

**DATA VISUALIZATION**  
**FINAL PROJECT REPORT**

**INSURANCE CHARGES**  
**BASED ON HEALTH USING FITBIT DATA**

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## **INTRODUCTION**

This project uses Fitbit data collected from Fitbit devices to analyse an individual's health and fitness level and determine their insurance premiums. Fitbit is a consumer electronics and fitness firm based in the United States. It produces wireless-enabled wearable devices, fitness monitors, and activity trackers including smartwatches and pedometers that collect data on a person's physical activity, heart rate, sleep habits, and other health-related metrics. The device offers high accuracy and is thus one of the most popular health tracking devices on the market. It is also well-known for reliability.

The idea behind utilizing Fitbit data to establish insurance prices is that those who live a healthy lifestyle and exercise regularly may have reduced healthcare expenditures and, as a result, should pay lower insurance premiums. Individuals who lead sedentary lifestyles and have poor health metrics, on the other hand, may be at higher risk for health issues and higher healthcare costs, requiring higher insurance premiums.

Source: <https://en.wikipedia.org/wiki/Fitbit>

## **AMBITIOUSNESS OF THE PROJECT**

The goal of this project is to produce useful visualizations and study health based on Fitbit health monitoring data in order to correlate and analyze the relationships between various aspects of health such as BMI, sleep analysis, daily activity analysis, and insurance charges.

## RESEARCH QUESTIONS

Question 1:

Analyze various users' daily activity by examining their step count, intensity, and so on to see if they are exhibiting any positive signs in their daily routine?

Question 2:

Analyze the relationship between sleeping activity and BMI using average sleeping hours?

Question 3:

Evaluate the relationship between BMI, physical activity, and health insurance costs?

## METHODOLOGY

The data sets utilized in this study are obtained from two different sources:

Data set 1: <https://www.fitabase.com/resources/knowledge-base/exporting-data/example-data-sets/>

Data set 2: <https://www.kaggle.com/datasets/mirichoi0218/insurance>

The data set 1 includes personal tracker data from thirty eligible Fitbit users who consented to minute-level output for physical activity, heart rate, and sleep monitoring between 03.12.2016-05.12.2016

The data set 2 consists of insurance charges for a specific region in the United States.

The two data sets are joined together by a common column BMI, which is used to examine health insurance charges.

## **ANALYSIS**

The data sets are linked using the user ID and BMI. Appropriate data connections have been made, and the information pertaining to daily activity, daily intensities, daily steps, weight log information of the users, as well as insurance charges, have then been put into Tableau for detailed visualizations and analysis.

Since the data is derived from a small number of people, the results may be inconsistent, but when larger data sets are used, the results can be more accurate.

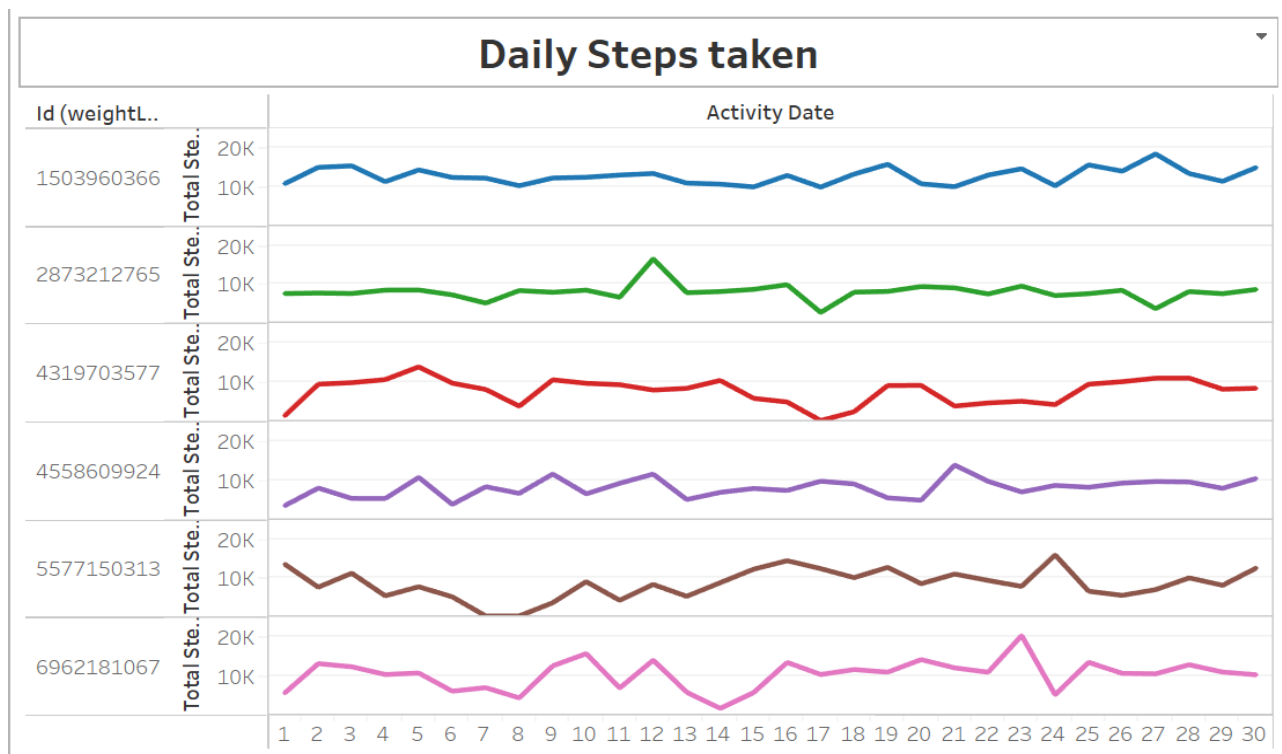
This project report presents visualizations that attempt to answer the project research questions.

## RESAERCH QUESTION 1

Analyze various users' daily activity by examining their step count, intensity, and so on to see if they are exhibiting any positive signs in their daily routine?

Do people involve in physical activity (assessed here in the form of daily step count)?

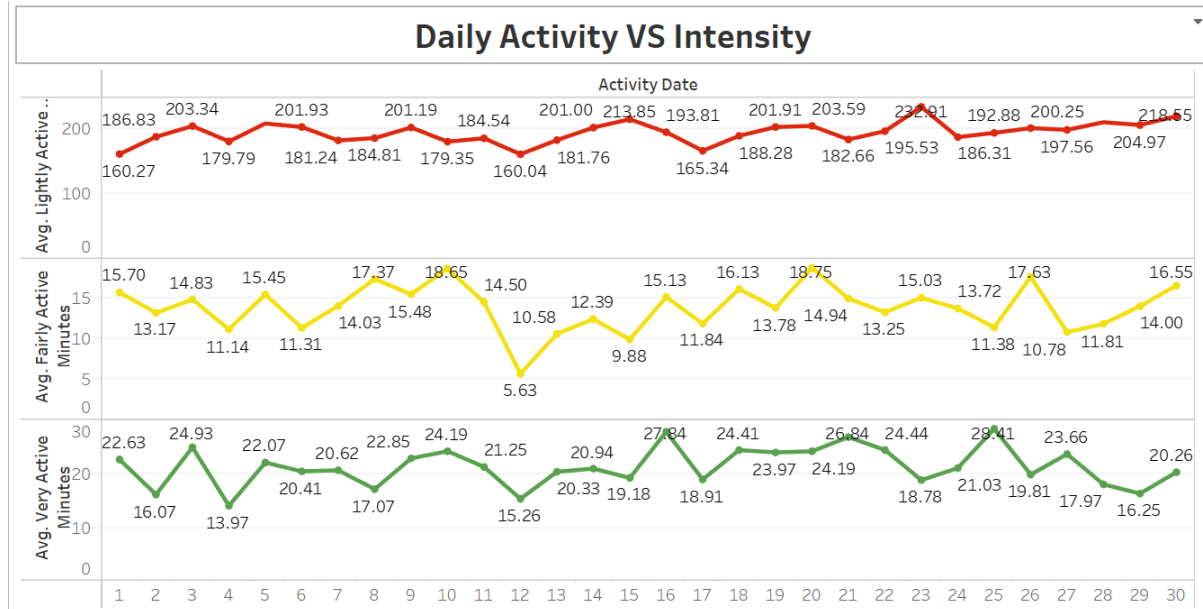
Do individuals involve in high intensity or low intensity physical activities?



### VISUALIZATION : ACTIVITY DATE VS TOTAL STEPS TAKEN

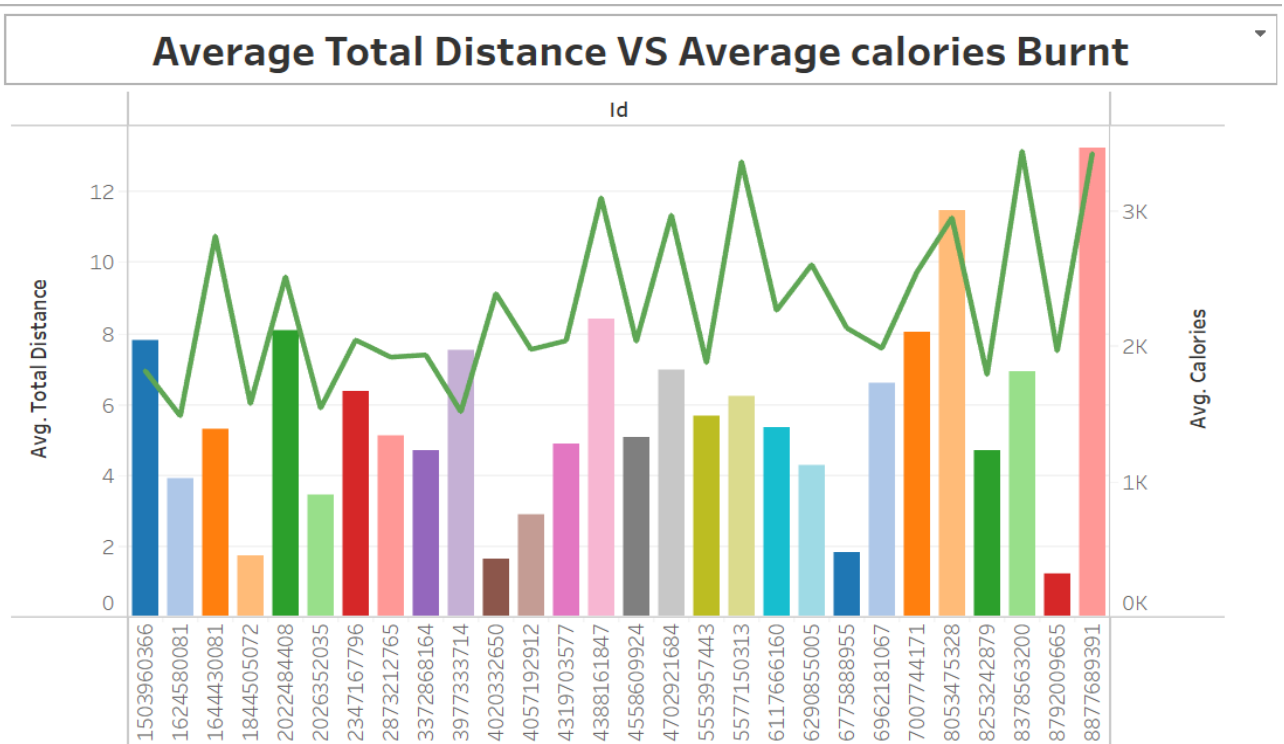
- For the following study topic, we explored THREE potential visualizations.
- The graph shows that user ID 1503960366 has a larger area under the curve than the other selective users, indicating that the user is the most active. It also shows that the user has burned more calories than the others.

- In comparison, user 2873212765 has the smallest area under the curve, implying that he is a less active member and has burned the fewest calories.



### VISUALIZATION: DAILY ACTIVITY VS INTENSITY

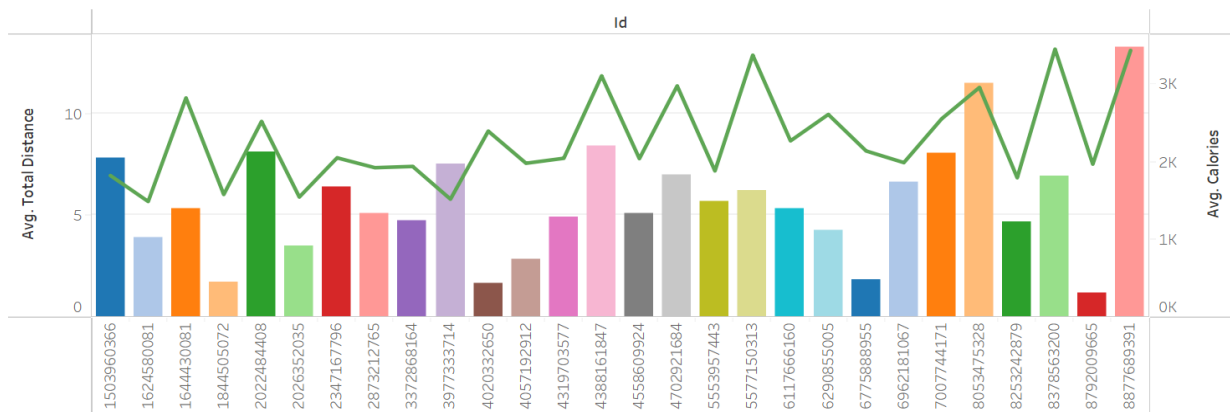
- The above visualization contrasts daily activity with variations in the intensity of active minutes, indicating how active a lifestyle individuals lead.
- The intensity interval of the individuals are divided into three categories:
  - 1) Lightly active minutes
  - 2) Fairly active minutes
  - 3) Very active minutes
- From the graph we can observe that the individuals have a greater number of lightly active minutes than both somewhat active and highly active minutes. This shows that they lead a sedentary rather than an active lifestyle.



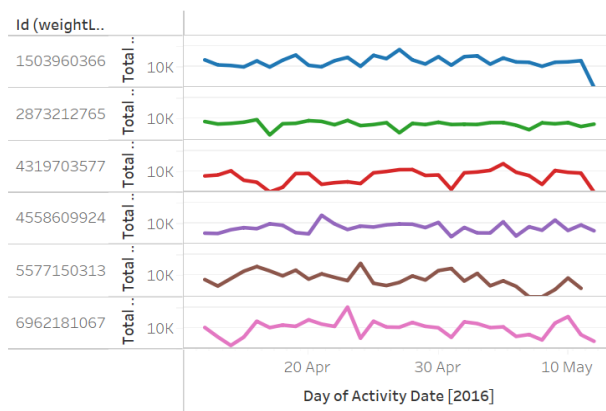
### VISUALIZATION: AVERAGE TOTAL DISTANCE VS AVERAGE CALORIES BURNT ON A DAILY BASIS

- The visualization above displays that the correlation between average total distance travelled and the average number of calories burnt.
- We can observe that the more distance covered, the more is the calories burnt indicating higher physical activity.
- Conversely, less distance covered indicate less calories burnt impacting their health in a long run.

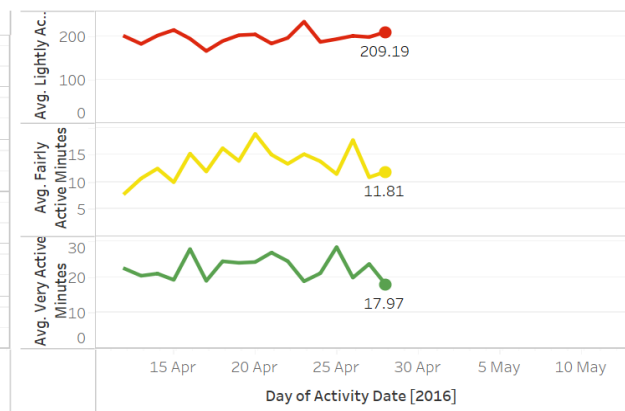
### Average Total Distance VS Average calories Burnt



### Daily Steps taken



### Daily Activity VS Intensity

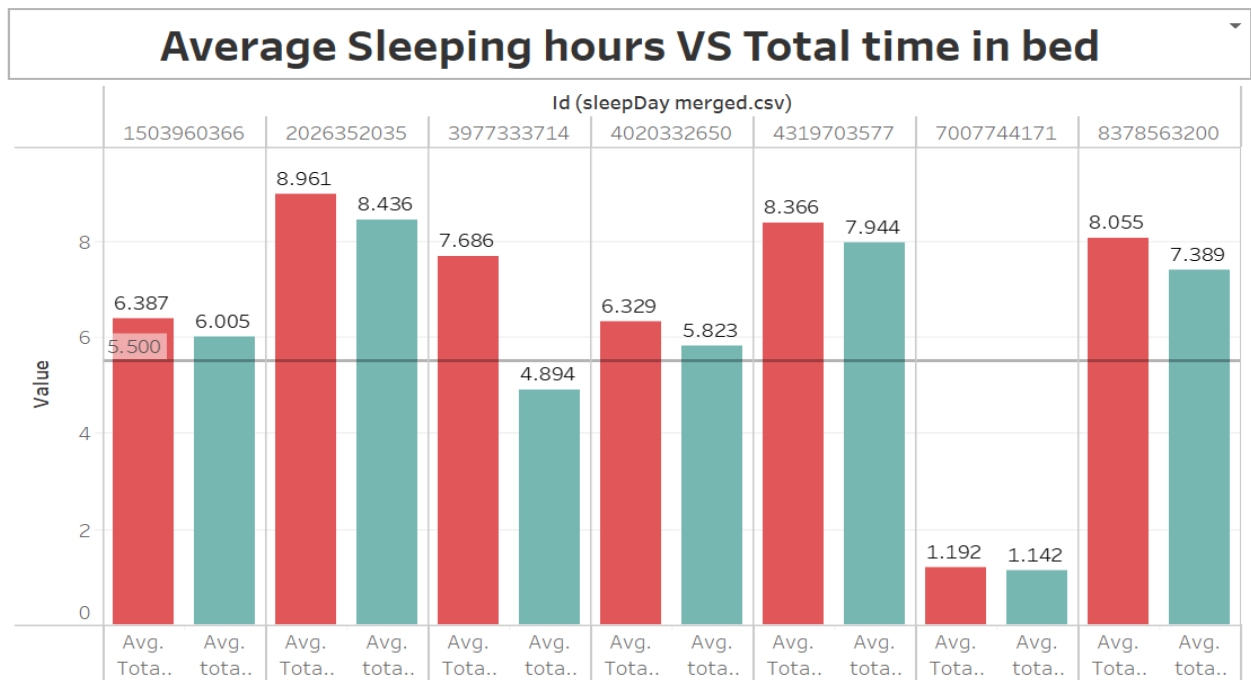


The above dashboard provides answers to research question 1 by analyzing users' daily activities and productivity, allowing insurance companies to assess their health and set the insurance premiums accordingly.



## RESAERCH QUESTION 2

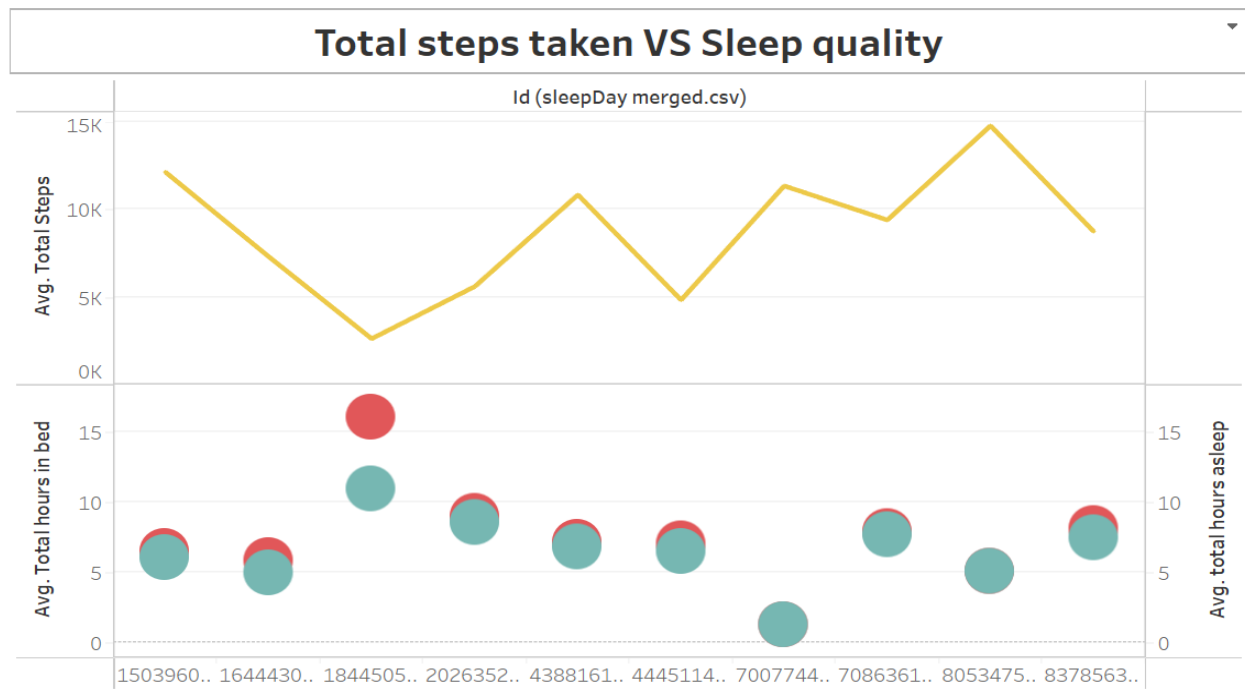
Analyze the relationship between sleeping activity and physical activity using average sleeping hours and total step count?



### VISUALIZATION : ACTIVE SLEEPING VS PASSIVE SLEEPING

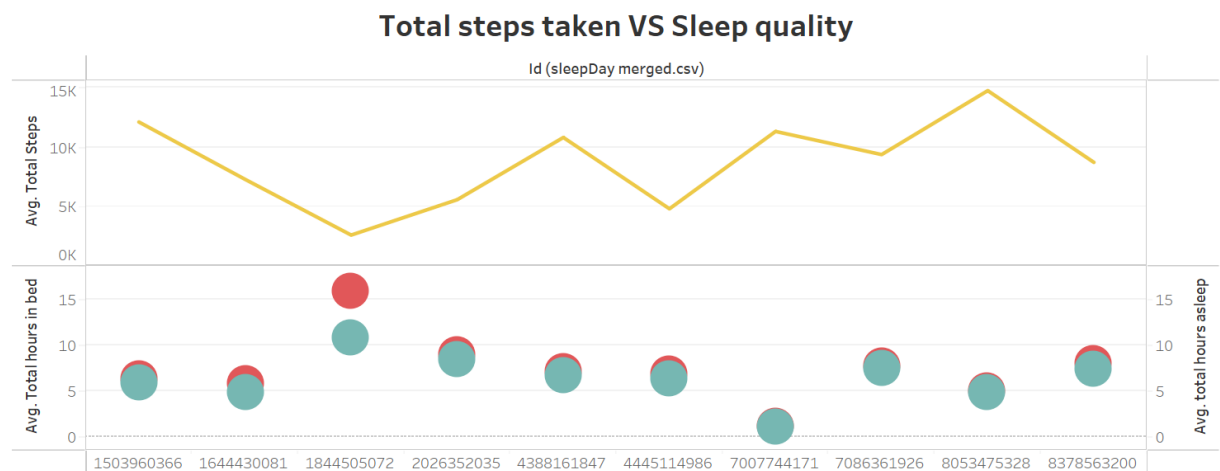
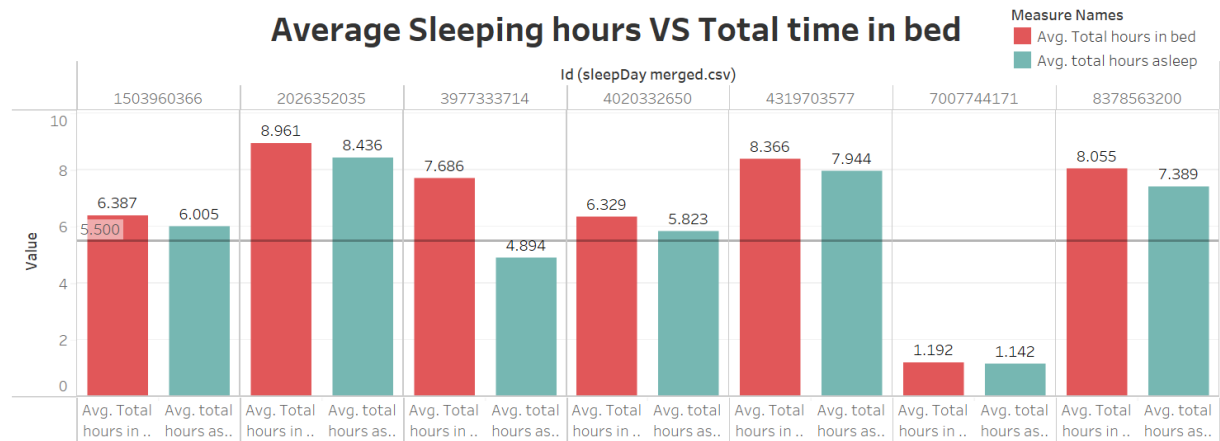
- The attached bar graph depicts the average number of hours in bed (shown in Red bars) and average number of hours asleep (shown in green bars) for seven randomly selected users.
- The primary finding is that there is a 30-45 minute difference between active and passive sleeping hours, which is significant, and users should consider increasing their daily activity to achieve better sleep, consequently improving overall health.
- We have taken average sleeping time required a 5.5 hours and drawn a constant line. From the observations, we can say that users 3977333714

and 7007744171 are not having enough sleep, this might be due to any underlying health conditions. It is recommended that they get a health check-up done.



## VISUALIZATION : TOTAL STEPS TAKEN VS SLEEP QUALITY

- We can observe that if the steps taken are more, there is less difference between active and passive sleeping. So with more activity the individual can be expected to have sound sleep.
- The user 1844505072 with lowest average steps has highest difference in time between active and passive sleeping whereas the user 8053475328 with highest average steps is observed to have almost no difference between total hours in bed and total hours asleep.



## IMPACT OF PHYSICAL ACTIVITY ON SLEEP QUALITY

The accompanying dashboard addresses research question 2 by explaining the sleep analysis and the user's physical activity, which insurance companies can use to analyze the individual's overall health.

### RESAERCH QUESTION 3

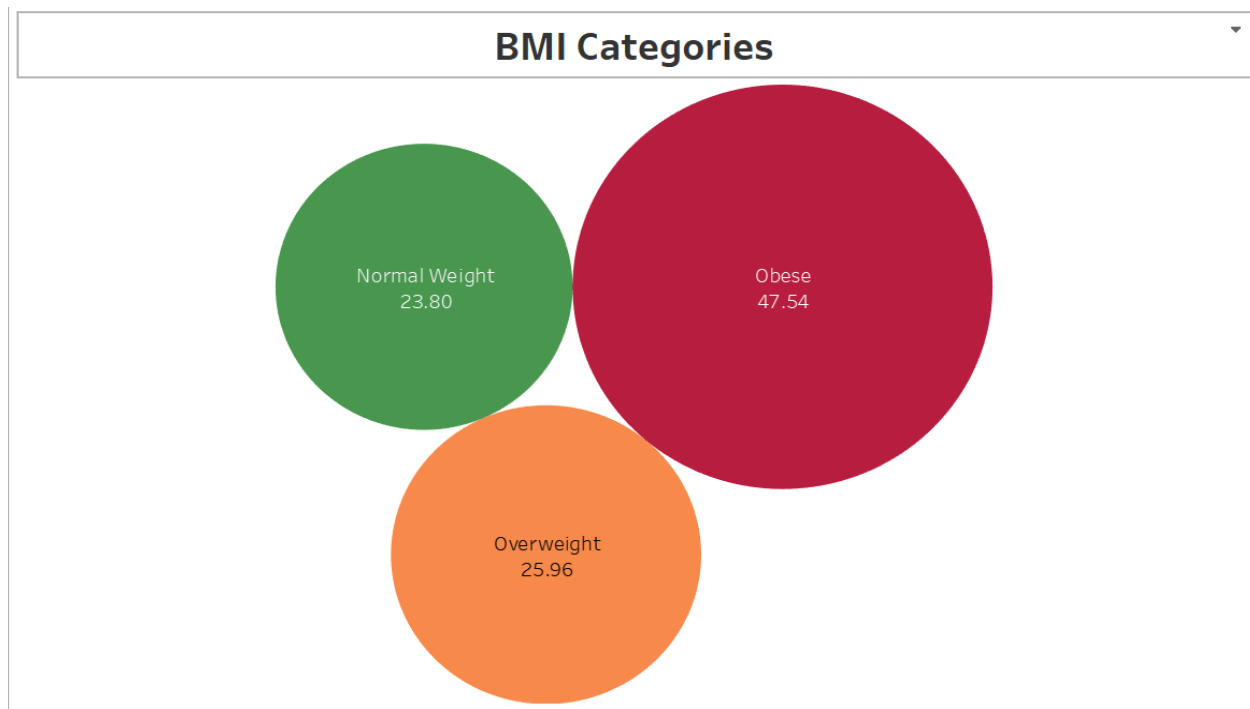
Evaluate the relationship between BMI, physical activity, and health insurance costs?

How is BMI categorised?

Do people with a healthy BMI involve in taking more steps?

How BMI and total steps taken be correlated with each other?

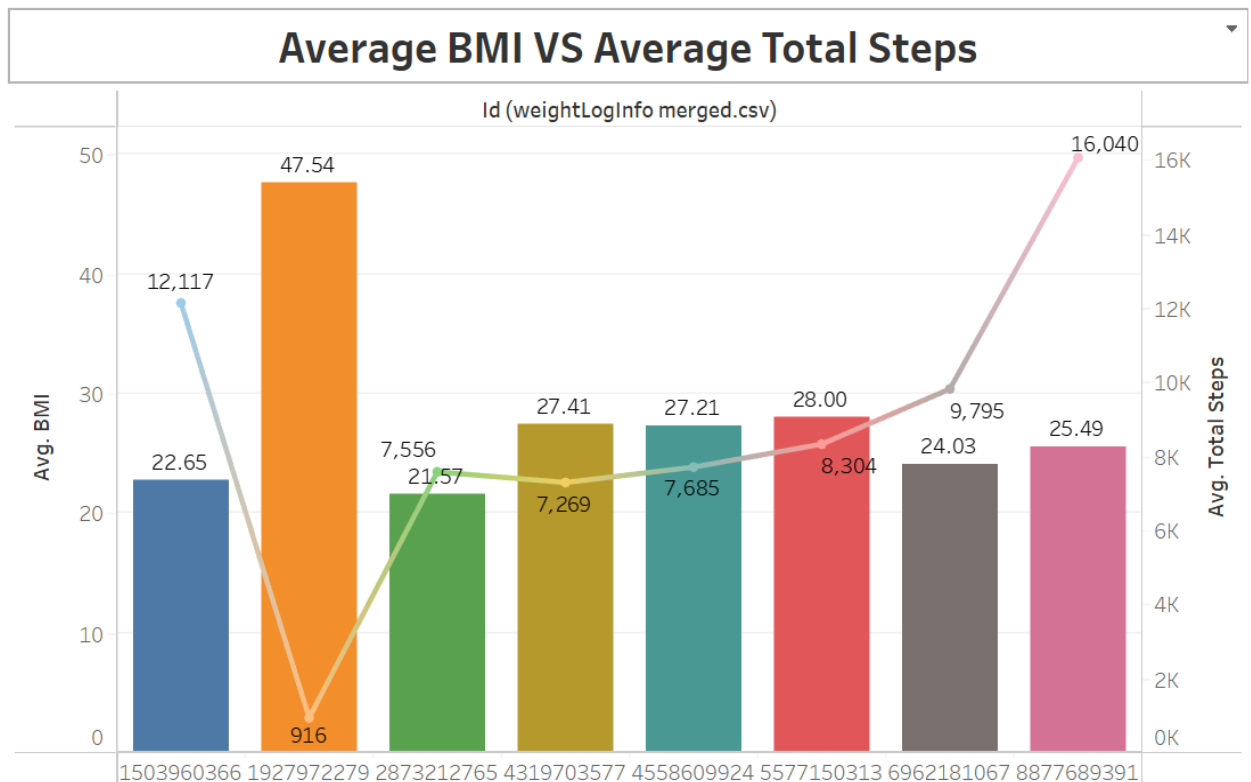
Are individuals with more BMI charges higher insurance charges?



#### VISUALIZATION : BMI CATEGORIES

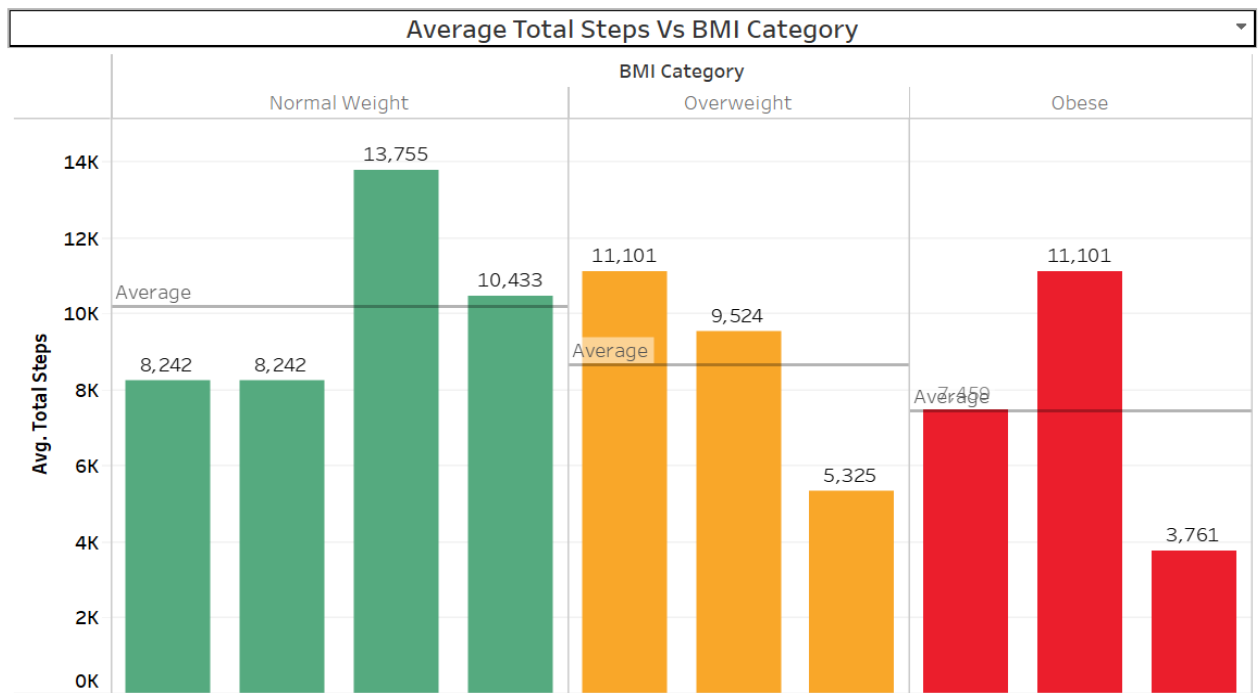
- The BMI categories have been determined and assigned to their corresponding ranges.
  - ▶ A user with a BMI of less than 18.5 is classified as "UNDERWEIGHT."

- ▶ Users with BMIs greater than 18.5 and less than 25 are classified as "HEALTHY WEIGHT".
- ▶ Users with a BMI greater than 25 and a BMI less than 29.9 are classified as "OVERWEIGHT."
- ▶ Obese users have a BMI of greater than 29.9.



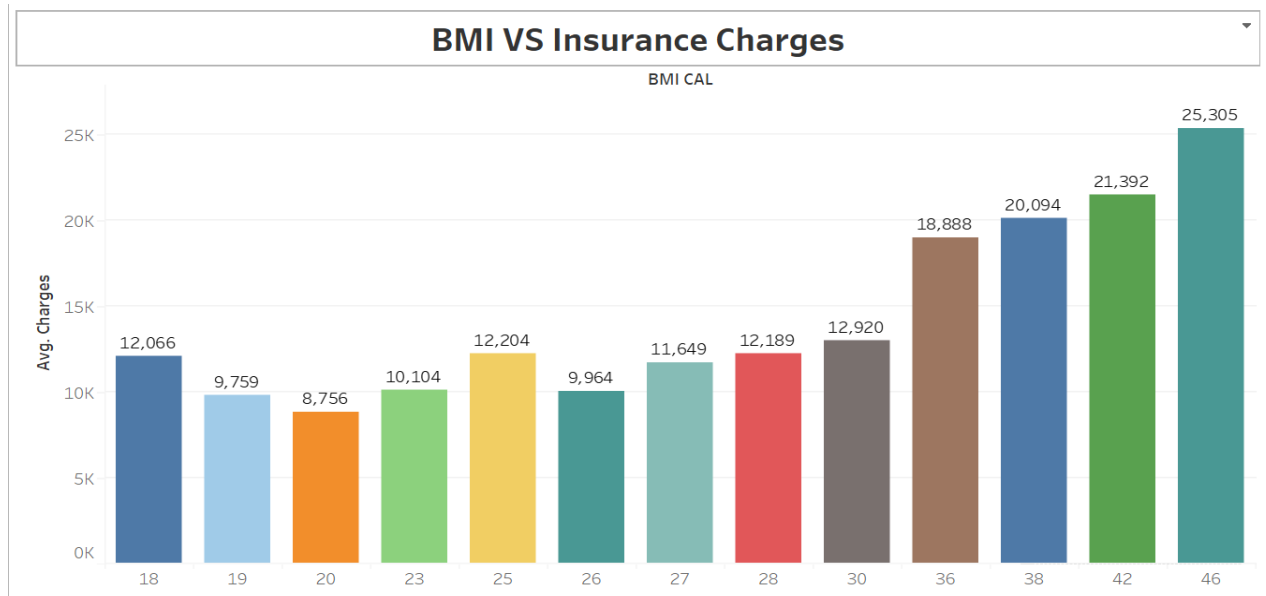
### VISUALIZATION : AVERAGE BMI VS AVERAGE TOTAL STEPS TAKEN

- The above visualization compares Average BMI and the Average total number of steps taken
- We can identify a correlation between total steps taken daily and BMI, with users with a high step count having a Healthy BMI and users with a low step count having a high BMI falling into the Obese category.



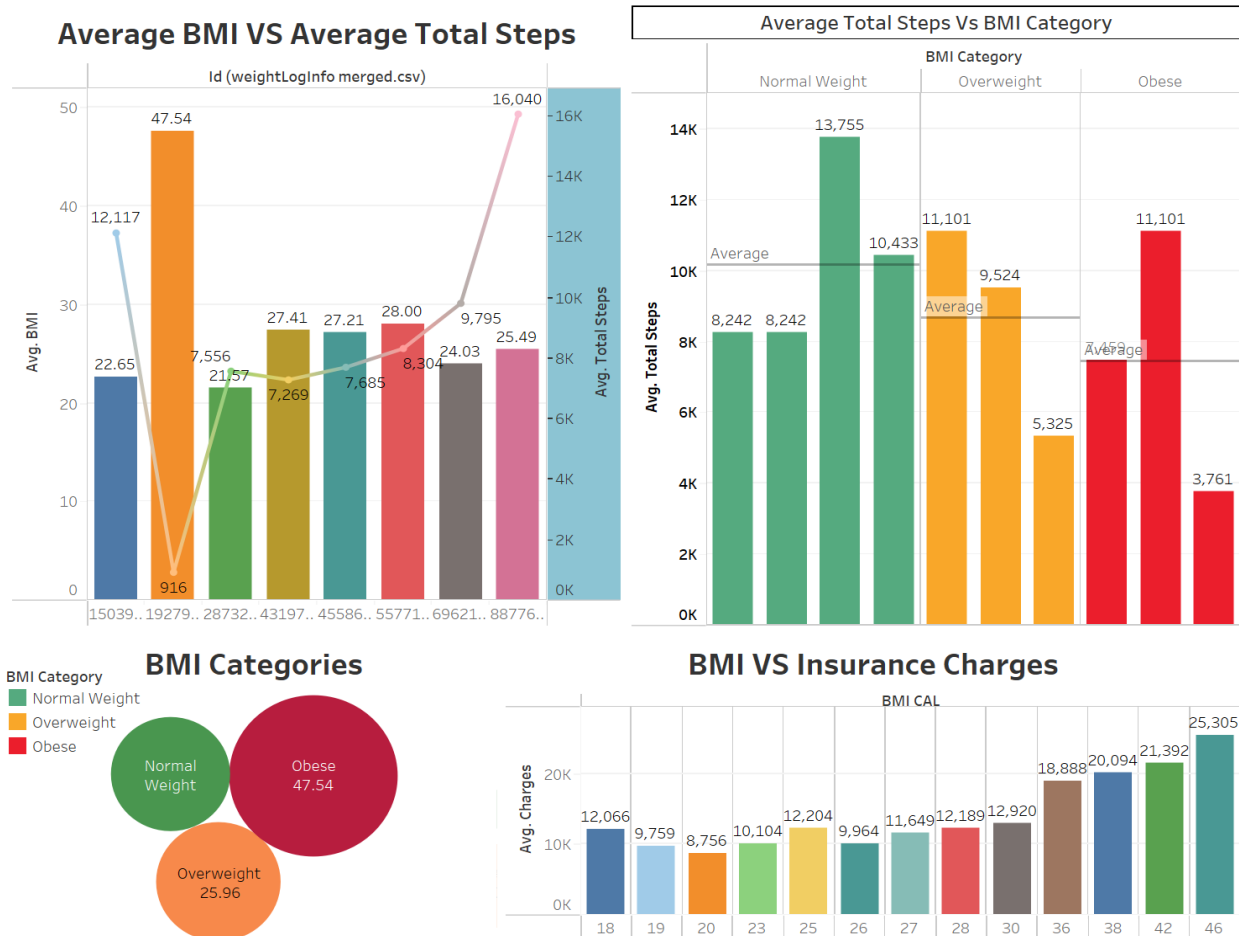
### VISUALIZATION : AVERAGE TOTAL STEPS VS BMI CATEGORIES

- This visualization aids in comprehending the average steps taken by individuals belonging to three weight categories: normal, overweight, and obese.
- The representation implies that people with higher BMI levels take less steps than people with lower BMI levels.
- The average number of steps taken by people with normal weight is around 10,000.
- Categorical columns are formed depending on BMI levels, and the color becomes darker as the BMI level increases.



### **VISUALIZATION : BMI VS INSURANCE CHARGES**

- The above graph implies that people with higher BMI levels likely to pay more than people with lower BMI values.
- The cost of insurance for BMI less than 18.5 (Underweight category) are higher because they have high risk factors; similarly, BMI greater than 29.9 (Obese category) has high risk factors.
- Insurance rates for BMIs ranging from 18.5 to 25 (normal weight category) are normal since they have a low risk profile, but BMIs ranging from 25 to 29.9 (overweight category) have relatively high risk factors.



## BMI AND INSURANCE CHARGES

The dashboard above addresses research question 3 by assessing the user's BMI and categorizing them accordingly, indicating the risk level so that insurance charges can be imposed in accordance with the individual's risk profile.



## CONCLUSION

In conclusion, utilizing Fitbit data to analyse insurance charges based on health indicated a substantial association between health indicators such as BMI and step count and insurance charges. This implies that insurance firms may utilize data from wearable gadgets to assess a person's health and charge accordingly.

Few conclusions that can be drawn are as follows:

- Individuals who are physically active on a daily basis are more likely to be healthy (assessed in terms of step count and intensity of the physical activity). The average amount of steps completed by people of normal weight is roughly 10,000.
- The typical difference between total time in bed and actual sleeping hours is 30-45 minutes. Physical activity and sleep quality are linked; persons with a large difference in active and passive sleeping hours appear to be unhealthy.
- Based on their BMI, those who fall into the overweight or obese categories tend to have higher insurance costs due to their high health risk factors.

## **FUTURE RESEARCH QUESTIONS**

- 1) How do different health indicators (such as blood pressure, cholesterol levels, and so on) affect insurance costs?
- 2) Is there a major difference in insurance costs based on gender, age, or other demographic factors?
- 3) How much influence do lifestyle factors like exercise, food, and smoking habits have on insurance rates?
- 4) How do pre-existing medical conditions affect insurance rates, and is there a major variation in rates between people with and without pre-existing diseases?
- 5) How do health-related insurance expenses compare to other characteristics such as driving history in terms of their impact on overall insurance premiums?
- 6) How far can modern technology, such as wearables and health tracking applications, be utilized to effectively assess a person's health and decide insurance charges?
- 7) How can insurance companies effectively convey the logic behind health-related insurance charges in order to promote transparency and fairness for customers?