Bellabeat: How Can a Wellness Technology Company Play It Smart?

By

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This case study is one of the Capstone Projects of the **Google Data Analytics Professional Certificate**. To complete this project I followed the 6 steps of Data Analysis. **Ask, Prepare, Process, Analyze, Share, Act**

STEP 1: ASK

Introduction

Bellabeat is a high-tech manufacturer of health-focused products for women. Collecting data on activity, sleep, stress, and reproductive health has allowed Bellabeat to empower women with knowledge about their own health and habits. Since it was founded in 2013, Bellabeat has grown rapidly and quickly positioned itself as a tech-driven wellness company for women.

The co-founder and Chief Creative Officer, Urška Sršen believes that analyzing smart device fitness data from competitors could help unlock new growth opportunities for the company.

Business Task: Analyze Fitbit Fitness Tracker Data provided by Mobius to gain insights into how consumers use competitor smart devices.

Business Objectives:

- 1. What are some trends in smart device usage?
- 2. How could these trends apply to Bellabeat customers?
- 3. How could these trends help influence Bellabeat marketing strategy?

Deliverables:

- 1. A clear summary of the business task
- 2. A description of all data sources used
- 3. Documentation of any cleaning or manipulation of data
- 4. A summary of your analysis
- 5. Supporting visualizations and key findings
- 6. High-level content recommendations based on you analysis

Key Stakeholders:

- 1. Bellabeat founders: Urška Sršen & Sando Mur
- 2. Bellabeat marketing analytics team

STEP 2: PREPARE

Data Source:

• Fitbit Fitness Tracker Data (CC0: Public Domain, dataset made available through Mobius): 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.

Limitations of the Data:

- 1. The sample size is only 30 female Fitbit users which may have a low representation.
- 2. Lack of demographic data (age, ethnicity, health conditions, etc.).
- 3. Data was collected between March-May 2016, not reflective of current usage or behaviors.

Data Selection: The file we are using for this project is:

• dailyActivity_merged.csv

STEP 3: PROCESS

This step of the project will be completed with R

```
# set CRAN mirror
options(repos = c(CRAN = "https://cloud.r-project.org"))

# install & load packages
install.packages("tidyverse")
install.packages("janitor")
install.packages("skimr")
install.packages("knitr")
install.packages("kableExtra")

library(tidyverse)
library(janitor)
library(lubridate)
library(skimr)
library(knitr)
library(kableExtra)
```

Preparing Environment:

```
# using read_csv function to import our dataset & clean_names to standardize column names
activity <- read_csv("dailyActivity_merged.csv") %>% clean_names()
```

Importing Data:

```
## Rows: 940 Columns: 15
## -- Column specification ------
## Delimiter: ","
## chr (1): ActivityDate
## dbl (14): Id, TotalSteps, TotalDistance, TrackerDistance, LoggedActivitiesDi...
##
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
```

Data Cleaning & Manipulation:

- 1. Familiarize with data
- 2. Check for completeness of data
- 3. Perform sanity check of data

Using the head and glimpse function to preview and familiarize with data:

```
# preview first 6 rows of data
head(activity)
## # A tibble: 6 x 15
```

```
## 2 1503960366 4/13/2016
                                     10735
                                                     6.97
                                                                      6.97
## 3 1503960366 4/14/2016
                                     10460
                                                     6.74
                                                                      6.74
                                      9762
## 4 1503960366 4/15/2016
                                                     6.28
                                                                      6.28
                                                     8.16
## 5 1503960366 4/16/2016
                                     12669
                                                                      8.16
## 6 1503960366 4/17/2016
                                      9705
                                                     6.48
                                                                      6.48
## # i 10 more variables: logged activities distance <dbl>,
       very_active_distance <dbl>, moderately_active_distance <dbl>,
       light_active_distance <dbl>, sedentary_active_distance <dbl>,
## #
## #
       very_active_minutes <dbl>, fairly_active_minutes <dbl>,
       lightly_active_minutes <dbl>, sedentary_minutes <dbl>, calories <dbl>
## #
```

basic information about the data glimpse(activity)

```
## Rows: 940
## Columns: 15
## $ id
                            <dbl> 1503960366, 1503960366, 1503960366, 1503960~
                            <chr> "4/12/2016", "4/13/2016", "4/14/2016", "4/1~
## $ activity_date
## $ total_steps
                            <dbl> 13162, 10735, 10460, 9762, 12669, 9705, 130~
## $ total_distance
                            <dbl> 8.50, 6.97, 6.74, 6.28, 8.16, 6.48, 8.59, 9~
## $ tracker_distance
                            <dbl> 8.50, 6.97, 6.74, 6.28, 8.16, 6.48, 8.59, 9~
## $ very_active_distance
                            <dbl> 1.88, 1.57, 2.44, 2.14, 2.71, 3.19, 3.25, 3~
## $ moderately_active_distance <dbl> 0.55, 0.69, 0.40, 1.26, 0.41, 0.78, 0.64, 1~
                            <dbl> 6.06, 4.71, 3.91, 2.83, 5.04, 2.51, 4.71, 5~
## $ light_active_distance
## $ sedentary_active_distance
                            ## $ very active minutes
                            <dbl> 25, 21, 30, 29, 36, 38, 42, 50, 28, 19, 66,~
## $ fairly active minutes
                            <dbl> 13, 19, 11, 34, 10, 20, 16, 31, 12, 8, 27, ~
                            <dbl> 328, 217, 181, 209, 221, 164, 233, 264, 205~
## $ lightly_active_minutes
## $ sedentary_minutes
                            <dbl> 728, 776, 1218, 726, 773, 539, 1149, 775, 8~
## $ calories
                            <dbl> 1985, 1797, 1776, 1745, 1863, 1728, 1921, 2~
```

Investigating structure of dataset:

```
# show data type for each column
sapply(activity, class)
```

```
##
                            id
                                             activity_date
##
                     "numeric"
                                                "character"
##
                   total_steps
                                             total_distance
##
                     "numeric"
                                                  "numeric"
##
             tracker_distance logged_activities_distance
##
                     "numeric"
                                                  "numeric"
##
         very_active_distance moderately_active_distance
##
                     "numeric"
                                                  "numeric"
##
        light_active_distance
                                 sedentary_active_distance
##
                     "numeric"
                                                  "numeric"
          very_active_minutes
##
                                     fairly_active_minutes
##
                     "numeric"
                                                  "numeric"
##
       lightly_active_minutes
                                         sedentary minutes
##
                     "numeric"
                                                  "numeric"
##
                      calories
##
                     "numeric"
```

Counting unique ID and confirming whether dataset has 30 IDs:

```
# counting distinct values in id column
activity %>%
   summarize(unique_ids = n_distinct(id))

## # A tibble: 1 x 1
## unique_ids
```

This dataset has 33 distinct IDs

33

<int>

##

1

Finding out if there is any null/missing values in our data:

```
# counting null values in all columns
colSums(is.na(activity))
```

```
##
                             id
                                              activity_date
##
##
                   total_steps
                                             total_distance
##
##
             tracker_distance logged_activities_distance
##
##
         very_active_distance moderately_active_distance
##
##
        light_active_distance
                                 sedentary_active_distance
##
##
          very_active_minutes
                                     fairly_active_minutes
##
##
       lightly_active_minutes
                                         sedentary_minutes
##
                                                          0
##
                      calories
##
                              0
```

From the above observation, noted that:

- 1. Data frame has 940 rows and 15 columns.
- 2. There is no null/missing values.
- 3. There are 33 unique IDs, the sample size was expected to be 30 users.
- 4. The data type of the activity_date column is formatted as character instead of date.

The following data manipulation is performed:

- 1. Convert activity_date data type to date.
- 2. Convert date format to yyyy-mm-dd.
- 3. Create new column day_of_the_week by separating the date into day of the week for further analysis.
- 4. Create new column total_mins being the sum of very_active_minutes, fairly_active_minutes, lightly_active_minutes, and sedentary_minutes.
- 5. Create new column total_hoursby converting new column in #4 to number of hours. 6.Rearrange and rename columns.

Converting activity_date from character to date data type and converting format of date to yyyy-mm-dd. Then confirming it has been updated:

```
# converting activity date to yyyy-mm-dd date
activity activity date <- as. Date (activity activity date, format = "%m/%d/%Y")
# confirming data type change
head(activity)
## # A tibble: 6 x 15
##
             id activity_date total_steps total_distance tracker_distance
##
          <dbl> <date>
                                     <dbl>
                                                    <dbl>
                                                                     <dbl>
## 1 1503960366 2016-04-12
                                    13162
                                                     8.5
                                                                      8.5
## 2 1503960366 2016-04-13
                                                     6.97
                                                                      6.97
                                    10735
## 3 1503960366 2016-04-14
                                    10460
                                                     6.74
                                                                      6.74
## 4 1503960366 2016-04-15
                                     9762
                                                     6.28
                                                                      6.28
## 5 1503960366 2016-04-16
                                    12669
                                                     8.16
                                                                      8.16
## 6 1503960366 2016-04-17
                                      9705
                                                     6.48
                                                                      6.48
## # i 10 more variables: logged_activities_distance <dbl>,
       very_active_distance <dbl>, moderately_active_distance <dbl>,
       light_active_distance <dbl>, sedentary_active_distance <dbl>,
       very active minutes <dbl>, fairly active minutes <dbl>,
## #
       lightly active minutes <dbl>, sedentary minutes <dbl>, calories <dbl>
```

Adding new columns for readability:

```
# add weekday column
activity <- activity %>%
  mutate(
    day_of_the_week = factor(
        wday(activity_date, label=TRUE, abbr=FALSE),
        levels=c("Sunday", "Monday", "Tuesday", "Wednesday", "Thursday", "Friday", "Saturday"),
        ordered=TRUE
    ),
    total_exercise_minutes = NA,
    total_exercise_hours = NA
)

# quick check
glimpse(activity)
```

```
## Rows: 940
## Columns: 18
                         <dbl> 1503960366, 1503960366, 1503960366, 1503960~
## $ id
                         <date> 2016-04-12, 2016-04-13, 2016-04-14, 2016-0~
## $ activity_date
## $ total_steps
                         <dbl> 13162, 10735, 10460, 9762, 12669, 9705, 130~
                         <dbl> 8.50, 6.97, 6.74, 6.28, 8.16, 6.48, 8.59, 9~
## $ total_distance
## $ tracker distance
                         <dbl> 8.50, 6.97, 6.74, 6.28, 8.16, 6.48, 8.59, 9~
## $ very active distance
                         <dbl> 1.88, 1.57, 2.44, 2.14, 2.71, 3.19, 3.25, 3~
## $ moderately_active_distance <dbl> 0.55, 0.69, 0.40, 1.26, 0.41, 0.78, 0.64, 1~
## $ light_active_distance
                         <dbl> 6.06, 4.71, 3.91, 2.83, 5.04, 2.51, 4.71, 5~
```

```
<dbl> 25, 21, 30, 29, 36, 38, 42, 50, 28, 19, 66,~
## $ very active minutes
## $ fairly_active_minutes
                           <dbl> 13, 19, 11, 34, 10, 20, 16, 31, 12, 8, 27, ~
## $ lightly_active_minutes
                          <dbl> 328, 217, 181, 209, 221, 164, 233, 264, 205~
                          <dbl> 728, 776, 1218, 726, 773, 539, 1149, 775, 8~
## $ sedentary_minutes
## $ calories
                          <dbl> 1985, 1797, 1776, 1745, 1863, 1728, 1921, 2~
## $ day of the week
                          <ord> Tuesday, Wednesday, Thursday, Friday, Satur~
## $ total exercise minutes
                          ## $ total_exercise_hours
```

Calculation of exercise minutes:

```
# sum total of all active minutes columns
activity <- activity %>%
mutate(
   total_exercise_minutes = very_active_minutes +
      fairly_active_minutes + lightly_active_minutes + sedentary_minutes,

# converting the total exercise minutes to total hours
   total_exercise_hours = round(total_exercise_minutes / 60)
)

# confirming change
glimpse(activity)
```

```
## Rows: 940
## Columns: 18
## $ id
                            <dbl> 1503960366, 1503960366, 1503960366, 1503960~
                            <date> 2016-04-12, 2016-04-13, 2016-04-14, 2016-0~
## $ activity_date
## $ total_steps
                            <dbl> 13162, 10735, 10460, 9762, 12669, 9705, 130~
## $ total_distance
                            <dbl> 8.50, 6.97, 6.74, 6.28, 8.16, 6.48, 8.59, 9~
                            <dbl> 8.50, 6.97, 6.74, 6.28, 8.16, 6.48, 8.59, 9~
## $ tracker_distance
## $ very_active_distance
                            <dbl> 1.88, 1.57, 2.44, 2.14, 2.71, 3.19, 3.25, 3~
## $ moderately_active_distance <dbl> 0.55, 0.69, 0.40, 1.26, 0.41, 0.78, 0.64, 1~
## $ light_active_distance
                            <dbl> 6.06, 4.71, 3.91, 2.83, 5.04, 2.51, 4.71, 5~
<dbl> 25, 21, 30, 29, 36, 38, 42, 50, 28, 19, 66,~
## $ very active minutes
                            <dbl> 13, 19, 11, 34, 10, 20, 16, 31, 12, 8, 27, ~
## $ fairly_active_minutes
## $ lightly_active_minutes
                            <dbl> 328, 217, 181, 209, 221, 164, 233, 264, 205~
## $ sedentary_minutes
                            <dbl> 728, 776, 1218, 726, 773, 539, 1149, 775, 8~
## $ calories
                            <dbl> 1985, 1797, 1776, 1745, 1863, 1728, 1921, 2~
## $ day_of_the_week
                            <ord> Tuesday, Wednesday, Thursday, Friday, Satur~
                            <dbl> 1094, 1033, 1440, 998, 1040, 761, 1440, 112~
## $ total_exercise_minutes
## $ total_exercise_hours
                            <dbl> 18, 17, 24, 17, 17, 13, 24, 19, 18, 18, 24,~
```

Creating new activity table with rearranged columns:

```
total_exercise_minutes, total_exercise_hours, calories)
# preview of rearranged dataset
glimpse(new_activity)
## Rows: 940
## Columns: 18
## $ id
                            <dbl> 1503960366, 1503960366, 1503960366, 1503960~
## $ activity_date
                            <date> 2016-04-12, 2016-04-13, 2016-04-14, 2016-0~
## $ day_of_the_week
                            <ord> Tuesday, Wednesday, Thursday, Friday, Satur~
## $ total steps
                            <dbl> 13162, 10735, 10460, 9762, 12669, 9705, 130~
## $ total distance
                            <dbl> 8.50, 6.97, 6.74, 6.28, 8.16, 6.48, 8.59, 9~
                            <dbl> 8.50, 6.97, 6.74, 6.28, 8.16, 6.48, 8.59, 9~
## $ tracker_distance
## $ very_active_distance
                            <dbl> 1.88, 1.57, 2.44, 2.14, 2.71, 3.19, 3.25, 3~
## $ moderately_active_distance <dbl> 0.55, 0.69, 0.40, 1.26, 0.41, 0.78, 0.64, 1~
## $ light active distance
                            <dbl> 6.06, 4.71, 3.91, 2.83, 5.04, 2.51, 4.71, 5~
## $ sedentary_active_distance
                            ## $ very_active_minutes
                            <dbl> 25, 21, 30, 29, 36, 38, 42, 50, 28, 19, 66,~
```

This concludes the data cleaning and manipulation process. Data is now ready to be analyzed.

<dbl> 13, 19, 11, 34, 10, 20, 16, 31, 12, 8, 27, ~

<dbl> 328, 217, 181, 209, 221, 164, 233, 264, 205~

<dbl> 728, 776, 1218, 726, 773, 539, 1149, 775, 8~

<dbl> 1094, 1033, 1440, 998, 1040, 761, 1440, 112~ <dbl> 18, 17, 24, 17, 17, 13, 24, 19, 18, 18, 24,~

<dbl> 1985, 1797, 1776, 1745, 1863, 1728, 1921, 2~

STEP 4: Analyze

\$ fairly_active_minutes

\$ lightly_active_minutes

\$ sedentary_minutes
\$ total_exercise_minutes

\$ calories

\$ total_exercise_hours

Pulling a summary of new_activity for analysis:

- count no. of rows
- mean (average)
- std (standard deviation)
- min and max
- percentiles 25%, 50%, 75%

```
# improve number formatting and prevent scientific notation
options(scipen = 999, digits = 10)

# defining a custom summary
numeric_data <- new_activity %>% select(where(is.numeric))

summary_stats <- function(x) {
   data.frame(
      count = length(x),
      mean = mean(x),
      sd = sd(x),</pre>
```

```
min = min(x),
   p25 = quantile(x, 0.25),
   p50 = quantile(x, 0.50),
   p75 = quantile(x, 0.75),
   max = max(x)
}
# applying the summary function to each numeric column
stats_result <- map_dfr(numeric_data, summary_stats, .id = "variable")</pre>
# transforming table from long to wide format
stats_transposed <- stats_result %>%
  pivot_longer(-variable, names_to = "stat", values_to = "value") %>%
  pivot_wider(names_from = variable, values_from = value)
# view wide formatted table & add scroll wheel to results
kable(stats_transposed) %>%
  kable_styling(full_width = FALSE, position = "center") %>%
  scroll_box(width = "100%", height = "400px")
```

stat	id	total_steps	total_distance	tracker_distance	logged_activities_distance	very_active_dista
count	940	940.000000	940.0000000000	940.0000000000	940.0000000000	940.0000000
mean	4855407369	7637.910638	5.489702122	5.475351058	0.1081709399	1.5026808
sd	2424805476	5087.150742	3.924605909	3.907275943	0.6198965182	2.6589411
\min	1503960366	0.000000	0.000000000	0.000000000	0.0000000000	0.0000000
p25	2320127002	3789.750000	2.619999886	2.619999886	0.0000000000	0.0000000
p50	4445114986	7405.500000	5.244999886	5.244999886	0.0000000000	0.2099999
p75	6962181067	10727.000000	7.712499976	7.710000038	0.0000000000	2.0524999
max	8877689391	36019.000000	28.030000687	28.030000687	4.9421420097	21.9200000

Interpreting statistical findings:

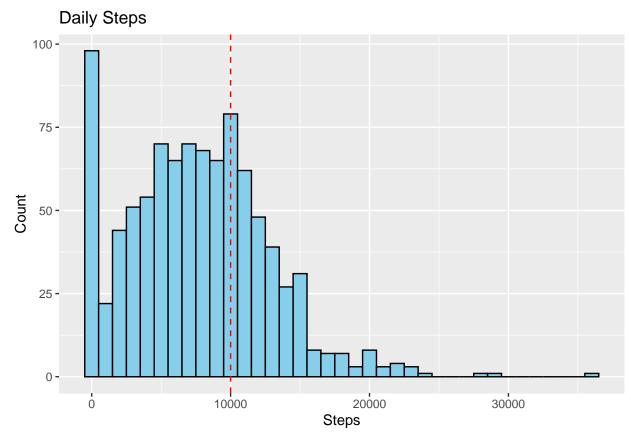
- 1. On average, users log around 7,638 steps per day, which is below the CDC's recommendation of 10,000 steps per day for adults (CDC Source).
- 2. With 75% of users recording under 10,727 steps daily, the data suggests that only a minority of users consistently reach high activity thresholds.
- 3. The majority of users are sedentary for 991 minutes (over 16 hours) per day, suggesting a need for lifestyle improvement.
- 4. Calories burned average around 2,303 per day, which seems typical, but requires deeper correlation analysis.

STEP 5: SHARE

For the share phase, we are creating visualizations and communicating our findings based on our analysis.

Data Visualization and Findings

```
# daily steps histogram
ggplot(new_activity, aes(x=total_steps)) +
  geom_histogram(binwidth=1000, fill="skyblue", color="black") +
  geom_vline(xintercept=10000, linetype="dashed", color="red") +
  labs(title="Daily Steps", x="Steps", y="Count")
```



Findings: Amount of Steps Users Take Daily

Chart 1:

In this histogram, we are looking at the distribution of steps users take daily.

- Majority of distribution is under 10,000 steps, which is below the the CDC's recommendation.
- The tallest bin shows that a high amount of users do not report steps.
- Outliers show a few days recorded 20,000+ steps, which may represent unusually active days, like long hikes, races, or special events.

```
# logins per weekday
login_counts <- new_activity %>%
   count(day_of_the_week)
```

```
# order weekdays
login_counts$day_of_the_week <- factor(login_counts$day_of_the_week,
    levels=c("Monday","Tuesday","Wednesday","Thursday","Friday","Saturday","Sunday")
)

# bar chart
ggplot(login_counts, aes(x=day_of_the_week, y=n)) +
    geom_col(fill="skyblue", color="black") +
    labs(title="Logins by Day", x="Day", y="Logins")</pre>
```

Logins by Day

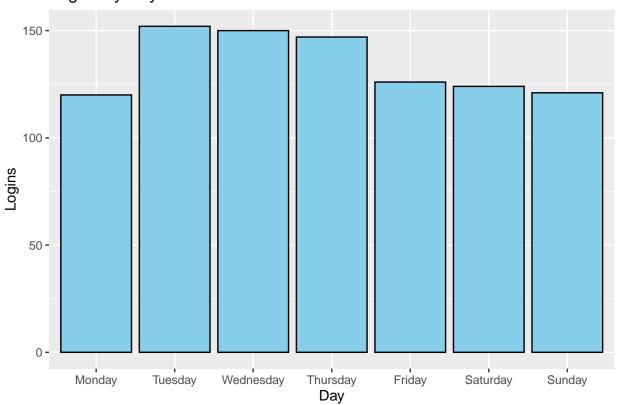


Chart 2: Findings: User Logins by Day of Week

- This chart shows how often users logged into the Fitbit app across the days of the week.
- We can see that usage is highest during the middle of the week, especially from Tuesday through Thursday.
- Logins begin to decline on Friday and remain lower through the weekend and into Monday.

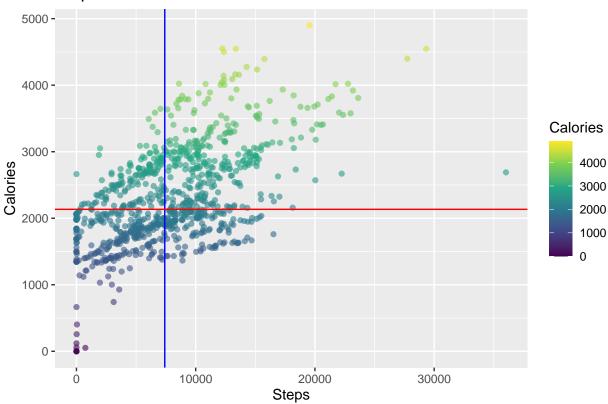
Chart 3:

```
# scatter: steps vs calories
med_steps <- median(new_activity$total_steps, na.rm=TRUE)
med_cals <- median(new_activity$calories, na.rm=TRUE)

ggplot(new_activity, aes(x=total_steps, y=calories, color=calories)) +</pre>
```

```
geom_point(alpha=0.6) +
scale_color_viridis_c() +
geom_vline(xintercept=med_steps, color="blue") +
geom_hline(yintercept=med_cals, color="red") +
labs(title="Steps vs Calories", x="Steps", y="Calories", color="Calories")
```

Steps vs Calories



Findings: Relationship Between Steps and Calories Burned

- The scatterplot shows a positive correlation.
- Calorie burn rises consistently with step counts up to about 15,000. After that, the increase in calories burned slows down.
- There are a few outliers where users recorded over 20,000 steps, which may represent unusually active days, like long hikes, races, or special events.

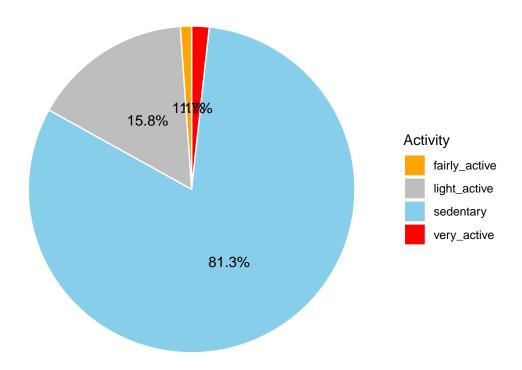
Chart 4:

```
# total minutes by activity
act_mins <- new_activity %>%
summarise(
   very_active = sum(very_active_minutes, na.rm=TRUE),
   fairly_active = sum(fairly_active_minutes, na.rm=TRUE),
   light_active = sum(lightly_active_minutes, na.rm=TRUE),
   sedentary = sum(sedentary_minutes, na.rm=TRUE)
```

```
) %>%
  pivot_longer(cols=everything(), names_to="type", values_to="minutes") %>%
  mutate(pct = round(minutes/sum(minutes)*100, 1))

# pie chart
ggplot(act_mins, aes(x="", y=minutes, fill=type)) +
  geom_col(color="white") +
  coord_polar("y") +
  geom_text(aes(label=paste0(pct,"%")), position=position_stack(vjust=0.5)) +
  scale_fill_manual(values=c(
    "very_active"="red",
    "fairly_active"="orange",
    "light_active"="gray",
    "sedentary"="skyblue"
)) +
  labs(title="Activity Breakdown", fill="Activity") +
  theme_void()
```

Activity Breakdown



Findings: Activity in Minutes

- Sedentary minutes makes up 81.3% of the chart.
- Fairly active and very active are exponentially low, both under 2%.
- This shows that the app isn't being used much for actual fitness tracking, which goes against its main purpose of encouraging activity.

STEP 6: ACT

In this final step, we share the insights from our analysis and give recommendations.

We go back to the original business questions and provide clear, key suggestions for Bellabeat.

1. What are the trends identified?

- Users spend most of their logged time in sedentary activity, with very little time in fairly or very active
- As more steps are taken, the amount of calories burn increases.
- Recorded daily step counts fall below 10,000 on average, this is below the CDC's recommendation for maintaining physical health (CDC Source).
- People seem to log in more during weekdays and less on weekends. Suggesting that weekends are likely being used as breaks or for relaxation.

2. How could these trends apply to Bellabeat customers?

- Bellabeat's users may also show high sedentary time, since much of the activity tracked reflects normal routines rather than workouts.
- Most step counts fall below 10,000, which suggests Bellabeat customers may also need help reaching healthy activity levels.
- Usage being higher mid-week could mean Bellabeat users are more engaged during weekdays.
- Calories burned increased with steps, so Bellabeat customers could benefit from setting realistic goals that push consistent activity.

3. How could these trends help influence Bellabeat marketing strategy?

- Bellabeat could market features that remind users to stay active or reward light movements during the day.
- Because daily step counts are under 10,000 on average, Bellabeat can promote shorter, yet realistic goals like 6-8k steps.
- Since the most app activity is during the weekdays, Bellabeat could send reminders or weekly challenges to encourage active consistency.
- Bellabeat could also introduce a weekend challenge to keep users engaged when activity normally drops.

Overall, Bellabeat can use these insights to encourage realistic goals, increase engagement throughout the entire week, and position itself as both a lifestyle and fitness companion.