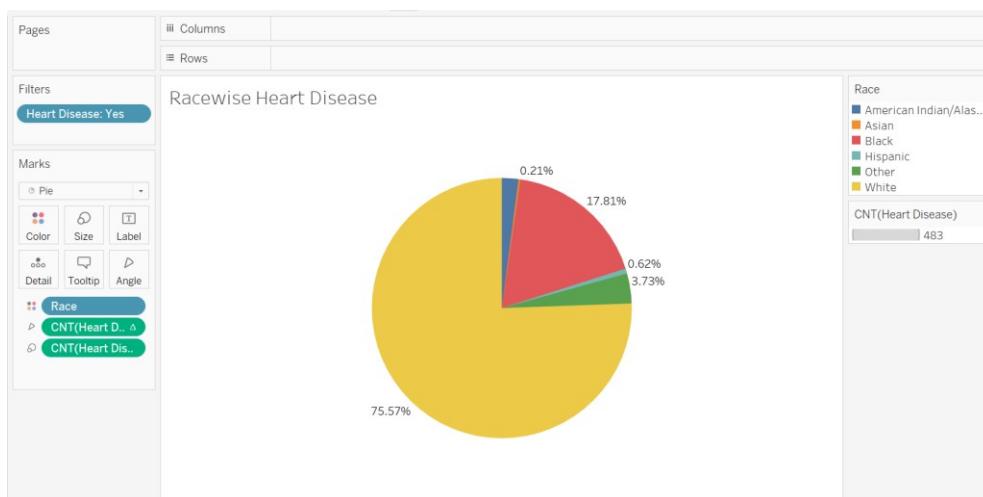
Prepare the Data for Visualization: Preparing the data for visualization involves cleaning the data to remove irrelevant or missing data, transforming the data into a format that can be easily visualized, exploring the data to identify patterns and trends, filtering the data to focus on specific subsets of data, preparing the data for visualization software, and ensuring the data is accurate and complete. This process helps to make the data easily understandable and ready for creating visualizations to gain insights into the performance and efficiency. Since the data is already cleaned we can move to visualization.

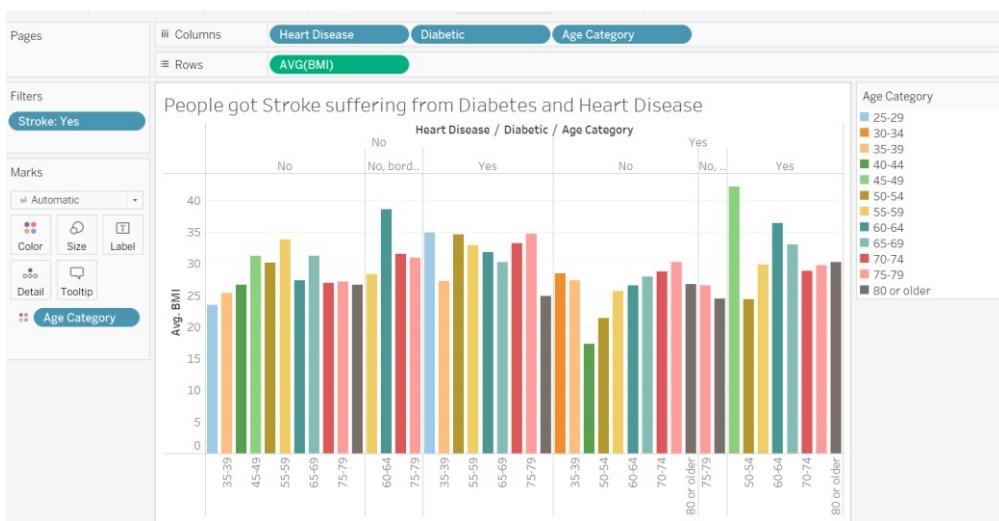
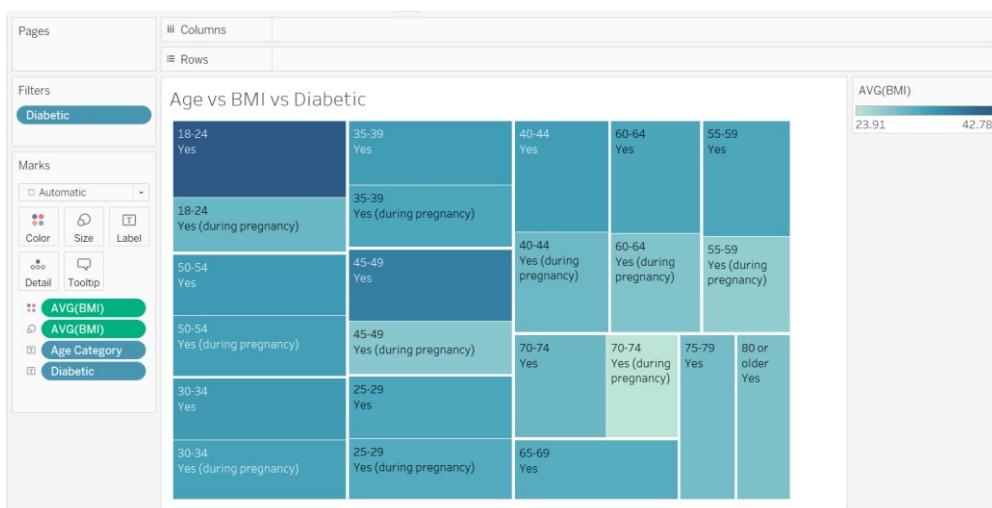
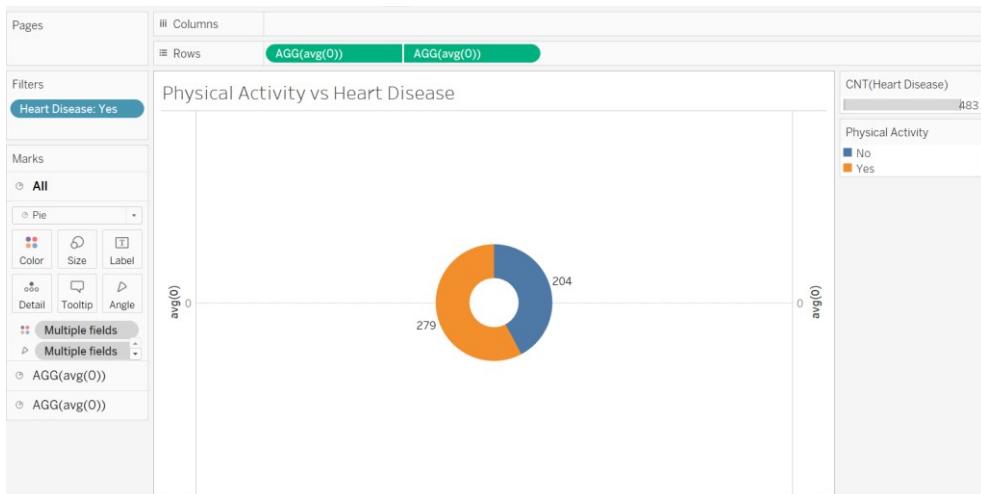
Data Visualization

No of Unique Visualizations: There are 10 unique visualizations.



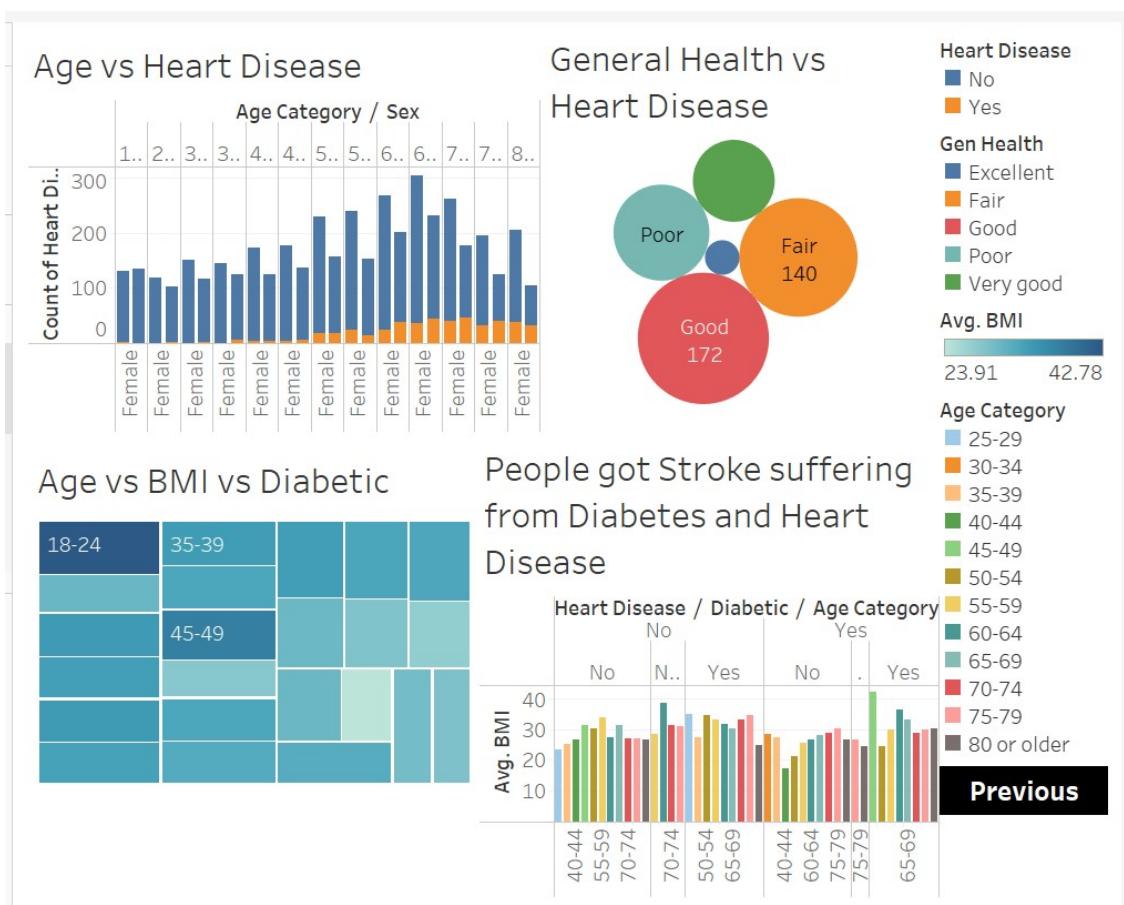
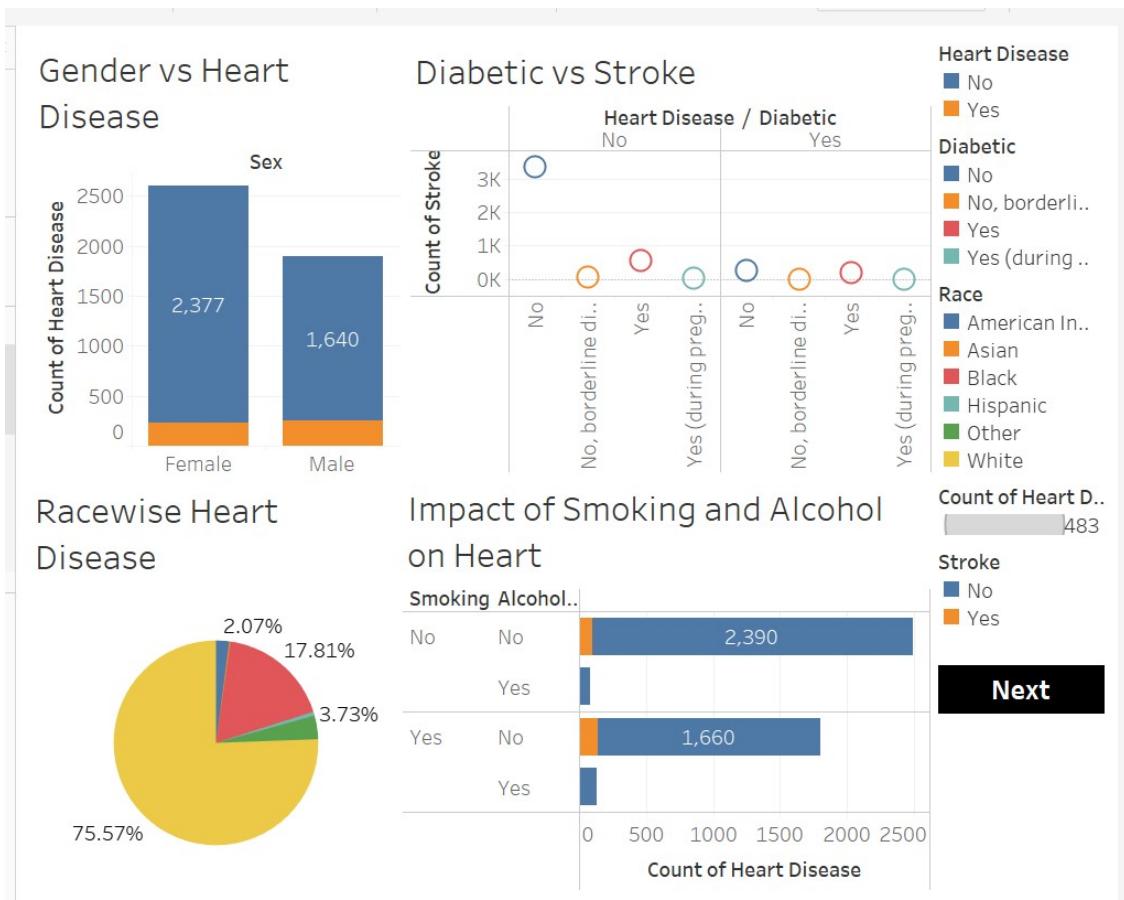






Dashboard

Responsive and Design of Dashboard:

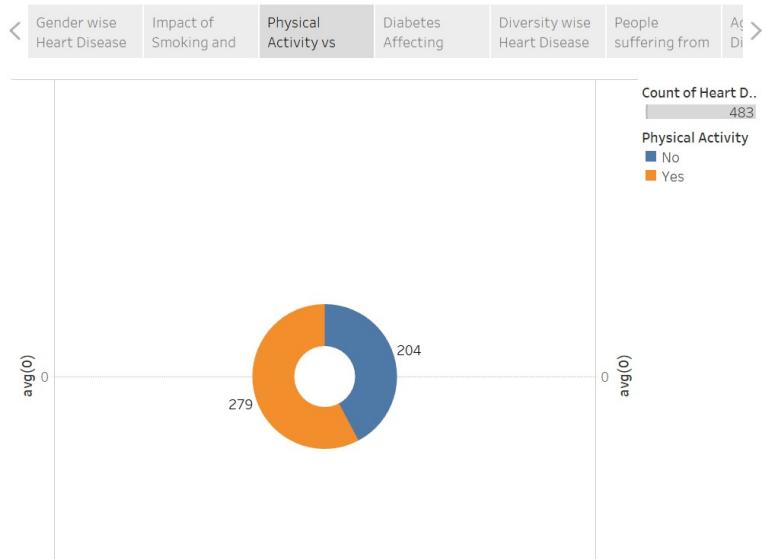


Story

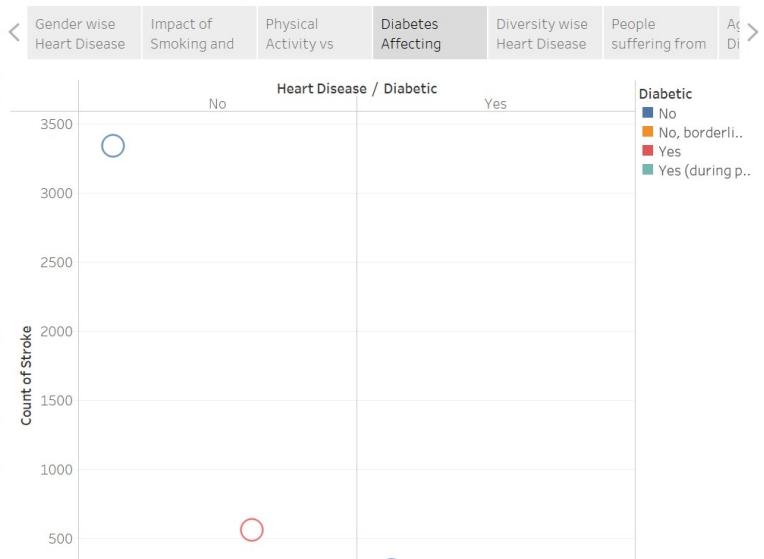
No of scenes of Story: Total 8 unique scenes of story.



Heart Disease Story

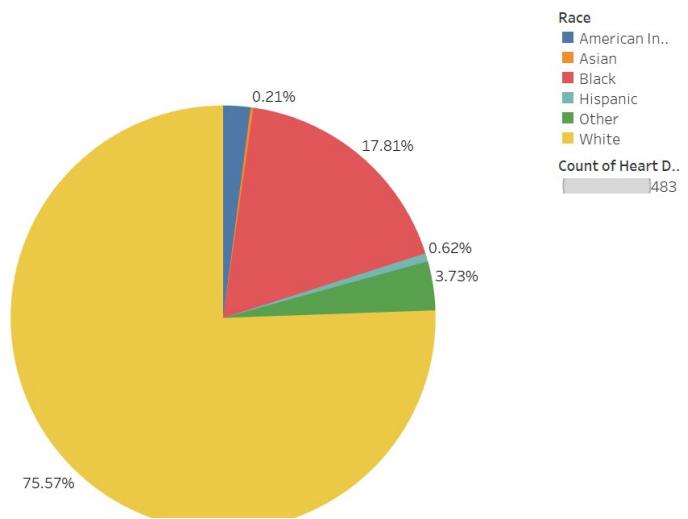


Heart Disease Story



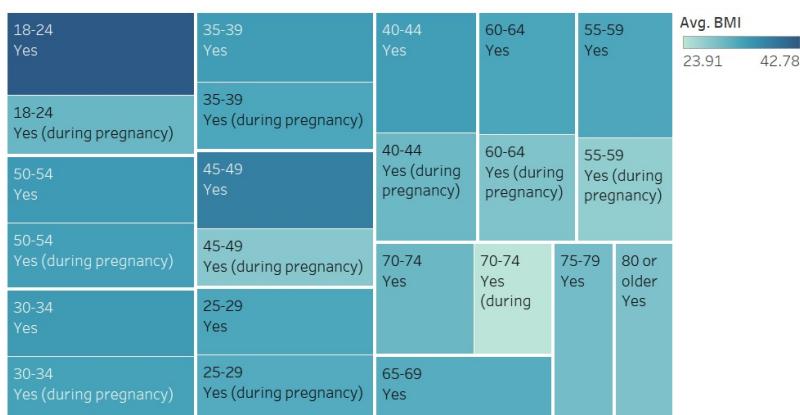
Heart Disease Story

< Gender wise Heart Disease Impact of Smoking and Physical Activity vs Diabetes Affecting Diversity wise Heart Disease People suffering from Age Di >

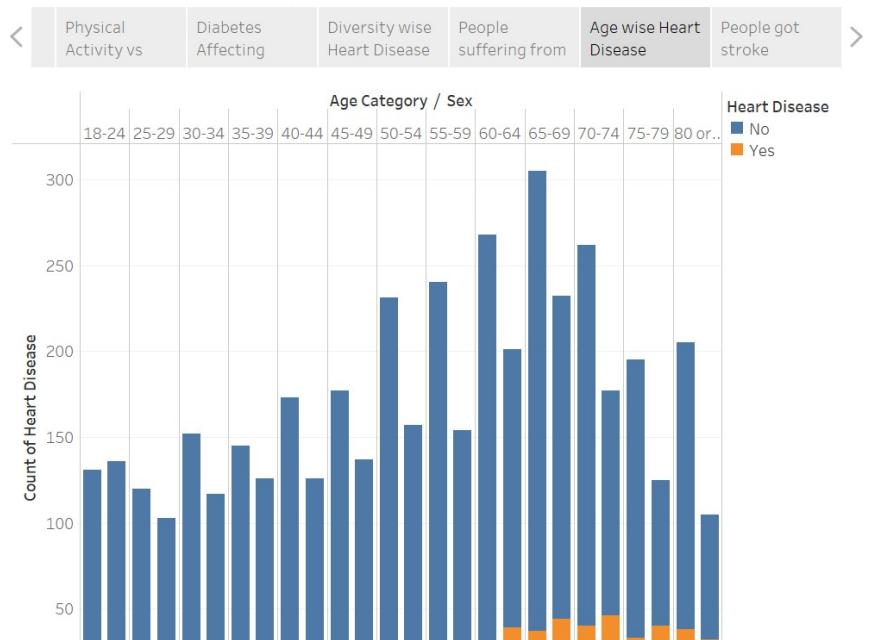


Heart Disease Story

< Gender wise Heart Disease Impact of Smoking and Physical Activity vs Diabetes Affecting Diversity wise Heart Disease People suffering from Age Di >



Heart Disease Story



Heart Disease Story



Performance Testing

Amount of Data Rendered to DB:

Navigator

SCHEMAS

Filter objects

- assignment3
- project
- superstore
- sys
- tableau-project**
 - Tables
 - heart_new2
 - Views
 - Stored Procedures
 - Functions

Local instance MySQL80

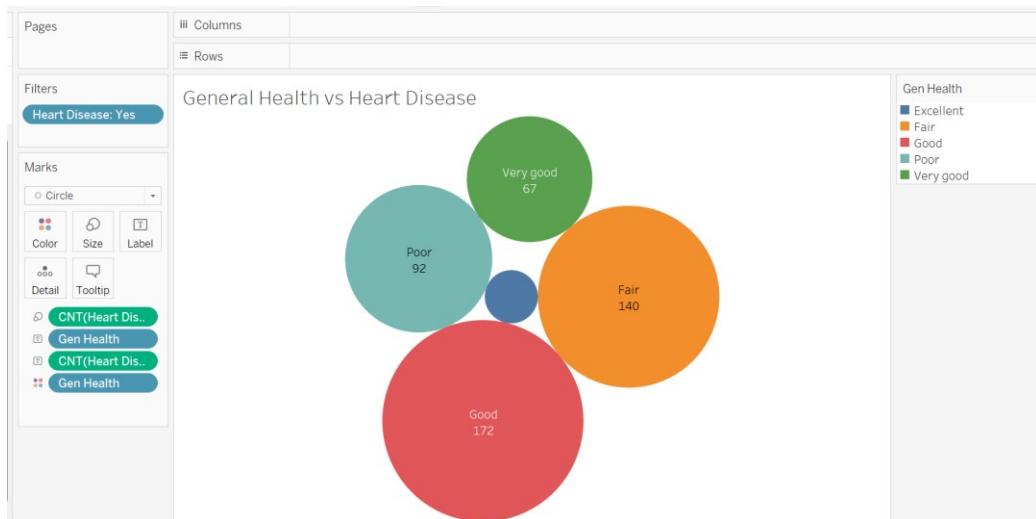
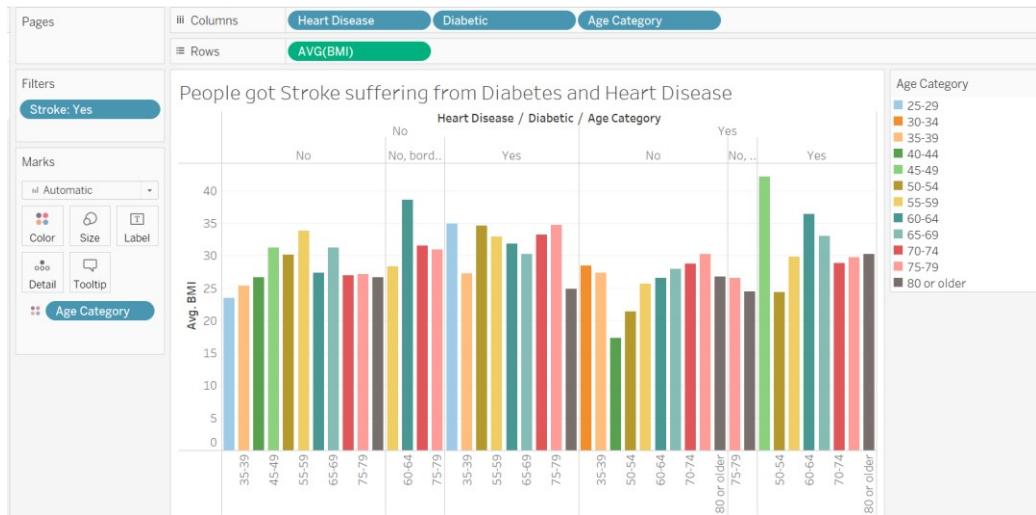
tableau-project.heart_new2

Table Details

Engine: InnoDB
Row format: Dynamic
Column count: 18
Table rows: 4327
AVG row length: 367
Data length: 1.5 MiB
Index length: 0.0 bytes
Max data length: 0.0 bytes
Data free: 0.0 bytes
Table size (estimate): 1.5 MiB
File format:
Data path:
Update time:
Create time: 2023-11-02 14:14:32

Information on this page may be outdated. Click **Analyze Table** to update it.

Utilization of Data Filters:

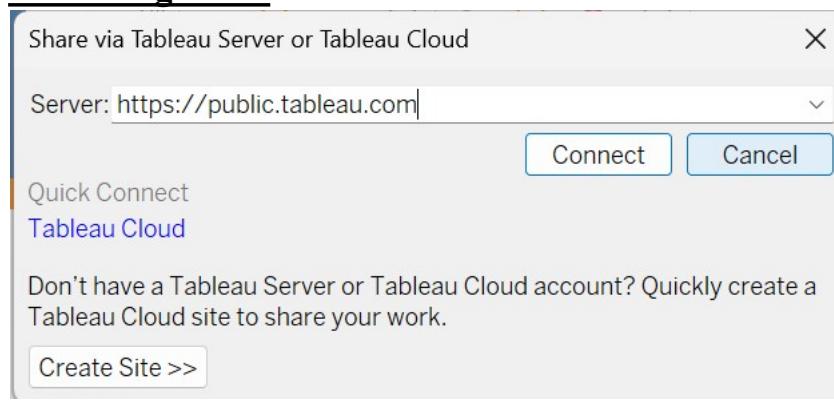


No of Calculation Fields: In this analysis we have not created any new column using calculation filed as data found in dataset was clean and sufficient for analysis.

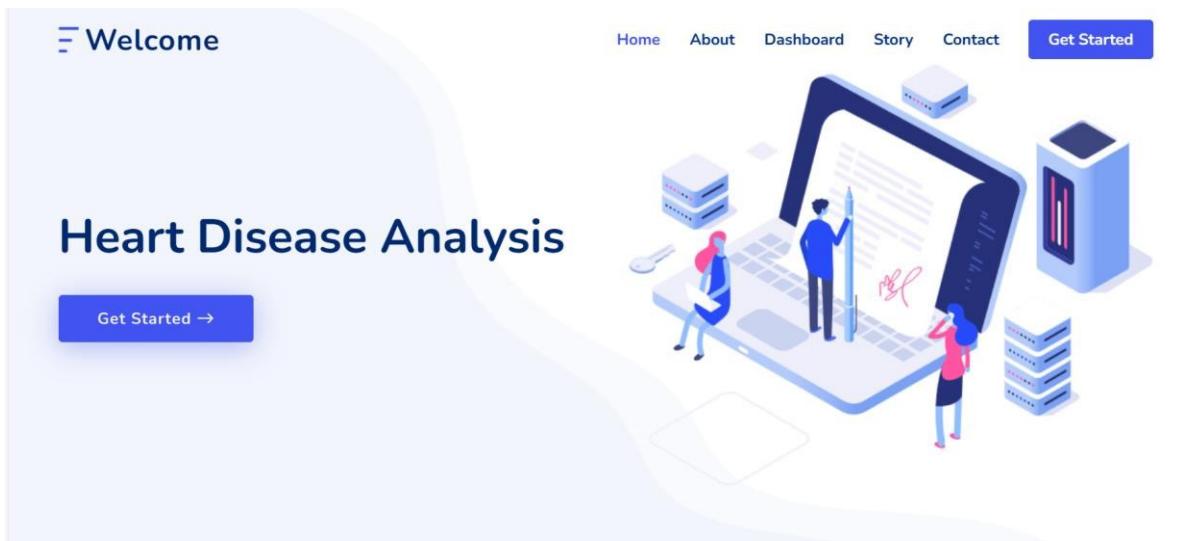
No of Visualizations/ Graphs:

1. Gender wise Heart Disease
2. Age wise Heart Disease
3. People Suffering from Diabetic and Stroke
4. Impact of Smoking and alcohol drinking on heart disease
5. Other Diseases vs Stroke
6. Race wise Heart disease
7. General Health vs Heart Disease
8. Physical activity vs heart disease
9. Age and BMI vs Heart disease
10. People got stroke suffering from Diabetes and Heart disease

Web Integration



Embed Dashboard and Story with Flask:



Import favorites Dell You are signed in as... Gmail YouTube Maps

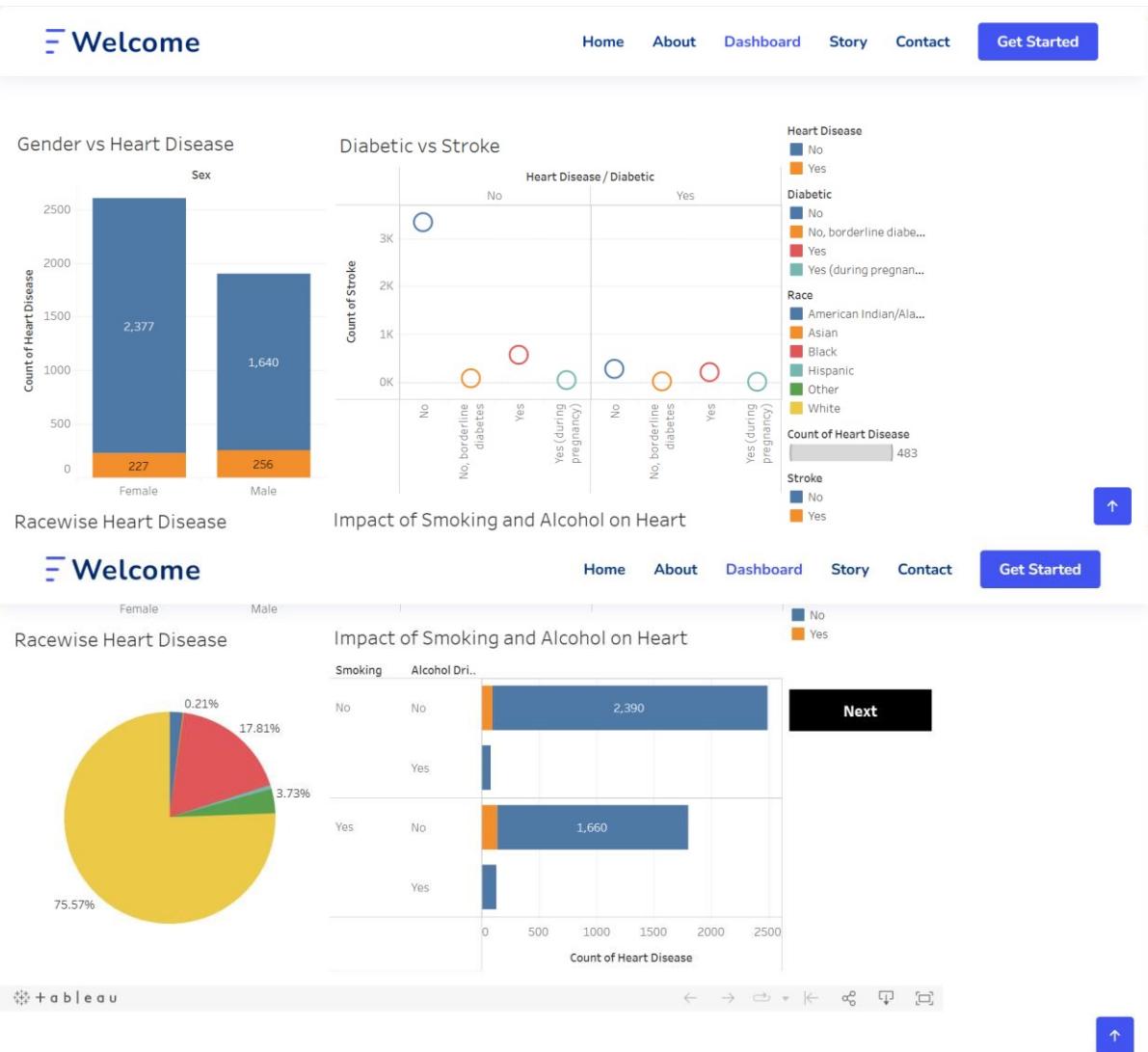
Welcome

Home About Dashboard Story Contact Get Started

Heart disease(heart disease) is a group of diseases related to cardio vascular diseases, manifested by a violation of the normal functioning of the heart. May be caused by damage to the epicardium, valvular apparatus of the heart, heart vessels. According to the National Heart, Lung and Blood Institute in Framingham(USA), the most important factors in the development of cardio vascular disease in humans are abesity, sedentary lifestyle and smoking.

The diagram illustrates the causal factors leading to heart disease. A central red heart shape contains the text "Heart Disease" and a small ECG line. Seven arrows point from various colored circles to the heart: "Abnormal Blood Lipid Levels" (purple), "Tobacco" (yellow), "Physical Inactivity" (green), "Obesity" (red), "Type II Diabetes" (blue), "Hypertension" (light blue), and "Hypertension" (light blue).

alamy



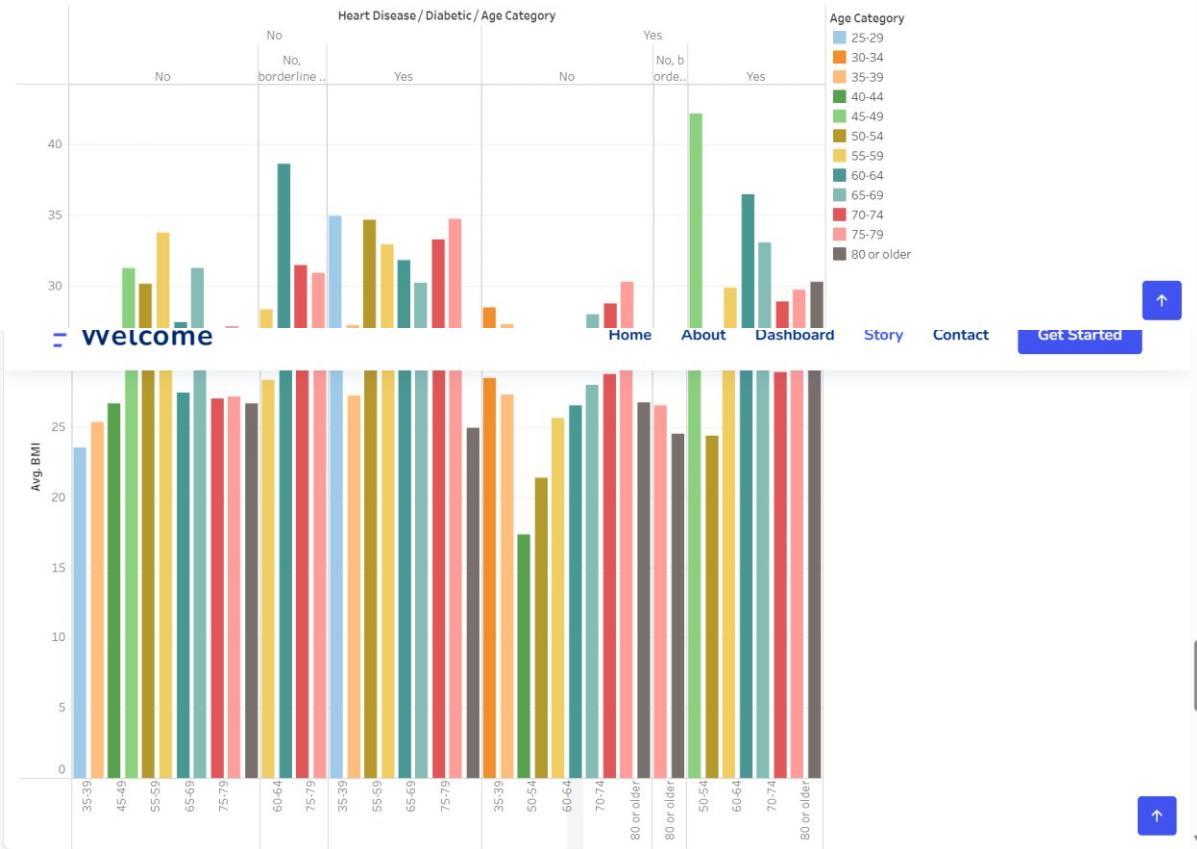
Welcome

Home About Dashboard Story Contact

Get Started

Heart Disease Story

Physical Activity vs Heart Disease Diabetes Affecting Heart Disease Diversity wise Heart Disease Count People suffering from Diabetes with avg age category Age wise Heart Disease People got stroke suffering from Diabetes and Heart



The image displays two versions of a contact form page. The top version is a detailed contact form with the following sections:

- Address:** Hyderabad, India
- Call Us:** +1 5589 55488 55, +1 6678 254445 41
- CONTACT:** Fields for Your Name, Your Email, Subject, and Message.

The bottom version is a simplified contact form with the following sections:

- Email Us:** info@example.com, contact@example.com
- Open Hours:** Monday - Friday, 9:00AM - 05:00PM
- Send Message** button.

Advantages and disadvantages

Dashboards can integrate data from various sources, providing a comprehensive view of the patient's health. This holistic approach can lead to more accurate predictions by considering multiple factors. Dashboards can be accessed remotely, allowing medical professionals to monitor and analyze patient data from different locations. This accessibility can lead to timely interventions and personalized healthcare. Dashboards can provide real-time or near-real-time insights, allowing for quick decision-making. This is crucial in healthcare settings where timely decisions can save lives. Predictions are only as good as the data they are based on. If the input data is inaccurate, incomplete, or biased, the predictions made using the dashboard can be unreliable. Building an effective predictive dashboard requires expertise in data analysis, statistics, and visualization. It can be challenging to design a dashboard that accurately predicts heart disease without the right skills and knowledge. Healthcare data is sensitive and subject to strict privacy regulations. Storing and processing this data in a dashboard raises concerns about security breaches and patient privacy if not handled properly.

Conclusion

Predicting heart disease using dashboards presents a powerful approach to understanding complex healthcare data. By leveraging visualizations and predictive models, healthcare professionals can gain valuable insights, leading to timely interventions and improved patient outcomes. However, the effectiveness of these predictive dashboards relies heavily on the quality of data, the expertise in designing accurate models, and the ethical considerations surrounding patient privacy and biases.

Future scope

Integrating more sophisticated machine learning algorithms like deep learning and ensemble methods can enhance the accuracy of predictions. Continued research and development in machine learning techniques will likely lead to more precise predictive models. As the volume of healthcare data continues to grow, big data technologies can be leveraged to process and analyze vast datasets. This can uncover hidden patterns and correlations, leading to more robust predictive models. Predictive dashboards can evolve to offer personalized treatment recommendations based on individual patient profiles. Integrating genetic data, lifestyle factors, and patient history can lead to highly customized and effective treatment plans.