



E-Report for Vital Signs Data

Data Science Laboratory
for Health Sciences | A Github Portfolio
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An abstract geometric design consisting of various colored shapes: a large yellow 'X' shape, a red triangle, a grey square, and several smaller squares in white, red, and yellow.

SCHOOL OF
HEALTH SCIENCES

In collaboration with
Arizona State University®

Vital Signs and Cardiovascular Risk

Assessment

Introduction to the Dataset

This dataset includes vital signs and cardiovascular health indicators such as **BMI, blood pressure (systolic and diastolic), cholesterol, glucose, physical activity, and stress levels**. These variables were selected because they are strong predictors of heart disease and general health risks. Behavioral factors like physical activity and stress were included due to their known influence on metabolic outcomes. The objective of this experiment is to analyze how stress levels and physical activity relate to cardiovascular risk factors such as BMI, blood pressure, and cholesterol, with the goal of understanding how lifestyle patterns influence heart health.

Methods

The dataset was cleaned by removing rows with missing BMI values and converting all vital sign variables (e.g., blood pressure, glucose) into numeric formats. Categorical variables such as sex, smoking status, and BMI classification were standardized for clarity and analysis. Physical activity was grouped into three levels: low (<4 hrs/week), moderate (4–10 hrs/week), and high (≥ 10 hrs/week).

Descriptive statistics were calculated to obtain the mean values for each variable of interest, including BMI, blood pressure, cholesterol, glucose, stress level, and weekly physical activity hours. Four visualizations were created to explore the data: a BMI density plot (with WHO categories), a scatter plot of physical activity vs. BMI, a box plot of stress by BMI category, and a bar plot comparing BMI categories across activity levels.

- **Key statistical tests conducted were:**

One-sample t-test to compare BMI with the healthy threshold of 25.

Pearson correlation to examine the relationship between BMI and physical activity.

ANOVA to assess stress level differences across BMI categories.

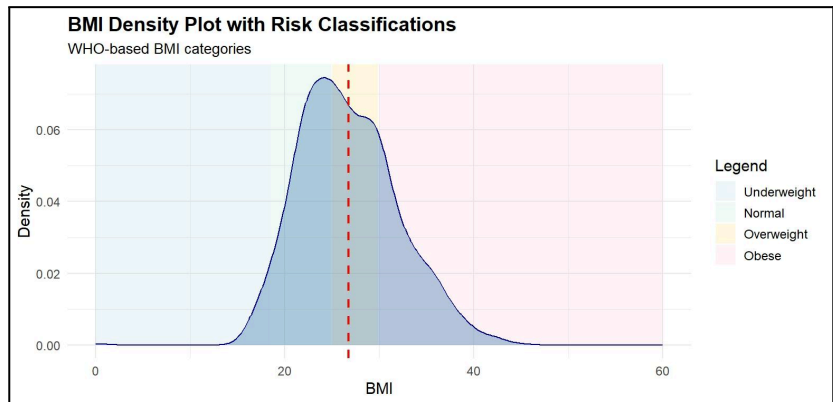
Chi-square test to evaluate the association between physical activity and BMI

categories.

Key Results and Figures

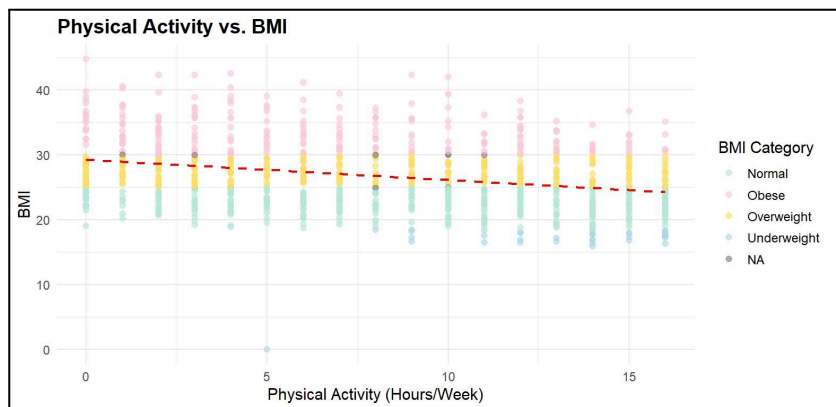
- BMI Distribution by WHO Classification** – A density plot showed the BMI curve concentrated in the overweight range. The average BMI (26.74) was above the healthy threshold, placing most individuals in the overweight category.

Figure 1. Density Plot of BMI Distribution by WHO Classification



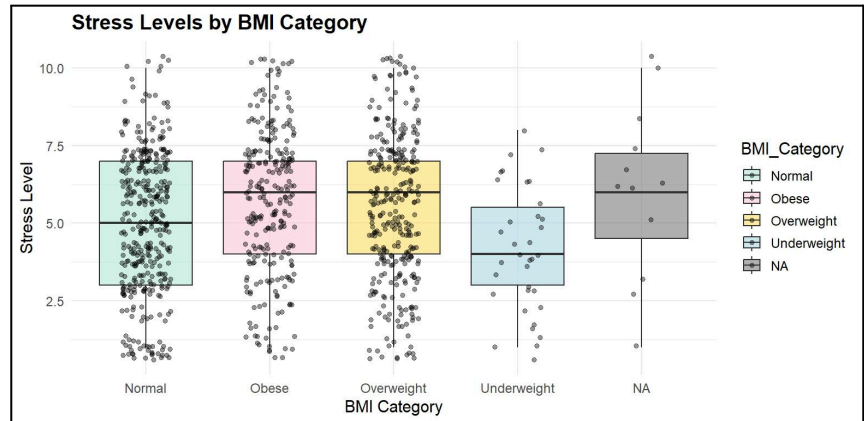
- Physical Activity vs. BMI** – A scatter plot with its regression line showing a moderate negative relationship ($r = -0.297$), indicating that higher physical activity is associated with lower BMI.

Figure 2. Scatter Plot of Physical Activity vs. BMI



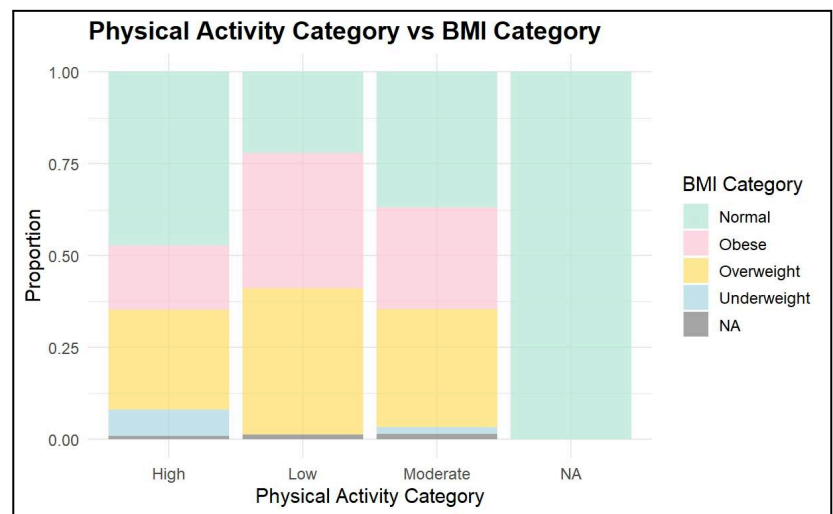
- Stress Levels by BMI Category** – A box plot revealed that obese and overweight groups had higher median stress levels. ANOVA confirmed significant variation across groups ($F \approx 18.38$, $p < 0.001$).

Figure 3. Stress Levels by BMI Category



4. **Physical Activity Category vs. BMI Category** – A stacked bar plot showed higher BMI groups had more individuals with low activity, supported by a significant chi-square test ($\chi^2 = 82.07$, $p < 0.001$).

Figure 4. Stacked Bar Plot of Physical Activity Category vs. BMI Category



Interpretation and Brief Conclusion

These results highlight how **lifestyle choices directly impact cardiovascular health**. The significantly elevated average BMI suggests a population trend toward being overweight. The **inverse correlation between activity and BMI** confirms the importance of regular exercise. Stress appears to **vary meaningfully by weight status**, potentially both as a cause and consequence of higher BMI. Lastly, the strong association between activity level and BMI category suggests a cycle where **low physical activity may aggravate weight gain**, further increasing cardiovascular risk.

These findings support targeted interventions that address both behavioral and physiological factors in improving heart health outcomes.