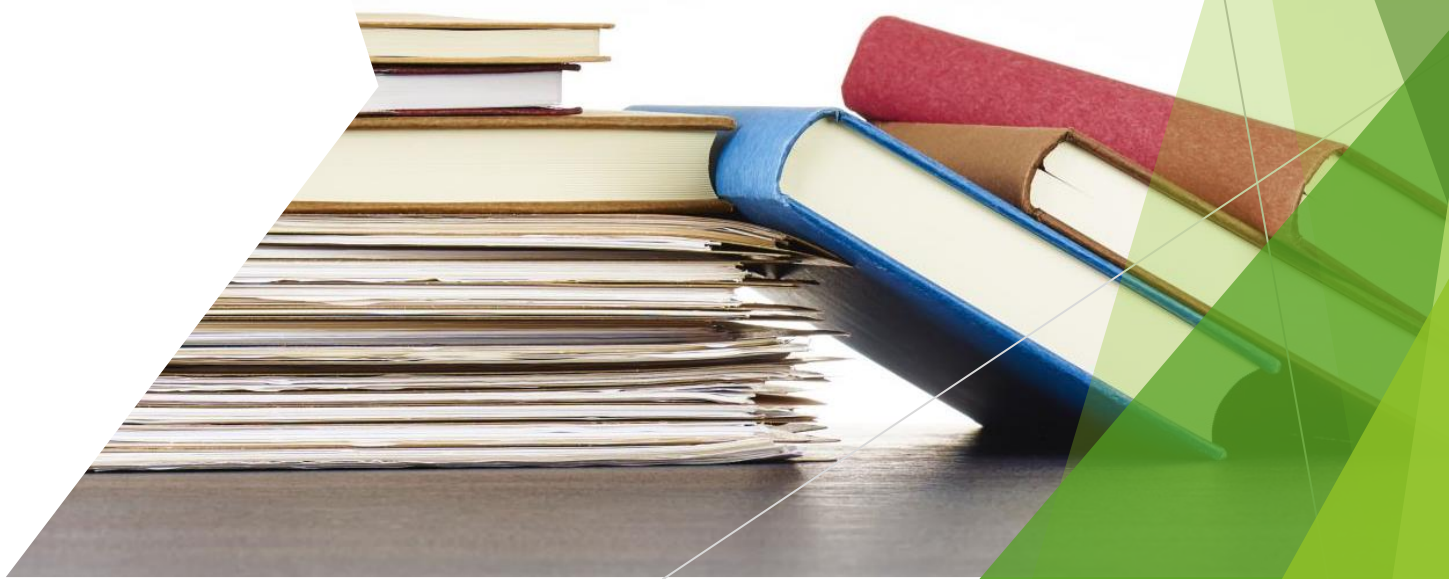
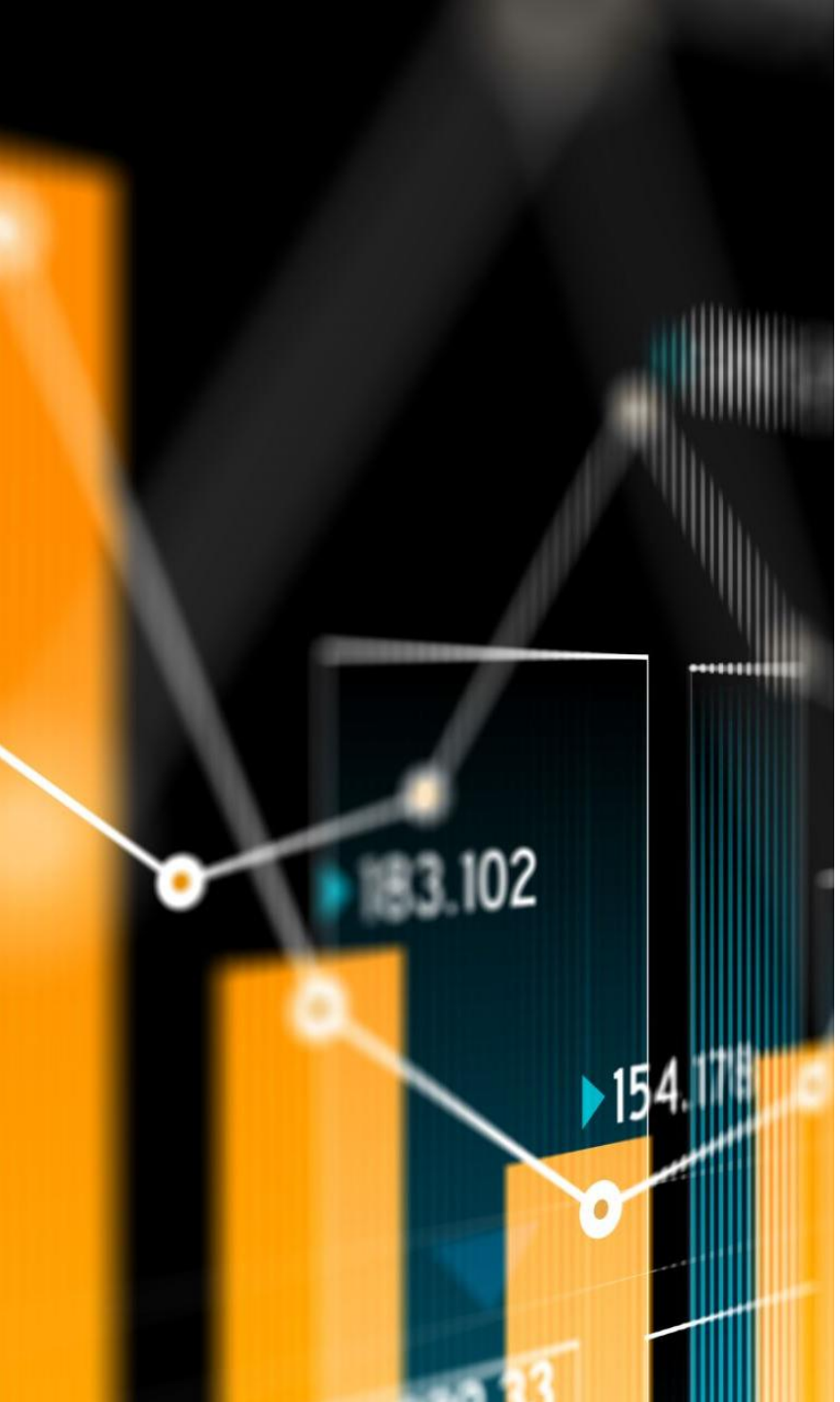
# Case Study: How Can a Wellness Technology Company Play It Smart?

***By Kristin Lu***

*February 1, 2024*





# Statement of Business Task

Analyze publicly available fitness tracker (smart device) usage data to discover trends which may help influence the marketing strategy for a wellness technology company Bellabeat.

# Data Preparation and Data Exploration

- The data used for this case study is the "**FitBit Fitness Tracker Data**" which was downloaded from Kaggle.
- This Kaggle data set contains personal fitness tracker from thirty fitbit users. Thirty eligible Fitbit users consented to the submission of personal tracker data, including minute-level output for **physical activity**, **heart rate**, and **sleep monitoring**. It includes information about daily activity, steps, and heart rate that can be used to explore users' habits.
- There are 18 files in the dataset. Not all the files were used for the analysis. The following is a description of the files used in this case study:
  - dailyActivity_merged.csv - this file contains the following columns: Id, ActivityDate, (in Short Date format "m/d/yyyy"), TotalSteps, TotalDistance, VeryActiveDistance, ModeratelyActiveDistance, LightActiveDistance, SedentaryActiveDistance, VeryActiveMinutes, FairlyActiveMinutes, LightlyActiveMinutes, SedentaryMinutes, Calories, etc.
  - heartrate_seconds_merged.csv - this file contains the following columns: Id, Time (in "m/d/yyyy h:mm" format), Value (heartrate).
  - sleepDay_merged.csv - this file contains the following columns: Id, SleepDay (in "m/d/yyyy h:mm" format), TotalSleepRecords, TotalMinutesAsleep, and TotalTimeInBed.
  - weightLogInfo_merged.csv - this file contains the following columns: Id, Date (in "m/d/yyyy h:mm" format), WeightKg, WeightPounds, Fat, BMI, etc.

# Key Findings

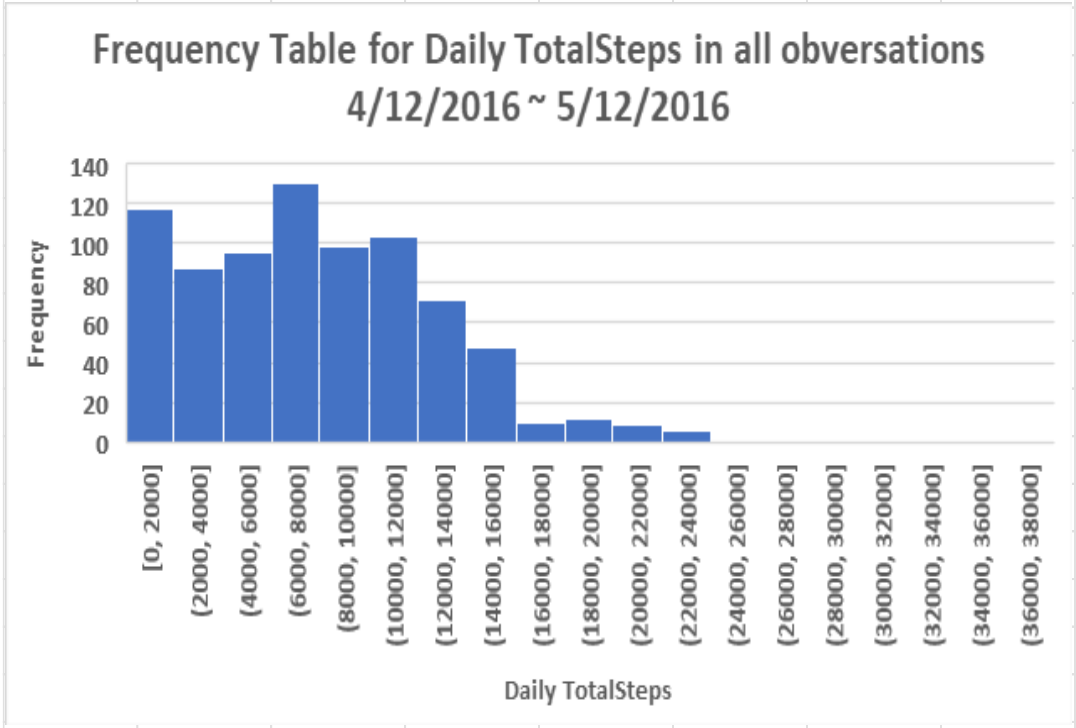
- Here are the trends found while analyzing smart device usage data from a public dataset:
  - The consumers in this dataset used smart devices to **track daily activity** such as how many steps they took, how far they walked at each intensity level, how long each intensity level lasted, and how many calories they burned.
  - The consumers used smart devices to **monitor** their **heart rate**.
  - The consumers used smart devices to **watch** their **weight** and **BMI level**.
  - The consumers used smart devices to track their **sleep duration** and **sleep efficiency**.
- These trends can apply to Bellabeat customers because:
  - Bellabeat's products like **Bellabbeat app**, **Leaf** and **Time** track user **activity**, **sleep**, and **stress**.
  - From the previous bullet item, we know that consumers use non-Bellabeat smart devices to track their **daily activity**, **sleep**, **heart rate**, **weight**, and **BMI** level.
  - Potentially biased data were removed prior to our analysis, meaning that our data represent a good sampling distribution. Therefore, trends found in our analysis regarding **activity** and **sleep** should apply to Bellabeat customers.
  - Stress may/may not cause abnormal heart rate or weight changes. However, the trends discovered in our analysis should help Bellabeat get the data its users want or need.

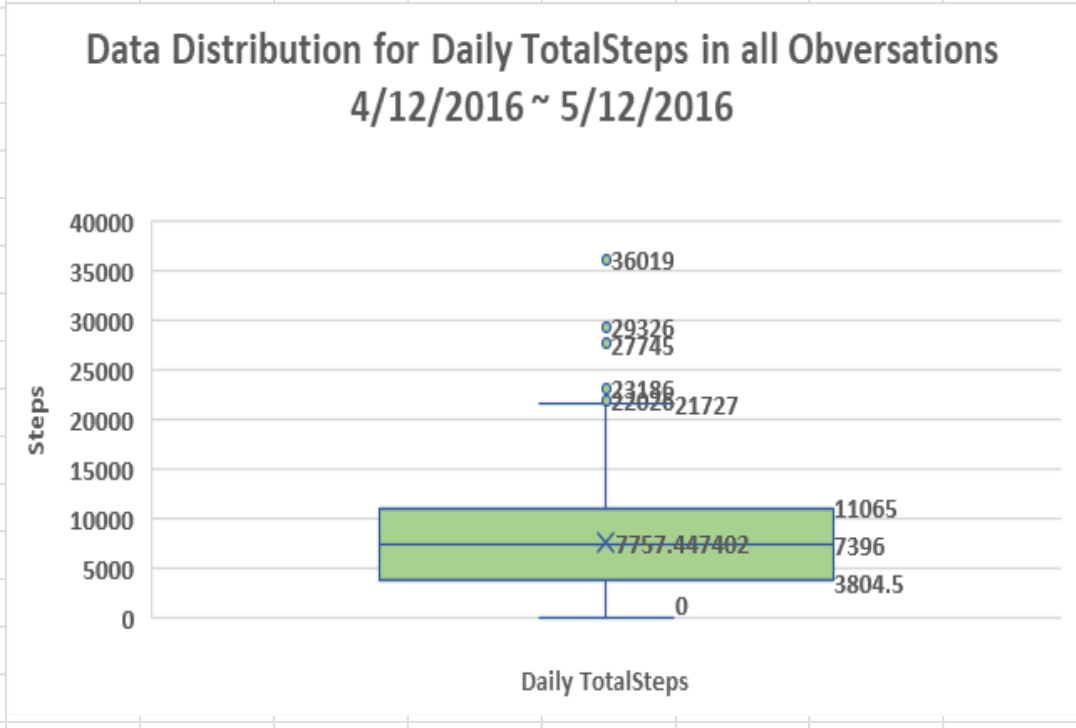
# Key Findings: Daily Activity Tracking

**Interesting findings:**

- **Each** consumer in this dataset used a smart device to track their daily activities, including total steps taken, total distance walked, distance walked per activity level, total minutes spent per activity level, and total calories burned.
- By studying the frequency table (histogram chart) and data distribution chart (box plot) of the daily total steps for all observations in the dataset, the **following trends were found**:
  - The **most common set** of values for **daily total steps** were **between 6,000 and 8,000 steps.** The **next common set** of values for **daily total steps** were **between 0 and 2,000 steps.**
  - The **median** (the middle number in a sorted list of numbers) of the daily total steps was **7,396**.
  - The upper quartile (or third quartile, is the value under which 75% of data points are found when arranged in increasing order) of the box plot shows that **75%** of the values for daily total steps were **under 11,065**.

# Key Findings: Daily Activity Tracking



# Key Findings: Daily Activity Tracking

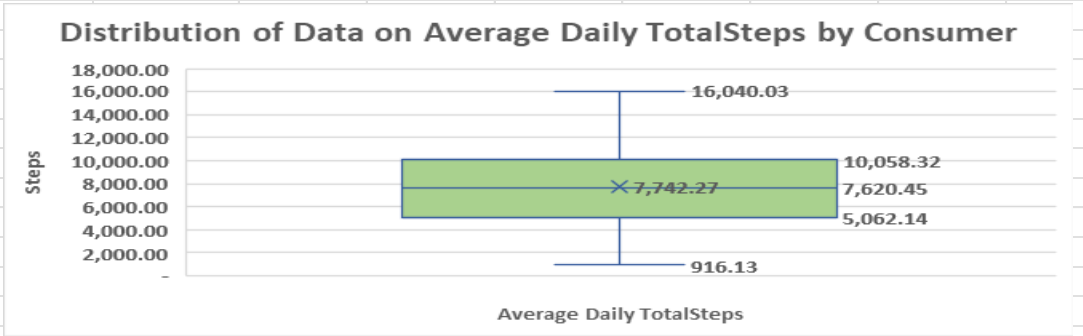
## Interesting findings:

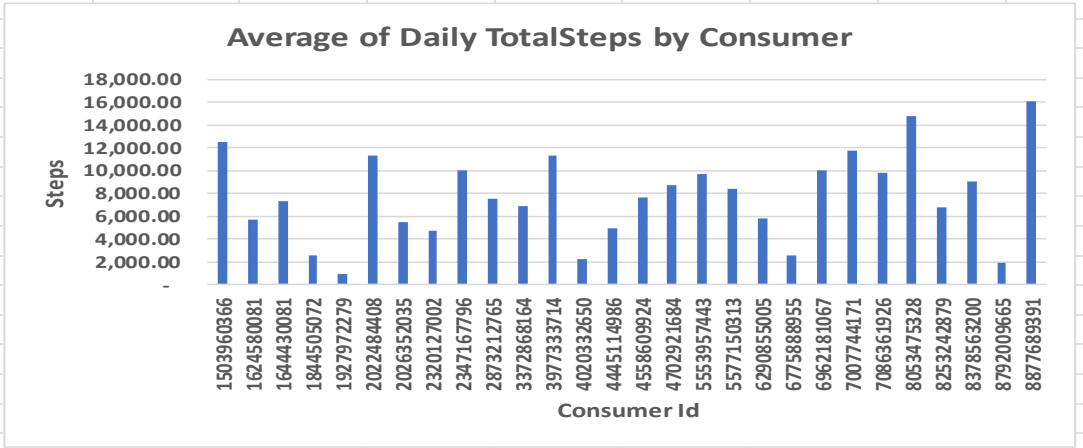
- **Aggregating** the data **by consumer Id**, **the following trends were discovered**:
  - Median average total daily steps per consumer is **7,620.45.**
  - The upper quartile of the boxplot shows that **75% of consumers** have an average daily total step count **below 10,058.32**.
  - According to this document, Walking Meeting - Preventing Chronic Disease, The Centers for Disease Control and Prevention (CDC) recommends walking **at least 10,000 steps per day**. It appears that **most consumers in this dataset were not meeting CDC recommendations.**

# Key Findings: Daily Activity Tracking

| Row Labels | Average of TotalSteps | Average of TotalDistance |
|---|---|---|
| 1503960366 | 12,520.63 | 8.07 |
| 1624580081 | 5,743.90 | 3.91 |
| 1644430081 | 7,282.97 | 5.30 |
| 1844505072 | 2,575.96 | 1.70 |
| 1927972279 | 916.13 | 0.63 |
| 2022484408 | 11,370.65 | 8.08 |
| 2026352035 | 5,456.07 | 3.39 |
| 2320127002 | 4,716.87 | 3.19 |
| 2347167796 | 10,077.18 | 6.73 |
| 2873212765 | 7,555.77 | 5.10 |
| 3372868164 | 6,861.65 | 4.71 |
| 3977333714 | 11,337.62 | 7.76 |
| 4020332650 | 2,267.23 | 1.63 |
| 4445114986 | 4,930.83 | 3.34 |
| 4558609924 | 7,685.13 | 5.08 |
| 4702921684 | 8,766.07 | 7.11 |
| 5553957443 | 9,676.31 | 6.34 |
| 5577150313 | 8,451.55 | 6.32 |
| 6290855005 | 5,851.32 | 4.43 |
| 6775888955 | 2,541.80 | 1.83 |
| 6962181067 | 10,001.73 | 6.73 |
| 7007744171 | 11,776.36 | 8.34 |
| 7086361926 | 9,766.07 | 6.67 |
| 8053475328 | 14,763.29 | 11.48 |
| 8253242879 | 6,842.28 | 4.93 |
| 8378563200 | 9,088.14 | 7.21 |
| 8792009665 | 1,919.93 | 1.23 |
| 8877689391 | 16,040.03 | 13.21 |
| **Grand Total** | **7,757.45** | **5.54** |

| |
|---|
| 12,520.63 |
| 5,743.90 |
| 7,282.97 |
| 2,575.96 |
| 916.13 |
| 11,370.65 |
| 4,716.87 |
| 10,077.18 |
| 7,555.77 |
| 6,861.65 |
| 11,337.62 |
| 2,267.23 |
| 4,930.83 |
| 7,685.13 |
| 8,766.07 |
| 9,676.31 |
| 8,451.55 |
| 5,851.32 |
| 2,541.80 |
| 10,001.73 |
| 11,776.36 |
| 9,766.07 |
| 14,763.29 |
| 6,842.28 |
| 9,088.14 |
| 16,040.03 |



# Key Findings: Daily Activity Tracking

**Interesting findings:**

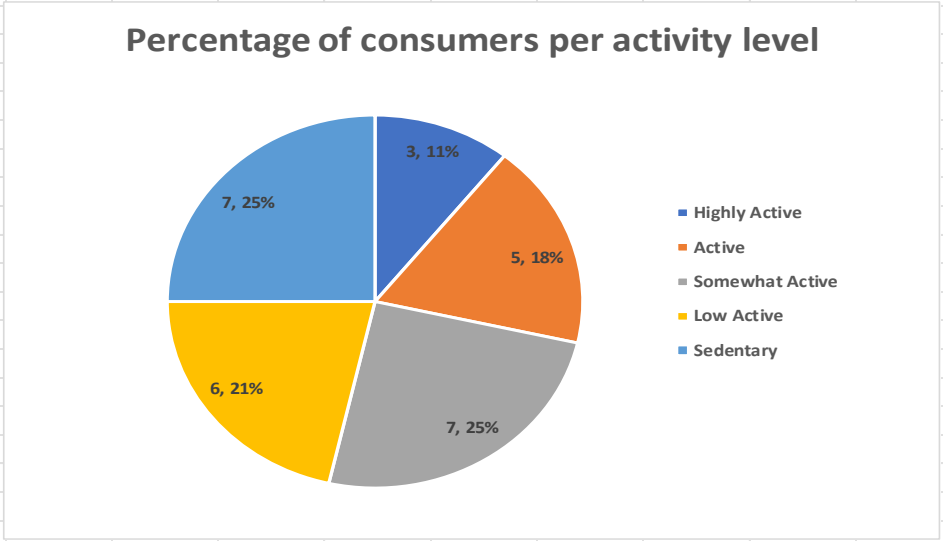
- Each consumer's "activity level“ was categorized based on their average number of steps taken per day and the following guidelines mentioned in the article How Many Steps a Day Is Considered Active?:
  - **Sedentary:** Less than 5,000 steps daily
  - **Low active:** About 5,000 to 7,499 steps daily
  - **Somewhat active:** About 7,500 to 9,999 steps daily
  - **Active:** More than 10,000 steps daily
  - **Highly active:** More than 12,500 steps daily
- The following trends where found:
  - **71%** of consumers took less than 10,000 steps per day on average (**25%** of consumers had an activity level of "**sedentary**", **21%** of consumers had an activity level of "**low active**", and **25%** of consumers have an activity level of "**somewhat active**“).

# Key Findings: Daily Activity Tracking

| Row Labels | Average of TotalSteps | Activity Level |
|---|---|---|
| 1503960366 | 12,520.63 | Highly Active |
| 1624580081 | 5,743.90 | Low Active |
| 1644430081 | 7,282.97 | Low Active |
| 1844505072 | 2,575.96 | Sedentary |
| 1927972279 | 916.13 | Sedentary |
| 2022484408 | 11,370.65 | Active |
| 2026352035 | 5,456.07 | Low Active |
| 2320127002 | 4,716.87 | Sedentary |
| 2347167796 | 10,077.18 | Active |
| 2873212765 | 7,555.77 | Somewhat Active |
| 3372868164 | 6,861.65 | Low Active |
| 3977333714 | 11,337.62 | Active |
| 4020332650 | 2,267.23 | Sedentary |
| 4445114986 | 4,930.83 | Sedentary |
| 4558609924 | 7,685.13 | Somewhat Active |
| 4702921684 | 8,766.07 | Somewhat Active |
| 5553957443 | 9,676.31 | Somewhat Active |
| 5577150313 | 8,451.55 | Somewhat Active |
| 6290855005 | 5,851.32 | Low Active |
| 6775888955 | 2,541.80 | Sedentary |
| 6962181067 | 10,001.73 | Active |
| 7007744171 | 11,776.36 | Active |
| 7086361926 | 9,766.07 | Somewhat Active |
| 8053475328 | 14,763.29 | Highly Active |
| 8253242879 | 6,842.28 | Low Active |
| 8378563200 | 9,088.14 | Somewhat Active |
| 8792009665 | 1,919.93 | Sedentary |
| 8877689391 | 16,040.03 | Highly Active |
| **Grand Total** | **7,757.45** | |

| Activity Level | Count |
|---|---|
| Highly Active | 3 |
| Active | 5 |
| Somewhat Active | 7 |
| Low Active | 6 |
| Sedentary | 7 |

**Percentage of Consumers with Average Daily TotalSteps less than 10,000 is:** **0.714286**



# Key Findings: Daily Activity Tracking

## Interesting findings:

- According to this article How many steps should people take per day?, most people in the United States take less than 10,000 per day. Same trend was found in the dataset we analyzed. Therefore, Bellabeat's marketing strategy should include **encouraging people to purchase and wear Bellabeat's smart devices to track/count the number of steps they take every day to ensure they achieve their goal of walking at least 10,000 steps a day.**

# Key Findings: Weight and BMI Level Tracking

**Interesting findings:**

- About **24%** of consumers in the dataset (8 out of 33 consumers) used smart devices to track their **weight** and **BMI level**. The weight status of a consumer was determined by his/her BMI value. Three consumers (or **9%** of all consumers) had the weight status of "overweight," and one consumer (or **3%** of all consumers) had the weight status of "obesity."
- Combining consumers' daily activity information and weight information and found that:
  - Of the three consumers with the "**overweight**" weight status, two were at the "**somewhat active**" activity level (an average of **5,000 to 7,499 steps per day**).
  - The consumer whose weight status was "**obesity**" had the activity level of "**sedentary**" (**less than 5,000 steps per day** on average).

# Key Findings: Weight and BMI Level Tracking

| Row Labels | Average of TotalSteps | Activity Level | Weight Status |
|---|---|---|---|
| 1503960366 | 12520.63333 | Highly Active | Healthy Weight |
| 1927972279 | 916.1290323 | Sedentary | Obesity |
| 2873212765 | 7555.774194 | Somewhat Active | Healthy Weight |
| 4558609924 | 7685.129032 | Somewhat Active | Overweight |
| 5577150313 | 8451.551724 | Somewhat Active | Overweight |
| 6962181067 | 10001.73333 | Active | Healthy Weight |
| 8877689391 | 16040.03226 | Highly Active | Overweight |
| **Grand Total** | **9008.802817** | | |

# Key Findings: Weight and BMI Level Tracking

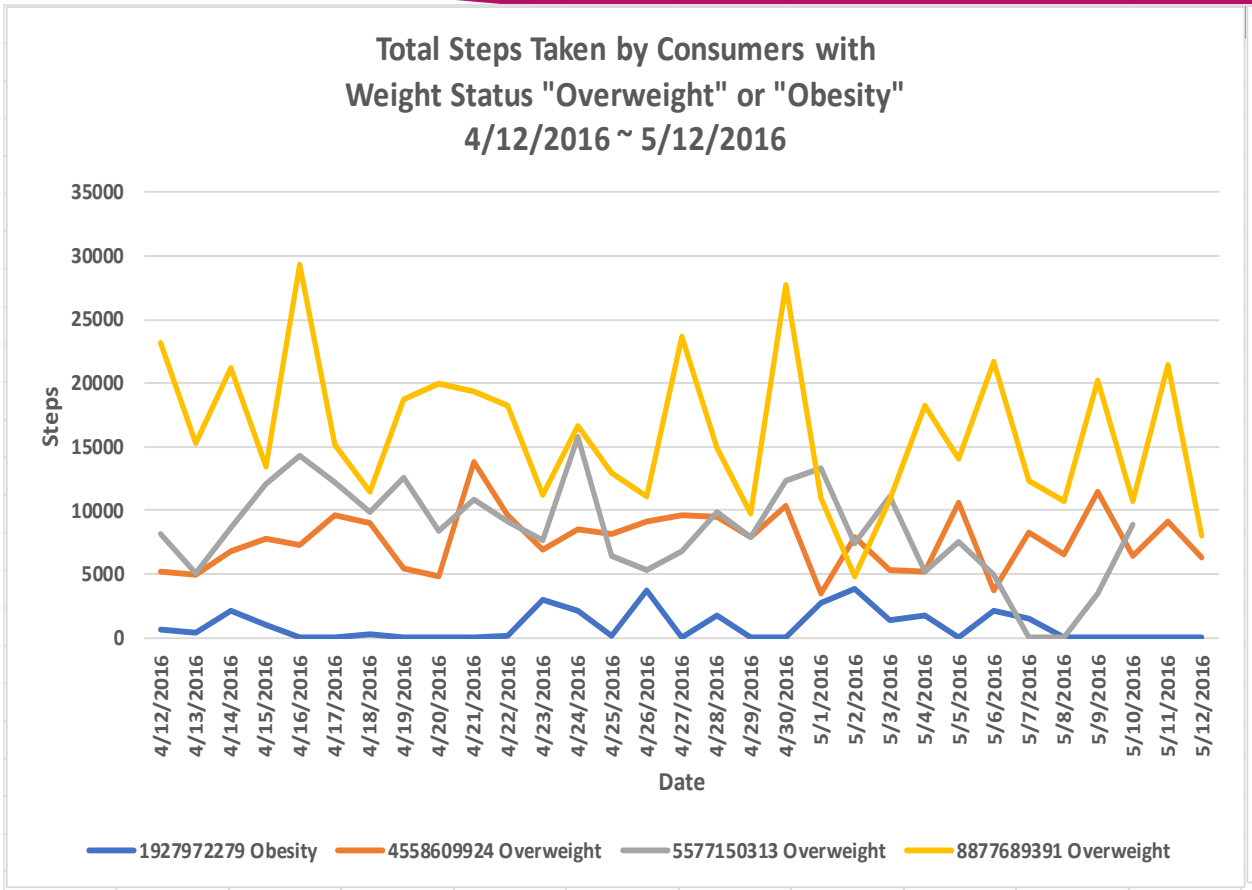
**Interesting findings:**

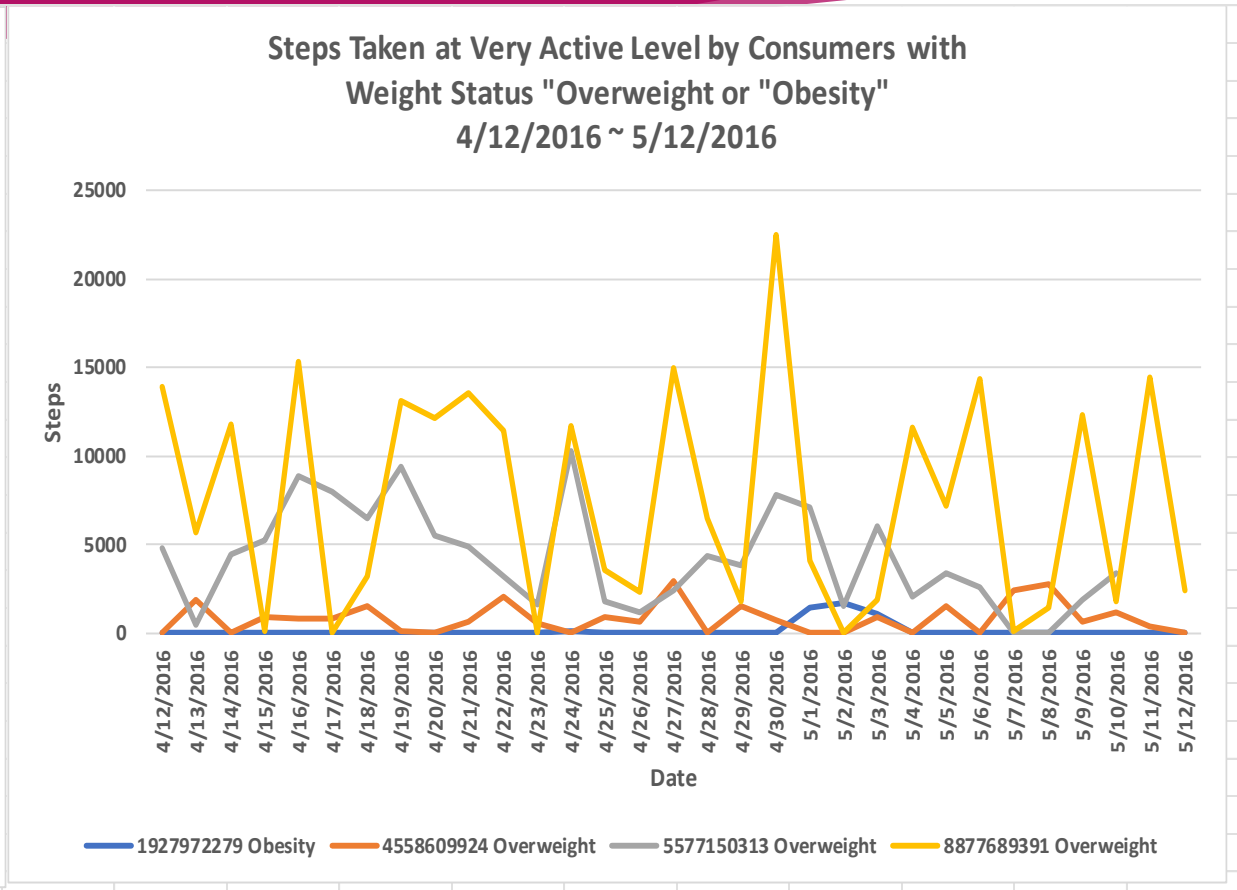
- According to this article "How many steps should people take per day?“, a 2018 analysis of 363 people with obesity found that people who walked **10,000 steps a day**, including **at least 3,500 steps** engaging in **moderate-to-vigorous activity** lasting 10 minutes or longer, had increased weight loss.
- Researching deeper into the daily activity data of consumers with the weight status of either "**overweight**" or "**obesity**“ and found that **only one** consumer took serious action to lose weight by walking more than 10,000 steps a day, at least 3,500 of which were at a very active level for 10 minutes or longer.
- Therefore, Bellabeat's marketing strategy should include **identifying people who may have weight or BMI level concerns and** encouraging them to **purchase and wear Bellabeat’s smart devices to track their weight and BMI level.**

# Key Findings: Weight and BMI Level Tracking

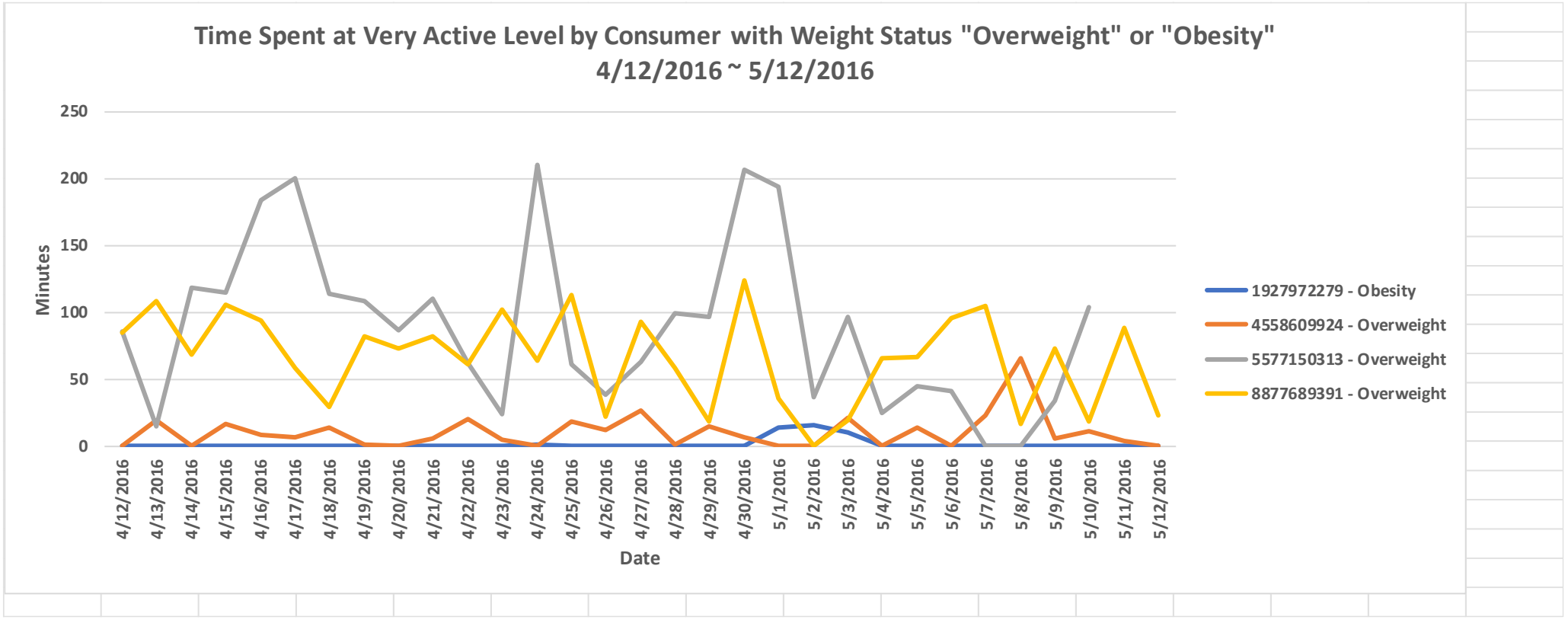
| Row Labels | Average of TotalSteps | Average of VeryActiveDistance | Average of VeryActiveSteps | Average of VeryActiveMinutes | Average of WeightPounds | Average of BMI | Weight Status | Activity Level |
|---|---|---|---|---|---|---|---|---|
| 1503960366 | 12,520.63 | 2.95 | 4,578.09 | 40.00 | 115.96 | 22.65 | Healthy Weight | Highly Active |
| 1927972279 | 916.13 | 0.10 | 138.44 | 1.32 | 294.32 | 47.54 | Obesity | Sedentary |
| 2873212765 | 7,555.77 | 0.68 | 993.11 | 14.10 | 125.66 | 21.57 | Healthy Weight | Somewhat Active |
| 4558609924 | 7,685.13 | 0.55 | 830.92 | 10.39 | 153.53 | 27.21 | Overweight | Somewhat Active |
| 5577150313 | 8,451.55 | 3.16 | 4,221.78 | 88.79 | 199.96 | 28.00 | Overweight | Somewhat Active |
| 6962181067 | 10,001.73 | 1.67 | 2,457.54 | 23.57 | 135.68 | 24.02 | Healthy Weight | Active |
| 8877689391 | 16,040.03 | 6.64 | 7,583.78 | 66.06 | 187.71 | 25.49 | Overweight | Highly Active |
| **Grand Total** | **9,008.80** | **2.24** | **2,955.09** | **34.41** | **159.14** | **25.13** | | |

# Key Findings: Weight and BMI Level Tracking



# Key Findings: Weight and BMI Level Tracking



# Key Findings: Sleep Duration and Sleep Efficiency Tracking

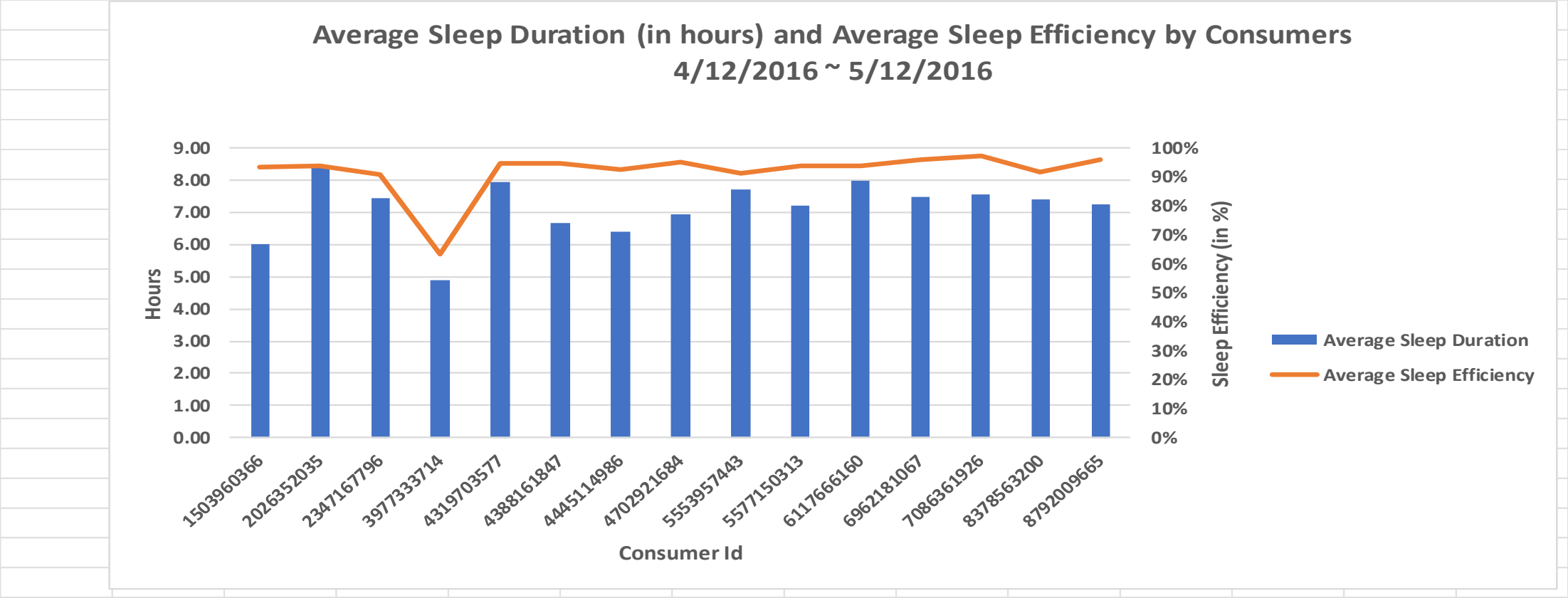
## Interesting findings:

- Approximately **70%** of consumers in the dataset (24 out of 33 consumers) used smart device to track their sleep durations and sleep efficiencies (or total sleep minutes and total time in bed) . The following issues were found:
  - **Sleep deprivation issues:** according to this article Is 6 Hours of Sleep Enough?, **consistently getting less than 6 hours of sleep can have consequences for a person's health and quality of life.** 2 consumers (or **6%** of the consumers in the dataset) slept **less than 6 hours per day** on **more than 50% of the days** during the data collection date range**.**
  - **Sleep efficiency issue:** sleep efficiency is commonly defined as the ratio of **total sleep time** to **total time in bed**. A normal sleep efficiency is **85%** or higher. 1 consumer (or **3%** of the consumers in the dataset) had **poor sleep efficiency**, with an average sleep efficiency of about **63%**.
- For some consumers, it may be **important** to be able to **use a smart device to track their sleep durations and sleep efficiencies** and **receive alerts** when **the device detects** that the customer is **consistently getting less than 6 hours of sleep** or **has poor average sleep efficiency**.
- Therefore, Bellabeat's marketing strategy should include **identifying the potential buyers**, and encouraging them to **purchase and wear Bellabeat's smart devices to track their sleep durations and sleep efficiencies.**

# Key Findings: Sleep Duration and Sleep Efficiency Tracking

| Row Labels | Average of TotalHoursAsleep | Average of SleepEfficiency | Sum of ShortSleepDay | Count of Id | Percentage of Short Sleep Day |
|---|---|---|---|---|---|
| 1503960366 | 6.01 | 94% | 14 | 25 | 56% |
| 2026352035 | 8.44 | 94% | 1 | 28 | 4% |
| 2347167796 | 7.45 | 91% | 0 | 15 | 0% |
| 3977333714 | 4.90 | 63% | 24 | 28 | 86% |
| 4319703577 | 7.94 | 95% | 3 | 26 | 12% |
| 4388161847 | 6.67 | 95% | 6 | 23 | 26% |
| 4445114986 | 6.42 | 93% | 8 | 28 | 29% |
| 4702921684 | 6.96 | 95% | 4 | 27 | 15% |
| 5553957443 | 7.73 | 91% | 5 | 31 | 16% |
| 5577150313 | 7.20 | 94% | 3 | 26 | 12% |
| 6117666160 | 7.98 | 94% | 2 | 18 | 11% |
| 6962181067 | 7.47 | 96% | 2 | 31 | 6% |
| 7086361926 | 7.55 | 97% | 2 | 24 | 8% |
| 8378563200 | 7.42 | 92% | 5 | 31 | 16% |
| 8792009665 | 7.26 | 96% | 2 | 15 | 13% |
| **Grand Total** | **7.14** | **0.92** | **81** | **376.00** | 22% |

# Key Findings: Sleep Duration and Sleep Efficiency Tracking

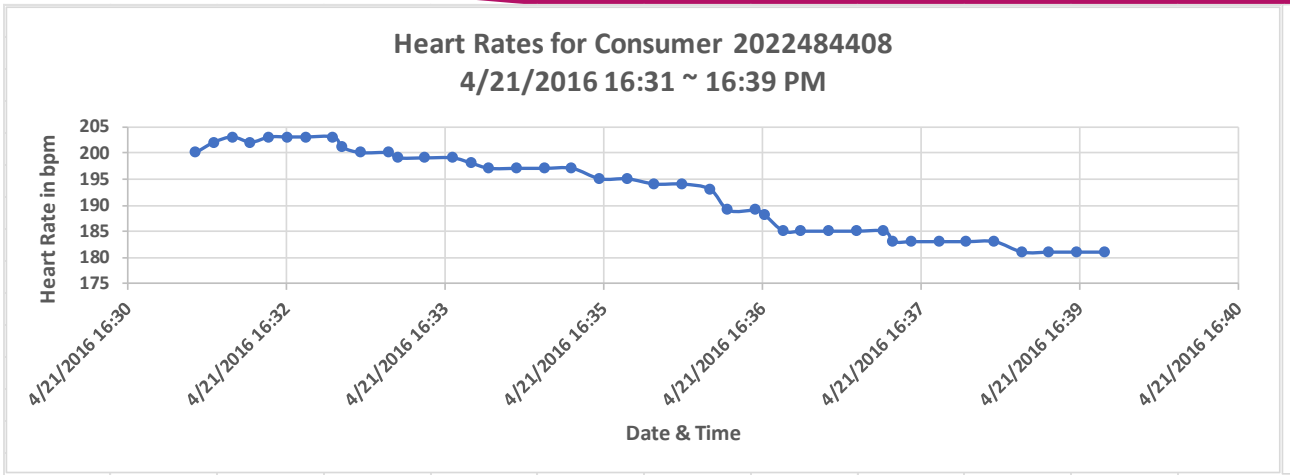


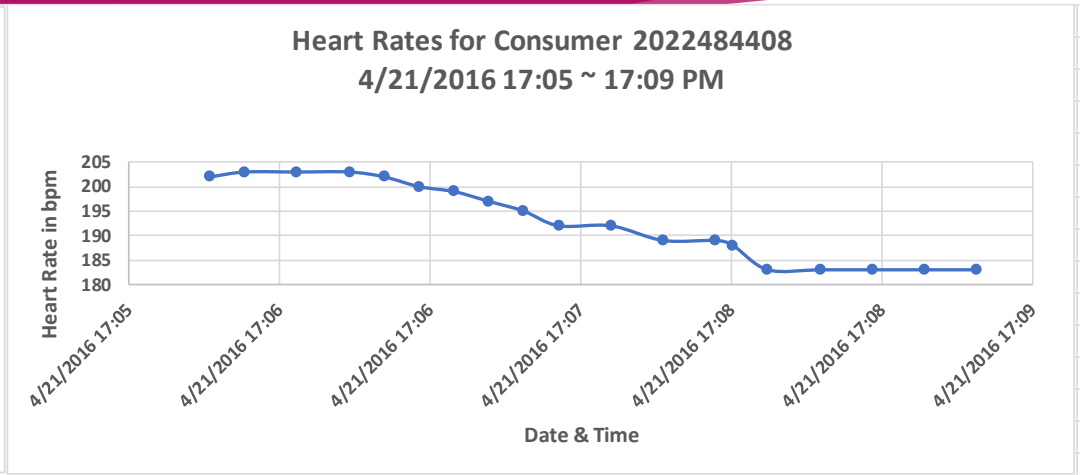
# Key Findings: Heart Rate Monitoring

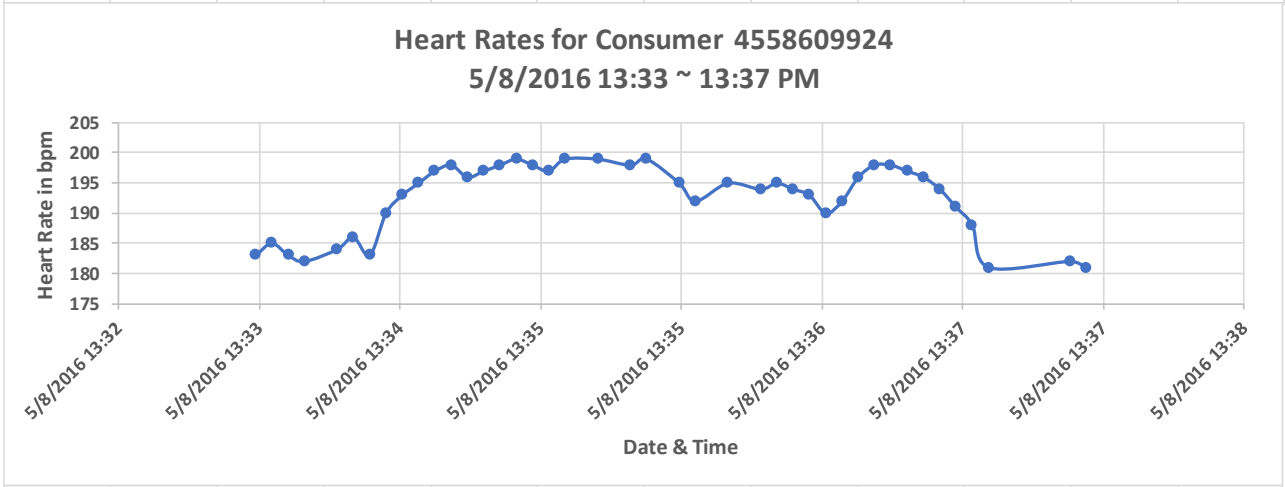
**Interesting findings:**

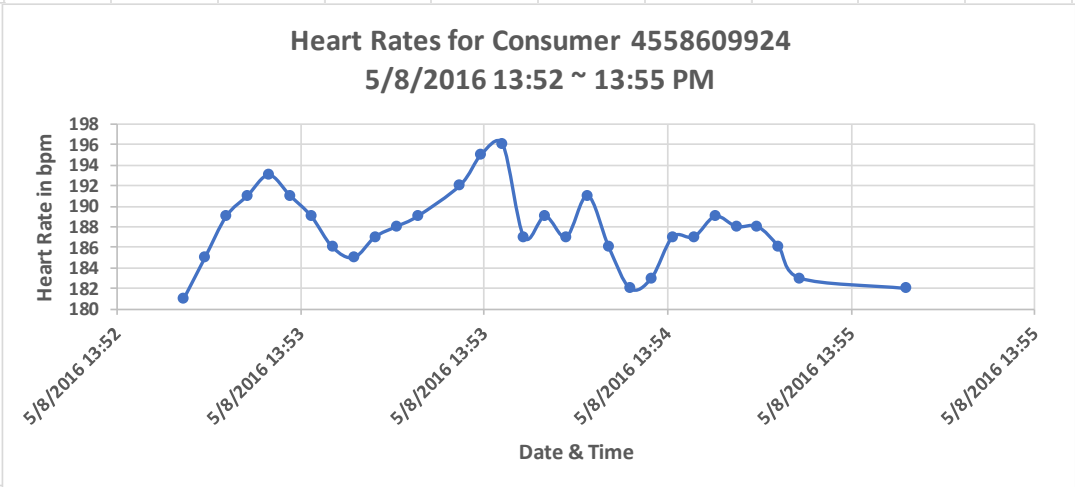
- Approximately **20%** of consumers in the dataset (7 out of 33 consumers) used smart device to monitor their heart rates. Among them, 4 consumers (or **12%** of all the consumers in the dataset) experienced high heart rates (which were **over 180 bpm**) that lasted for several minutes.
- For some consumers, it may be **important** to be able to **use a smart monitoring device** and **receive alerts** when **the device detects an abnormal heart rate**.
- Therefore, Bellabeat's marketing strategy should include **identifying the potential buyers**, and encouraging them to **purchase and wear Bellabeat's smart devices to monitor their heart rate during walking, exercise**, etc.

# Key Findings: Heart Rate Monitoring

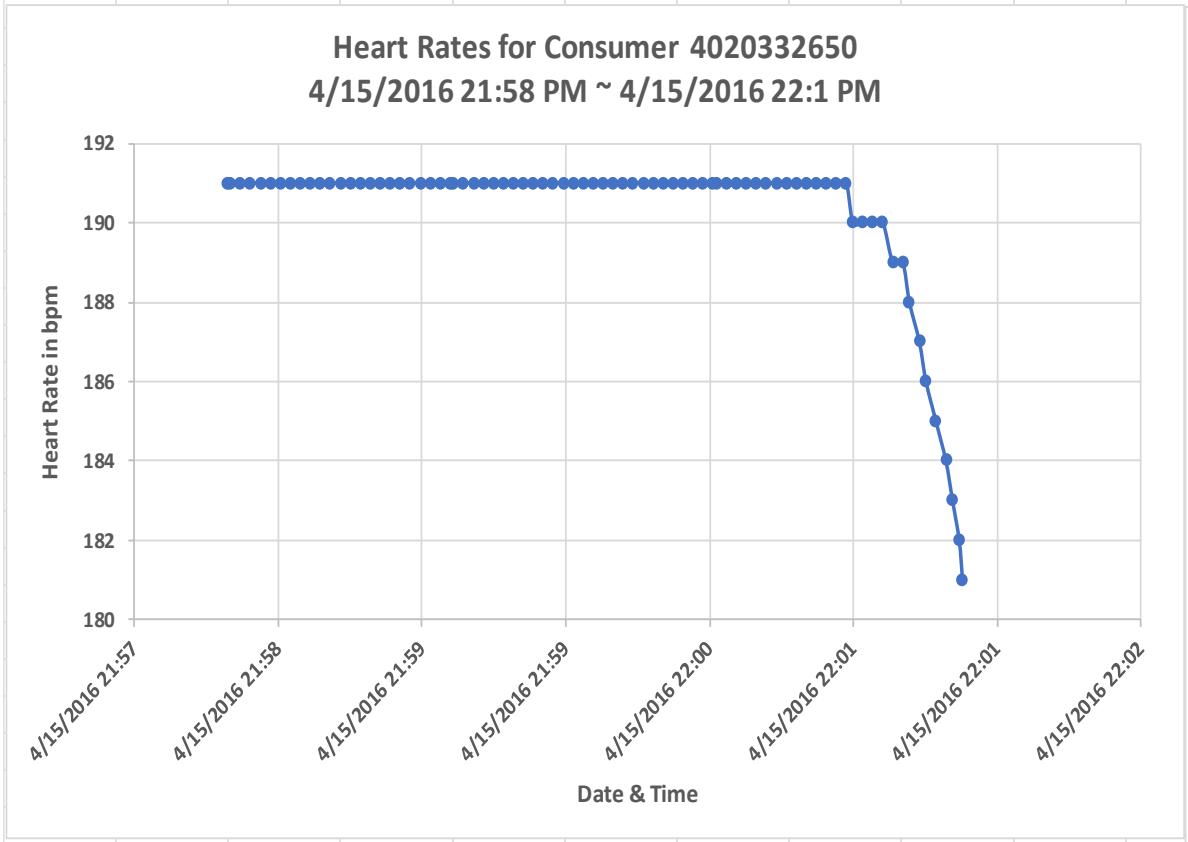


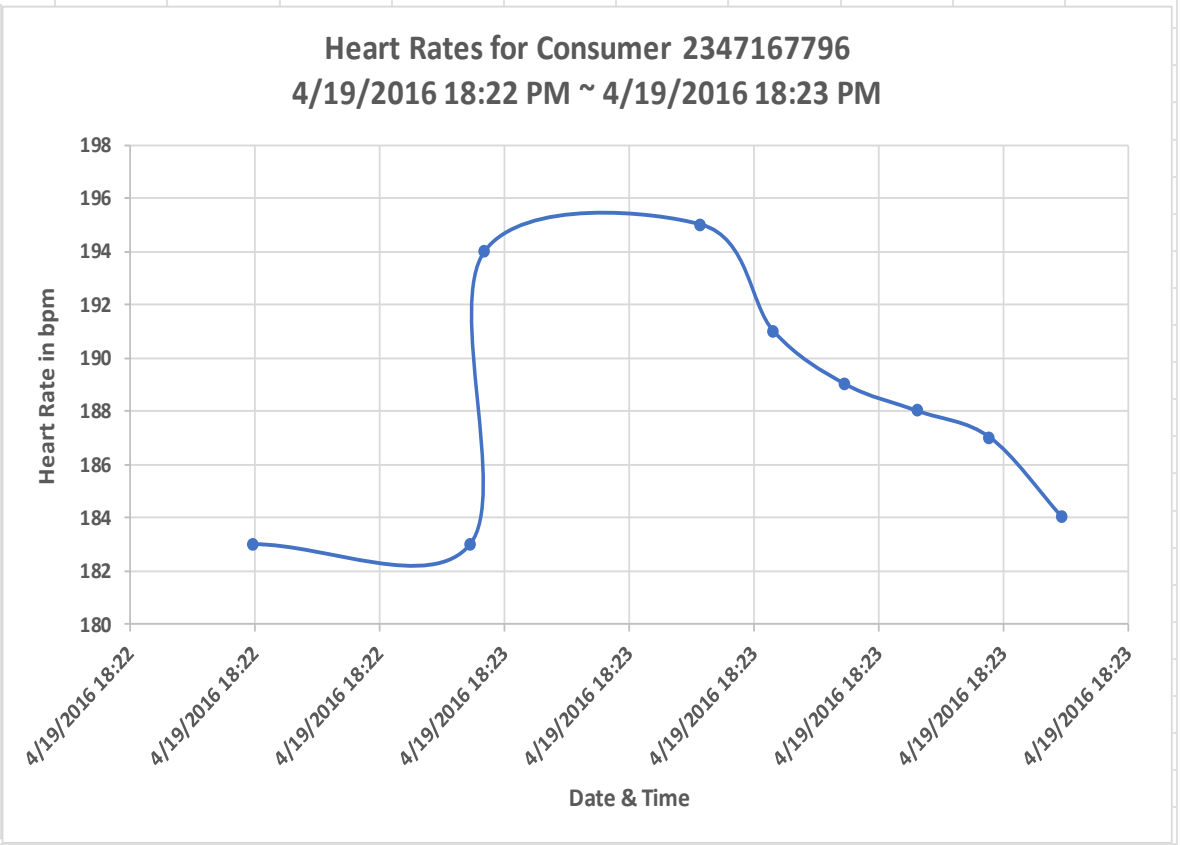



# Key Findings: Heart Rate Monitoring



# Recommendations

**High-level Recommendations for Bellabeat's Marketing Strategy:**

***Regarding monitoring customers' heart rates:***

- Request the technical team to **add** **the function of monitoring customers' heart rate** on Bellabeat's smart device **Time** (if it does not already have this function). This feature might include **sending an alert** to the customer if the device **detects abnormal heart rates** (too high or too low) for several minutes.
- **Identify people who may have heart rate issues** (tachycardia or bradycardia) and **promote this feature** to them. Approximately **20% of consumers** in the dataset were interested in and **used** this feature, and **12%** of consumers in the dataset **experienced** heart rate issues, so if Bellabeat's marketing team can find potential buyers, there might be **new growth opportunities** **in this area**. Potential customers may include:
  - People with heart disease or atrial fibrillation
  - People above middle age
  - People with thyroid disease or diabetes
  - Smokers

# Recommendations

**High-level Recommendations for Bellabeat's Marketing Strategy:**

***Regarding tracking customers' weights and BMI levels:***

- Request technical team to **add** the function to **track customers' weights and BMI levels** on Bellabeat's smart device **Time** (if this feature does not already exist). This feature might include **sending an alert** to the customer if the device detects that the customer's **BMI level** indicates she is **overweight or obese**, and **sending reminders** to help the customer manage her weight (e.g., **walk 10,000 steps per day**, with at least **3,500** of those steps being **moderate to vigorous**).
- **Identify people who may have weight or BMI level concerns** and **promote this feature to them**. About **20%** of consumers in the dataset were interested in and used this feature, and **12%** of consumers in the dataset were either **overweight** or **obese**, so if Bellabeat's marketing team can find potential buyers, there could be **new growth opportunities in this area**. Potential customers may include:
  - Women of certain racial groups (e.g., African-American women, Hispanic women)
  - Women of a certain age (for example, women between 40 and 59 years old)
  - Women who weigh more than 150 pounds.

# Recommendations

**High-level Recommendations For Bellabeat's Marketing Strategy:**

***Regarding tracking customers' daily activities***

- Request the technical team to **add** the function of **tracking customers' daily activities** (including total walking steps, total walking distance, walking distance for each activity level, total minutes spent for each activity level, and total calories burned) on Bellabeat's smart device **Time** (if this feature does not already exist). This feature might include **sending reminders** to customers who take less than 10,000 steps per day.
- **Encourage everyone to purchase** Bellabeat's smart device **Time**, follow CDC's recommendation to **set a goal of 10,000 steps each day**, and **track the daily activity using Time**. **Every** consumer in the dataset was interested in and used this feature, but at least **70%** of consumers in the dataset took less than 10,000 steps per day. If Bellabeat's marketing team can properly motivate buyers, there could **be a lot of growth** in this area.

# Recommendations

**High-level Recommendations For Bellabeat's Marketing Strategy:**

***Regarding tracking customers' sleep durations and sleep efficiencies:***

- Request the technical team to **add the function to track customers' sleep durations and sleep efficiencies** (or total sleep minutes and total time in bed) on Bellabeat's smart device **Time** (if this feature does not already exist). This functionality may include **sending an alert** to the customer if the device detects that the customer is **consistently getting less than 6 hours of sleep** or **has poor average sleep efficiency**.
- **Identify people who may have sleep deprivation or sleep efficiency issues and promote this feature** to them. About **70%** of the consumers in the dataset were interested in and used this feature, at least **6%** of the consumers in the dataset had sleep deprivation issues, and at least **3%** of the consumers in the dataset had sleep efficiency issues. If Bellabeat's marketing team can find potential buyers, there might be **some growth in this area**. Potential customers may include:
  - Elderly women
  - Women who need to take care of their families and spend time working
  - Women with chronic illness
  - Women who frequently experience menstrual stress or pain