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# E-Report for Time Series Monitoring Data

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Data Science Laboratory  
for Health Sciences | A Github Portfolio  
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SCHOOL OF  
HEALTH SCIENCES

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In collaboration with  
Arizona State University®

# Time Series Analysis of Wellness Trends

## Introduction to the Dataset

This dataset tracks monthly health and lifestyle metrics across three patients. The key variables include average steps (as a measure of physical activity), stress levels (a psychological factor), and BMI (body composition). The inclusion of time (months) and patient ID allows for time-dependent analysis and individual-level insights. These variables were chosen because they represent both behavioral (steps, stress) and physiological (BMI) dimensions, providing a holistic view of patient wellness over time. The objective of this experiment was to evaluate how physical activity and stress levels evolve monthly and to examine their relationship with BMI. The intent is to uncover health behavior patterns and determine how they might influence or predict changes in body composition.

## Methods

The dataset was first cleaned and transformed into a long format to separate individual patients and standardize variable columns. Variables were converted appropriately (e.g., month number to label), and missing values were removed to ensure statistical accuracy. Descriptive statistics such as mean, median, and standard deviation were computed for each main variable—steps, stress, and BMI.

Visualizations were created to reveal trends and comparisons: line plots for step progression, bar charts for stress levels per month, scatter plots for BMI vs. steps, and box plots for BMI differences among patients. These were chosen for their effectiveness in communicating time trends, correlations, and distributional differences.

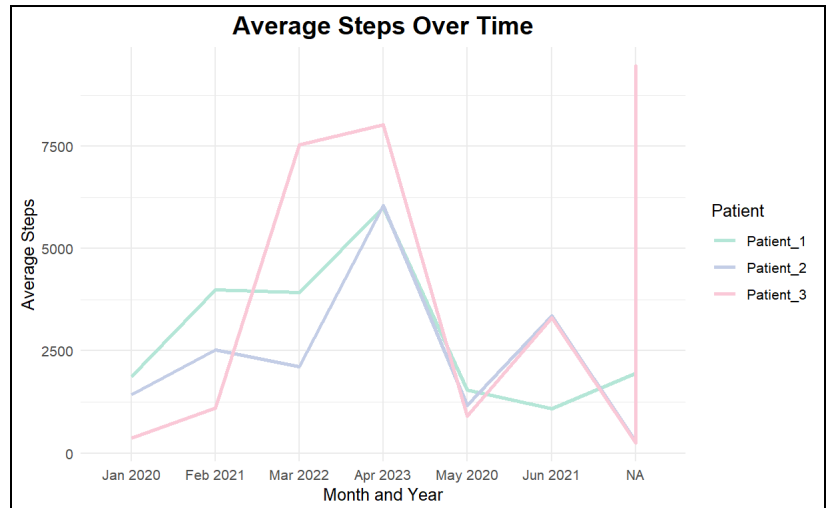
## Key statistical tests conducted were:

- **Linear regression** to analyze change in steps over time and differences between patients
  - **Two-way ANOVA** to test the effects of month and patient on stress levels
  - **Pearson's correlation** between average steps and BMI
  - **Kruskal-Wallis test** to compare BMI differences across patients
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## Key Results and Figures

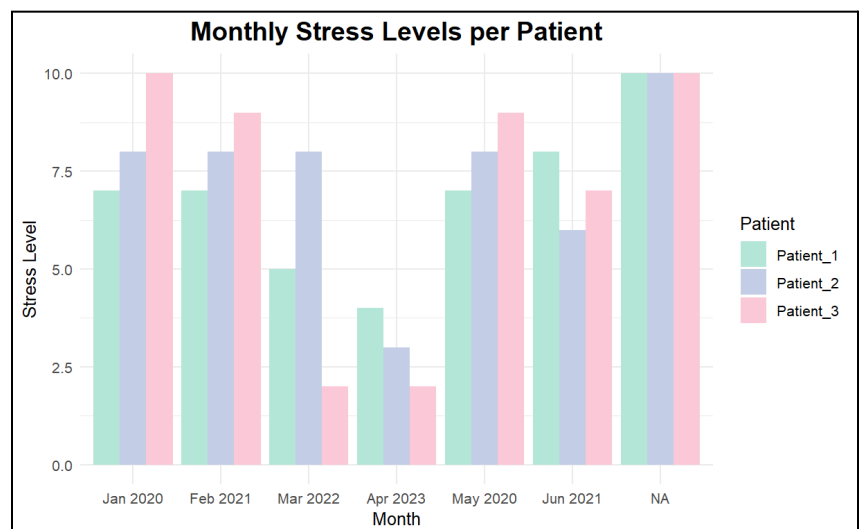
1. **Steps Over Time** – A line plot showed that average monthly steps increased steadily across all patients, with Patient 2 generally being less active than the others.

**Figure 1.** Line Plot of Steps Over Time



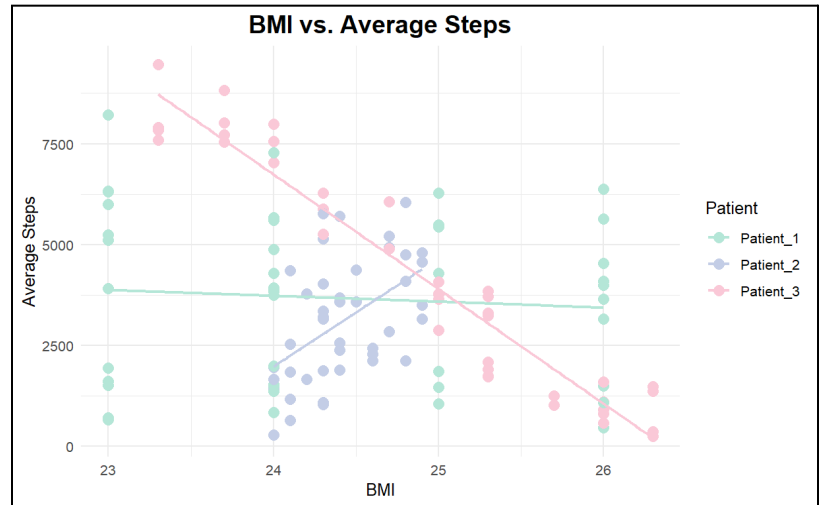
2. **Monthly Stress Levels per Patient** – A grouped bar chart revealed month-to-month fluctuations in stress. All patients exhibited varying levels, and interactions between month and patient were statistically significant.

**Figure 2.** Grouped Bar Chart of Monthly Stress Levels per Patient



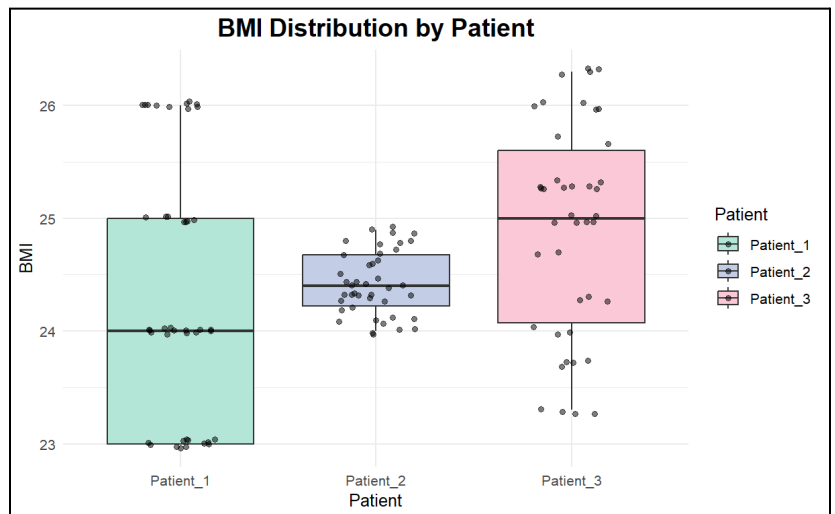
3. **BMI vs. Average Steps** – A scatter plot indicated a moderate negative relationship between BMI and physical activity, where higher average steps tended to be associated with lower BMI.

**Figure 3.** Scatter Plot of BMI vs. Average Steps



4. **BMI Distribution by Patient** – A box plot visualized significant BMI differences between the three patients. Patient 3 had more consistent BMI values, while others showed greater variability.

**Figure 4.** Box Plot of BMI Distribution by Patient



## Interpretation and Brief Conclusion

The results suggest that physical activity increased steadily over time, which may be due to behavioral improvements or external factors (e.g., coaching or monitoring). Stress patterns varied by both individual and month, indicating a strong psychosocial component to

patient health. A moderate negative correlation between steps and BMI suggests that more physically active individuals tend to maintain healthier body composition. Additionally, BMI significantly differed between patients, hinting at personal lifestyle or genetic factors at play.

*# This experiment underscores the importance of long-term behavioral monitoring in understanding health patterns. Tracking changes over time offers deeper insights than static measurements, helping to tailor more effective health interventions.*

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