

**Washington State University**  
**MIS 420 – Business Intelligence**  
**Online**

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**T-SQL #3**

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## Introduction

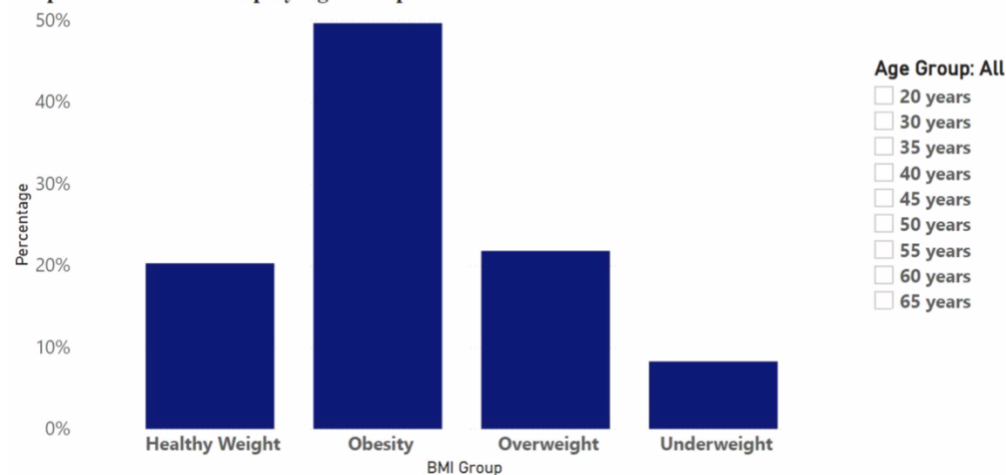
The project utilizes more than 70,000 patient health records of health and potential coronary artery disease indicators and focuses on the analysis of treadmill stress test. The goal is to use charts and matrices to discover problems and analyze them from various perspectives and finally provide a professional report.

## Data Analysis

**Table of count & proportion by Age Group and BMI Group**

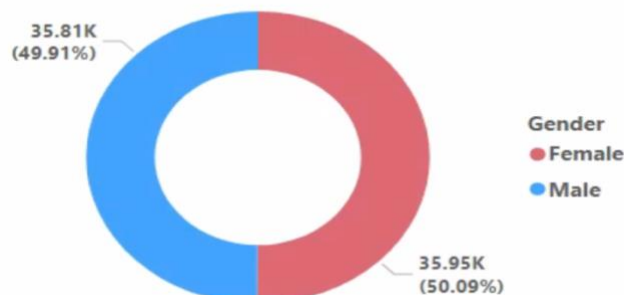
Age Group	Healthy Weight			Obesity			Overweight			Underweight			Total		
	ID	%CT ID	%RT ID	ID	%CT ID	%RT ID	ID	%CT ID	%RT ID	ID	%CT ID	%RT ID	ID	%CT ID	%RT ID
20 years	2987	20.53%	20.47%	7233	20.29%	49.57%	3161	20.21%	21.66%	1210	20.40%	8.29%	14591	20.33%	100.00%
30 years	1448	9.95%	20.20%	3555	9.97%	49.60%	1562	9.99%	21.79%	602	10.15%	8.40%	7167	9.99%	100.00%
35 years	1456	10.01%	20.62%	3479	9.76%	49.28%	1604	10.26%	22.72%	521	8.78%	7.38%	7060	9.84%	100.00%
40 years	1460	10.04%	20.38%	3576	10.03%	49.92%	1563	9.99%	21.82%	565	9.53%	7.89%	7164	9.98%	100.00%
45 years	1445	9.93%	20.25%	3474	9.75%	48.68%	1607	10.28%	22.52%	610	10.28%	8.55%	7136	9.94%	100.00%
50 years	1423	9.78%	20.16%	3511	9.85%	49.74%	1498	9.58%	21.22%	627	10.57%	8.88%	7059	9.84%	100.00%
55 years	1415	9.73%	20.09%	3503	9.83%	49.74%	1529	9.78%	21.71%	596	10.05%	8.46%	7043	9.81%	100.00%
60 years	1448	9.95%	19.89%	3664	10.28%	50.34%	1542	9.86%	21.18%	625	10.54%	8.59%	7279	10.14%	100.00%
65 years	1466	10.08%	20.19%	3647	10.23%	50.23%	1573	10.06%	21.66%	575	9.69%	7.92%	7261	10.12%	100.00%
Total	14548	100.00%	20.27%	35642	100.00%	49.67%	15639	100.00%	21.79%	5931	100.00%	8.27%	71760	100.00%	100.00%

**Proportion of BMI Group by Age Group**



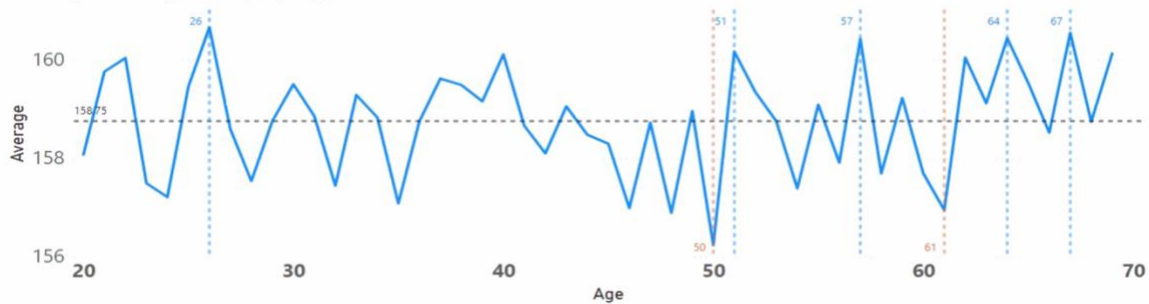
From the above metrics and chart, there are 71760 total patient records, 9 age groups, and 4 BMI groups. Patients in their 20s are the most distributed at 20.33% of the total, and the rest of the groups are generally distributed at 10%. In addition, checking the BMI ratio shows that "Obesity" patients are the most distributed with 49.67% of the total, and "Underweight" patients are the least distributed with 8.27%.

**Distribution by Gender**



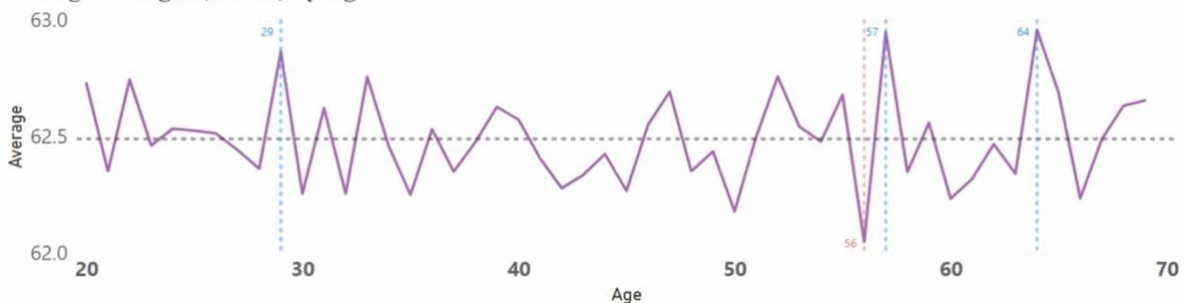
Through the left pie chart, the gender ratio of all patients is 49.91% for males and 50.09% for females, at a similar level.

**Average of weight(Lbs) by Age**



Based on the line charts above, the average weight by age is 158.75 lb., indicating that the average weight of 26, 51, 57, 64, and 67 years old are heavier than the other ages, and the average weight of 50, and 60 years old are lighter than the other ages. It can also be seen that the weight of 50 and 51 years old is clearly different by one year.

**Average of height (Inches) by Age**

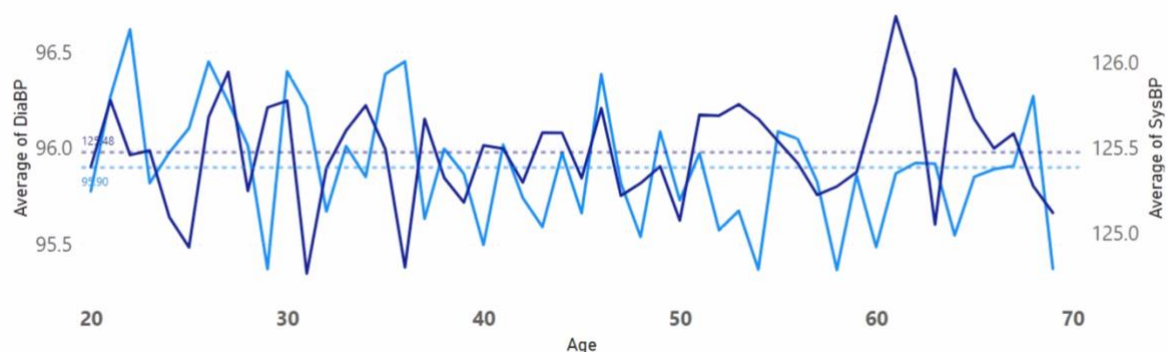


Based on the line chart above, the average height by age is 62.5 kg, indicating that the average height of 29, 57, and 64 years old are taller than the other ages, and the average height of 56 old is the shortest. It can also be seen that the height of 56 and 57 years old is clearly different by one year.

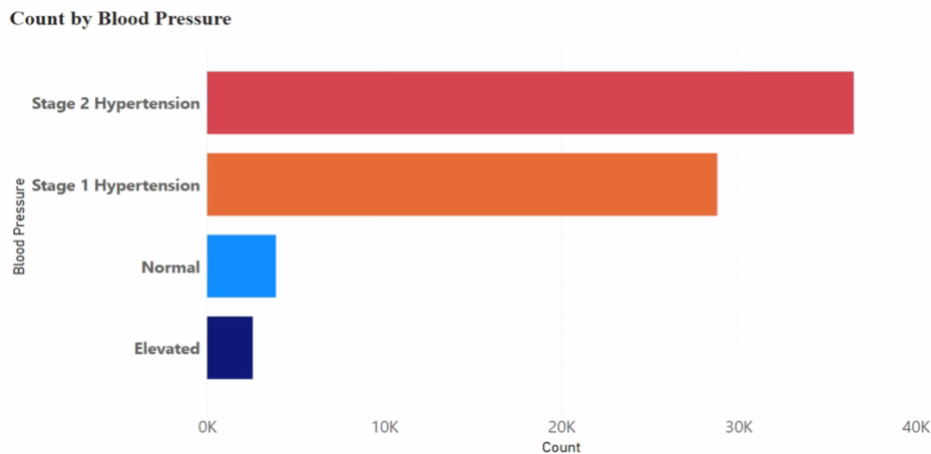
Also, compared to the average weight chart, 57 and 64 ages are on average heavier and taller than other ages.

**Average of DiaBP and Average of SysBP by Age**

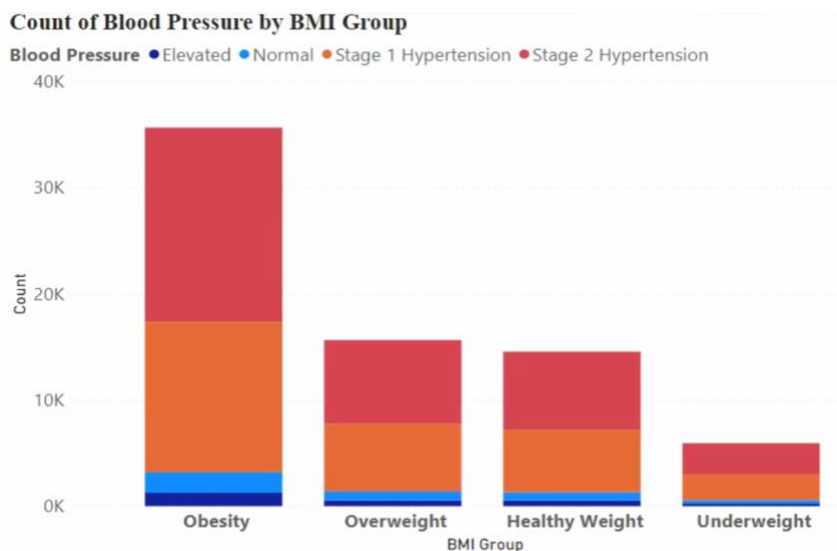
● Average of DiaBP ● Average of SysBP



The above line chart shows the average diastolic blood pressure and average systolic blood pressure by age. It may be seen that the average diastolic blood pressure is 95.90 mm Hg, and the average systolic blood pressure is 125.48 mm Hg. Normally, normal blood pressure levels should be below 80 mm Hg of diastolic blood pressure and below 120 mm Hg of system blood pressure, but it can be confirmed that blood pressure levels at most ages are not in the normal range.



The "Average of DiaBP and Average of SysBP by age" line chart above shows that there are problems with the patient's diastolic blood pressure and systolic blood pressure, so the above chart shows the distribution by 4 levels of blood pressure. As a result, only a few patients have normal blood pressure, and most patients have hypertension stage 2 and hypertension stage 1.



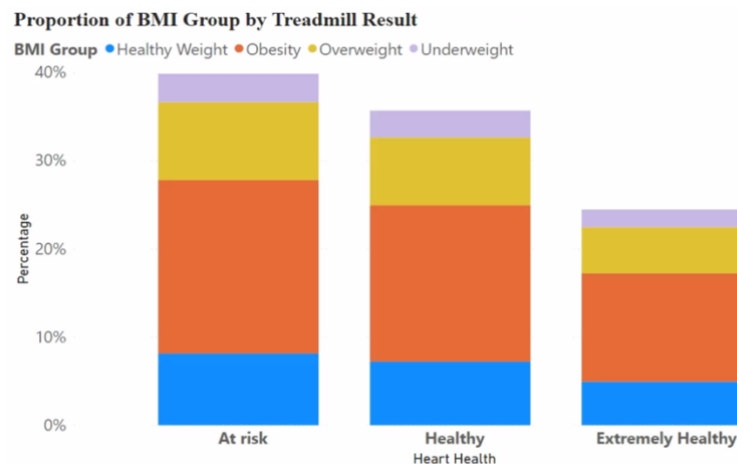
If you look at the left stacked chart, you can check the blood pressure distribution by BMI group. On average, all BMI groups have many distributions of stage 2 hypertension and stage 1 hypertension, while normal blood pressure and elevated blood pressure levels are very less.

**Table of Blood Pressure Level for each Age Group**

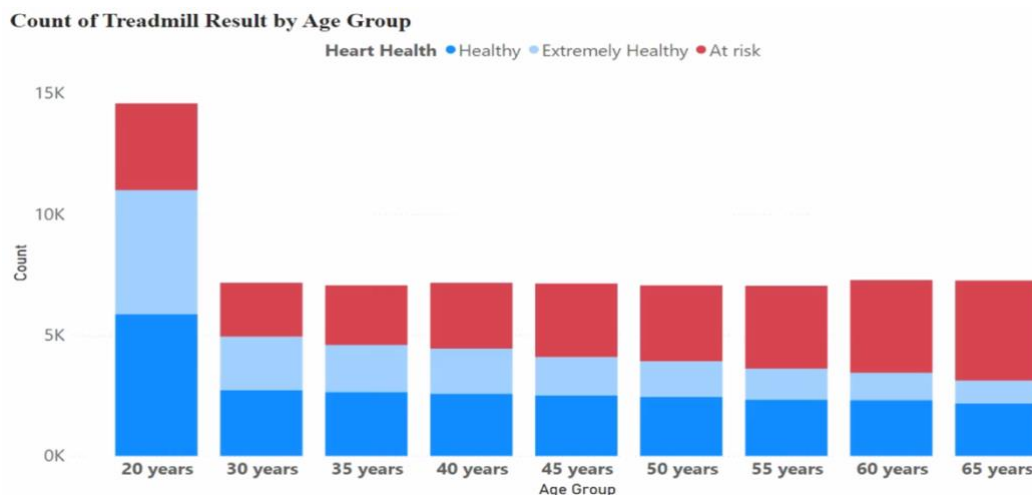
Age Group	Elevated	Normal	Stage 1 Hypertension	Stage 2 Hypertension	Total
20 years	3.71%	5.65%	38.81%	51.82%	100.00%
30 years	3.49%	5.08%	40.31%	51.12%	100.00%
35 years	3.63%	5.69%	39.82%	50.86%	100.00%
40 years	3.38%	5.29%	41.50%	49.83%	100.00%
45 years	3.71%	5.21%	39.48%	51.60%	100.00%
50 years	3.54%	5.64%	40.44%	50.38%	100.00%
55 years	3.72%	5.45%	40.41%	50.42%	100.00%
60 years	3.63%	5.51%	40.56%	50.31%	100.00%
65 years	3.40%	4.96%	41.19%	50.45%	100.00%
<b>Total</b>	<b>3.59%</b>	<b>5.41%</b>	<b>40.13%</b>	<b>50.86%</b>	<b>100.00%</b>

In addition, the table on the right shows that on average, half (50%) of all age groups have two stages of hypertension and only 3% have normal blood pressure. However, the results may be inaccurate because this is a blood pressure written based on the results of the peak heart rate after the treadmill stress test.

Finally, check the results (3 heart health levels) of the treadmill stress test by BMI group and age group.



The stacked chart on the left shows that patients who are "Obesity" at all heart health levels account for the largest percentage and those who are "Underweight" account for the lowest percentage. In addition, it can be confirmed that 40% of all patients are at risk, and less than 30% of extremely healthy patients.



Based on the stacked chart above, checked the heart health status by age, and found that the group in their 20s had much more patients with very healthy or healthy hearts than those at risk. Conversely, there are more patients at risk for groups in their 60s and older. It can also be seen that as the age group increases, the number of patients at risk gradually increases and the number of patients with healthy hearts decreases.

## Conclusion

As a result of analyzing the relationship between the health record variables of each patient through the treadmill stress test, it was found that almost all age groups are obese, and the higher the age group, the higher the risk of potential coronary artery disease. The additional data we would like to propose for more insight are health record data of more people and data from the regions where they live (ex: Country, City, State). If such additional data is provided, I think that a deeper analysis can be performed. And in the case of the "BMI" column, it was thought that the effectiveness of the results could be threatened while analyzing. This is because the results of 'BMI' may not be the original figures for each patient because the data set was recorded at the maximum heart rate after performing a treadmill stress test. While conducting this analysis, I wanted to create a level metric that subdivided the treadmill stress test level divided by age group once more, but it was impossible with the SQL knowledge that I knew so far.

## Appendix

USE [Featherman\_Analytics];

```
SELECT *
, CASE -- results of treadmill test
    WHEN [HRTreadmillTest] >= [AvgMaxHeartRate] THEN 'At risk'
    WHEN [HRTreadmillTest] < [AvgMaxHeartRate] AND
        [HRTreadmillTest] > [HR Zone 60]
    THEN 'Healthy'
    WHEN [HRTreadmillTest] <= [HR Zone 50] OR [HRTreadmillTest] <= [HR Zone 60]
    THEN 'Extremely Healthy'
    END AS [Heart Health]
, CASE -- Blood Pressure
    WHEN [SysBP] < 120 AND [DiaBP] < 80 THEN 'Normal'
    WHEN ([SysBP] BETWEEN 120 AND 129) AND [DiaBP] < 80 THEN 'Elevated'
    WHEN ([SysBP] BETWEEN 130 AND 139) OR ([DiaBP] BETWEEN 80 AND 89) THEN 'Stage 1
Hypertension'
    WHEN ([SysBP] >= 140 AND [SysBP] < 180) OR ([DiaBP] >= 90 AND [DiaBP] < 120) THEN
'Stage 2 Hypertension'
    WHEN [SysBP] >= 180 OR [DiaBP] >= 120 THEN 'Hypertensive crisis'
    END AS [Blood Pressure]
, CASE -- Gender
    WHEN sex = 1 THEN 'Male'
    ELSE 'Female'
    END AS [Gender]
FROM
(SELECT *
, CASE -- BMI groups
    WHEN [BMI] < 18.5 THEN 'Underweight'
    WHEN [BMI] BETWEEN 18.5 AND 24.9 THEN 'Healthy Weight'
    WHEN [BMI] BETWEEN 25.0 AND 29.9 THEN 'Overweight'
    WHEN [BMI] >= 30.0 THEN 'Obesity'
    END AS [BMI Group]
, CASE -- Avg Max Heart Rate (85%)
    WHEN [Age Group] = '20 years' THEN 170
    WHEN [Age Group] = '30 years' THEN 162
    WHEN [Age Group] = '35 years' THEN 157
    WHEN [Age Group] = '40 years' THEN 153
    WHEN [Age Group] = '45 years' THEN 149
    WHEN [Age Group] = '50 years' THEN 145
    WHEN [Age Group] = '55 years' THEN 140
    WHEN [Age Group] = '60 years' THEN 136
    WHEN [Age Group] = '65 years' THEN 132
    WHEN [Age Group] = '70 years' THEN 128
    END AS [AvgMaxHeartRate]
, CASE -- HR Zone 50%
    WHEN [Age Group] = '20 years' THEN 100
    WHEN [Age Group] = '30 years' THEN 95
    WHEN [Age Group] = '35 years' THEN 93
    WHEN [Age Group] = '40 years' THEN 90
    WHEN [Age Group] = '45 years' THEN 88
    WHEN [Age Group] = '50 years' THEN 85
    WHEN [Age Group] = '55 years' THEN 83
    WHEN [Age Group] = '60 years' THEN 80
    WHEN [Age Group] = '65 years' THEN 78
    WHEN [Age Group] = '70 years' THEN 75
    END AS [HR Zone 50]
, CASE -- HR Zone 60%
    WHEN [Age Group] = '20 years' THEN 120
```

```

        WHEN [Age Group] = '30 years' THEN 114
        WHEN [Age Group] = '35 years' THEN 111
        WHEN [Age Group] = '40 years' THEN 108
        WHEN [Age Group] = '45 years' THEN 105
        WHEN [Age Group] = '50 years' THEN 102
        WHEN [Age Group] = '55 years' THEN 99
        WHEN [Age Group] = '60 years' THEN 96
        WHEN [Age Group] = '65 years' THEN 93
        WHEN [Age Group] = '70 years' THEN 90
        END AS [HR Zone 60]
FROM
(SELECT [ID],[age],[sex],[SysBP],[DiaBP],[HRTreadmillTest],[weightLbs]
,[heightInches],[BMI]
, CASE -- age groups
    WHEN age BETWEEN 20 AND 29 THEN '20 years'
    WHEN age BETWEEN 30 AND 34 THEN '30 years'
    WHEN age BETWEEN 35 AND 39 THEN '35 years'
    WHEN age BETWEEN 40 AND 44 THEN '40 years'
    WHEN age BETWEEN 45 AND 49 THEN '45 years'
    WHEN age BETWEEN 50 AND 54 THEN '50 years'
    WHEN age BETWEEN 55 AND 59 THEN '55 years'
    WHEN age BETWEEN 60 AND 64 THEN '60 years'
    WHEN age BETWEEN 65 AND 69 THEN '65 years'
    WHEN age BETWEEN 70 AND 79 THEN '70 years'
    END AS [Age Group]
FROM [featherman].[Health_heart_experimental]
) AS data
) AS data2

```