Vital Signs Diagnosis

Group 13

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INTRODUCTION

The report entails the exploratory data analysis of the dataset that holds a number of different health indicators and lifestyle factors of the cohort of several people. The data is obtained in file, 1 Vital signs diagnosis data.csv and contains patient details like age, sex, vital signs, and health condition and pattern indicators. The main goal of the given analysis is to comprehend the distributions of critical variables, discover their possible relationship with each other, and investigate the presence of any structures by reducing the dimensionality.

METHODOLOGY

The analysis involved:

- Data Cleaning: Removal of "Medication" column and rows with missing values.
- Summary Statistics: Calculation of min, max, mean, median, SD, and count for numeric variables.
- Visualizations:
    - Scatter Plot: Age vs. BMI.
    - Histograms: Distributions of numeric variables.
    - Boxplots: Spread and outliers of numeric variables.
    - Bar Plots: Frequencies of "Smoking_Status" and "Hypertension".
- Principal Component Analysis (PCA): Dimensionality reduction on scaled numeric variables, with a summary, biplot, and scatter plot of the first two principal components.

RESULTS AND FIGURES

Table 1. Summary Statistics for Numeric Variables after Data Cleaning.

Statistic	Patient.ID	Age	Sex	Weight_kg	Height_cm	BMI	Heart_rate	Smoking_Status	Physical_Activity Hours_Week	Stress_Level	Daily_Sleeping_hours	Glucose_mg.dL	Cholesterol_mg.dL
Min	1	18	0	40	130	14.86	50	0	0	1	4	80	101
Max	1000	90	1	86	175	42.96	154	2	16	10	9	196	303
Mean	502.03	54.01	0.49	62.39	153.3	26.93	100.15	1.01	7.91	5.37	5.43	129.32	189.67
Median	502	54	0	62	153	26.35	100	1	8	5	5	127	188
SD	284.97	21.12	0.5	9.16	11.89	5.3	19.16	0.82	4.81	2.25	1.21	22.43	35.18
Count	981	981	981	981	981	981	981	981	981	981	981	981	981

Figure 1. Scatter Plot of Age vs BMI.

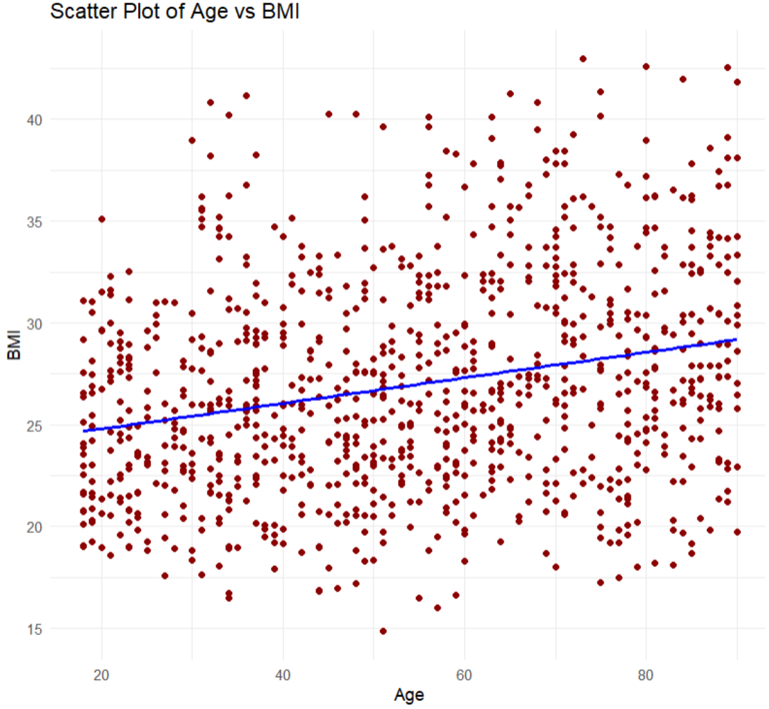


Figure 2. Histograms of Relevant Numeric Variables.

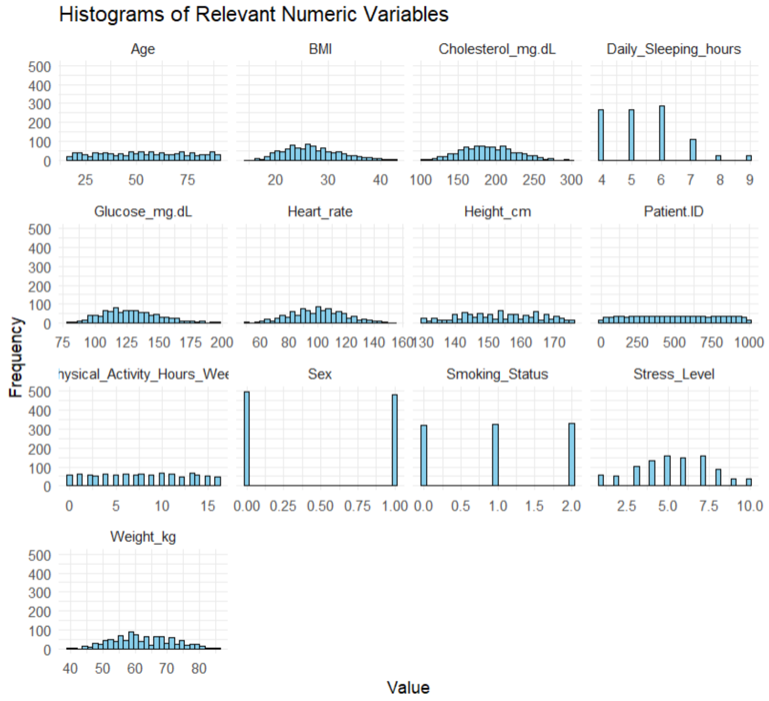


Figure 3. Boxplots of Relevant Numeric Variables.

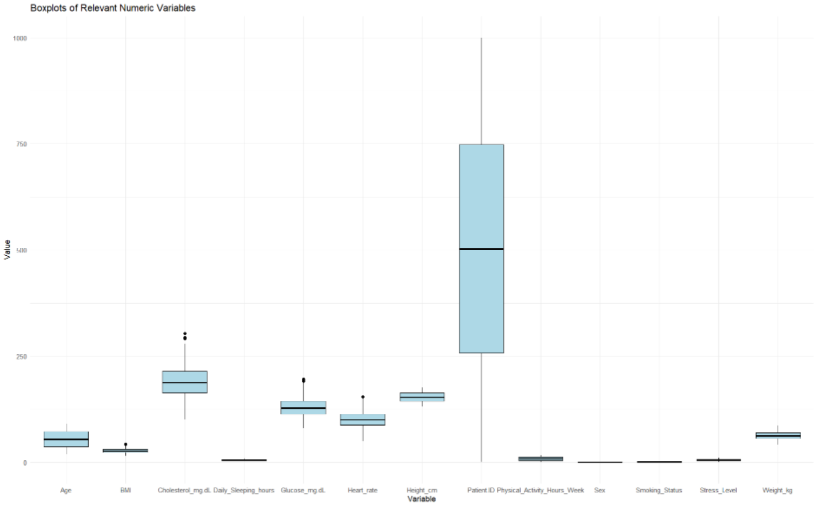


Figure 4. Bar Plot of Smoking Status.

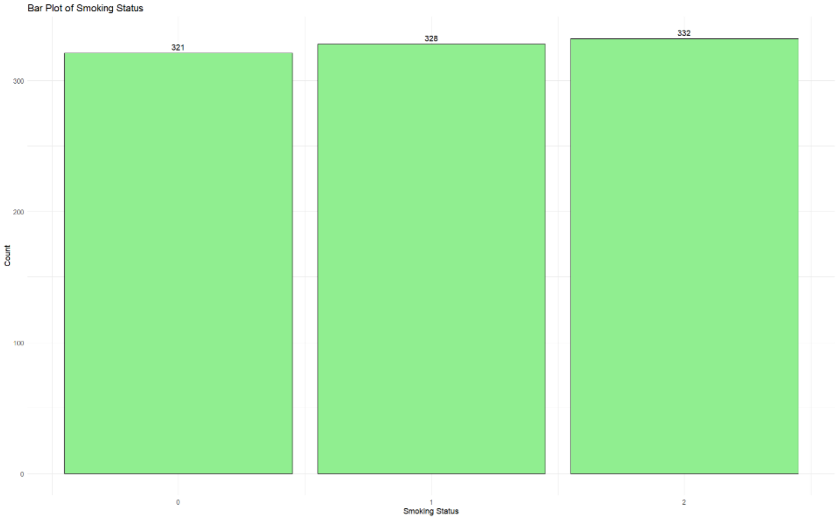
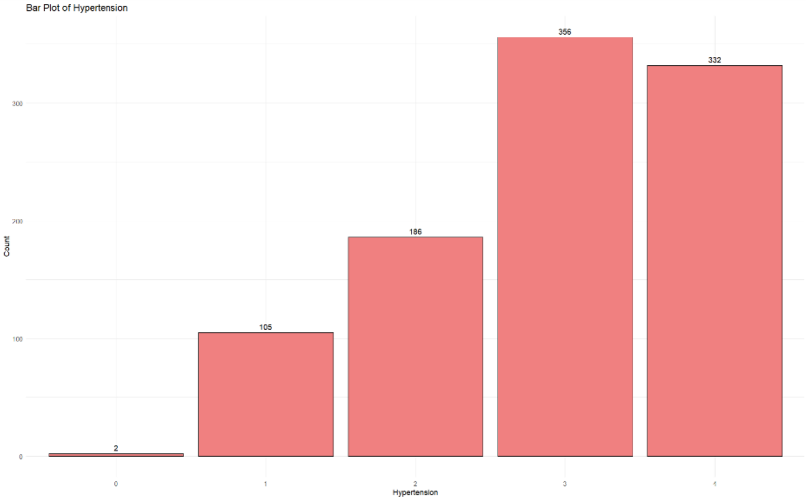


Figure 5. Bar Plot of Hypertension.



Principal Component Analysis (PCA)

Table 2. Importance of Principal Components.

This table gives the amount of variance explained by individual principal component (PC1-PC13), standard deviation, percentage of variance, and corresponding cumulative percentage.

Component	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12	PC13
Standard deviation	2.0615	1.3816	1.2566	1.11991	1.05034	0.98384	0.87751	0.7758	0.70221	0.23958	0.10491	0.06028	0.0088
Proportion of Variance	0.3269	0.1468	0.1215	0.09648	0.08486	0.07446	0.05923	0.0463	0.03793	0.00442	0.00085	0.00028	0.00001
Cumulative Proportion	0.3269	0.4737	0.5952	0.69167	0.77653	0.85099	0.91022	0.9565	0.99445	0.99887	0.99971	0.99999	1

Figure 6. Variance Explained by Each Principal Component. This bar chart shows the percentage of total variance explained by each principal component.

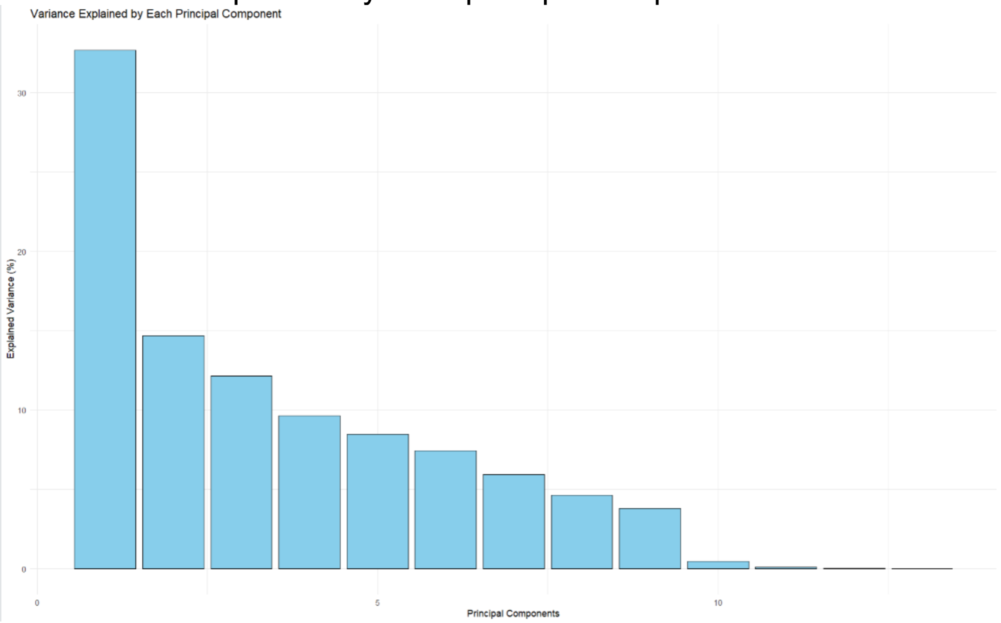


Figure 7. PCA of Relevant Numeric Variables (Biplot). This biplot visualizes data points and variable loadings on PC1 and PC2, indicating variable contributions to these components.

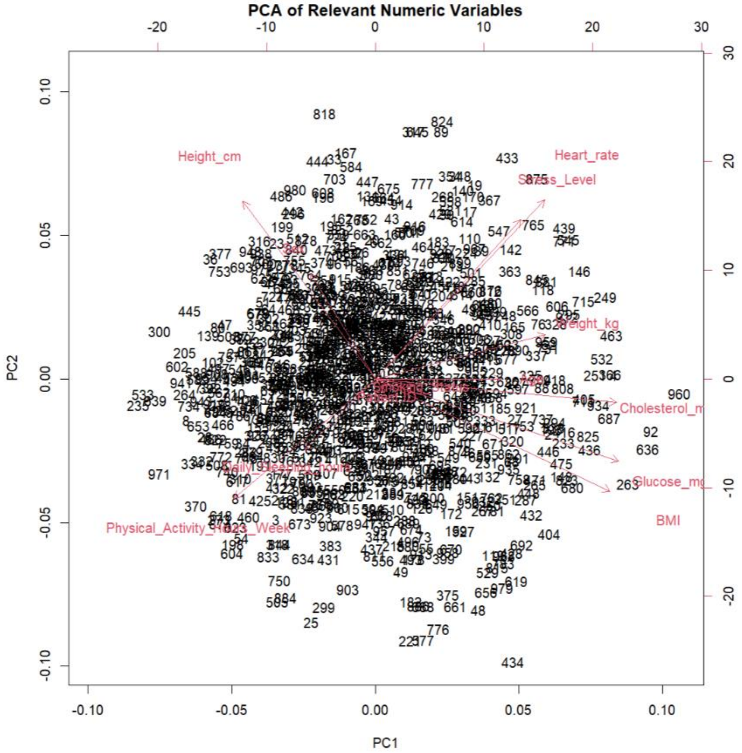
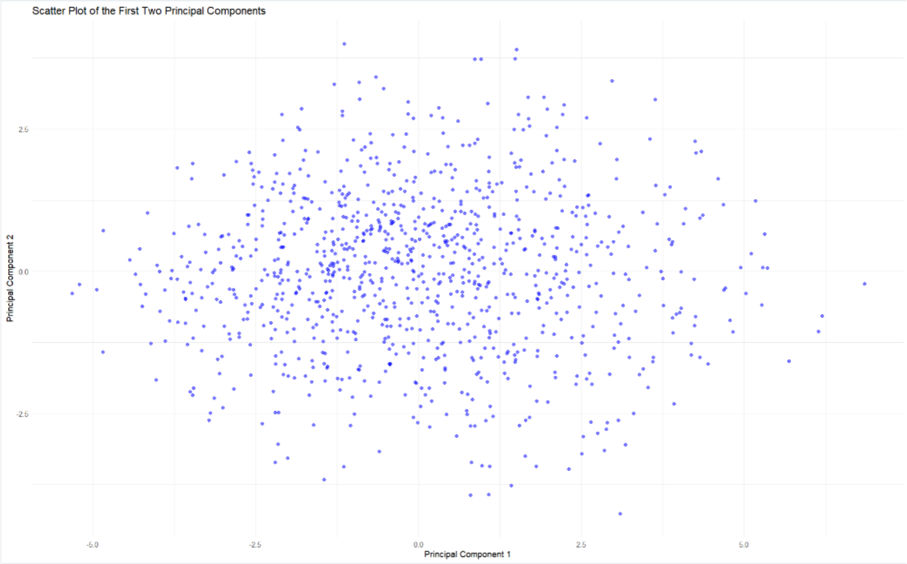


Figure 8. Scatter Plot of the First Two Principal Components. This scatter plot displays data points projected onto the first two principal components.



Discussion

This descriptive study of vital signs and lifestyle information provides some important evidence on the health status of the analyzed cohort. Preliminary descriptive statistics identified the wide age span (18-90 years) and average BMI indicating the existence of an overweight population. These results were also elaborated on through visualizations: a positive correlation between age and BMI of slight magnitude, uneven distribution of numeric health indicators, and the high occurrence of high hypertension categories were notable. PCA was effective in dimensionality reduction where the first eight components took over 95 percent variance of the data. The PCA scatter plot however, did not show any specific patient clusters indicating that there are complex interactions of factors as opposed to specific subgroups. Such basic analysis highlights how complicated health data is, creating additional research directions through focusing on the investigation of certain health outcomes or risks.

Interpretation and Conclusion

The discussion gives an overarching knowledge of the data set. Whereas certain tendencies, such as a small positive correlation between age and BMI, are present, data is highly fluctuating. The differences in distributions between variables are very high and higher levels of hypertension are prevalent. In PCA, it is stated that only a small group of the major components can explain the bulk of the variance in the data in which case there is a possibility of reducing the dimensions. Nevertheless, the absence of distinct groupings in the PCA scatter plot suggests a complicated structure of the data which can potentially necessitate additional analysis to find out certain subgroups or connections.