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Statistics 1040 Project

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Sleep and GPA

Students often hear about the effect of sleep on concentration, reasoning, memory consolidation and more. We wanted to see if the amount of sleep a student had each night affected their GPA. Our two hypotheses were: First, if a student gets six hours of sleep per night they will have an approximate GPA of 3.5. Second, we looked more generally to see if higher amounts of sleep and a higher GPA were independent or dependent. We surveyed 95 students by having them write down how many hours of sleep they get on average per night and their cumulative GPA.
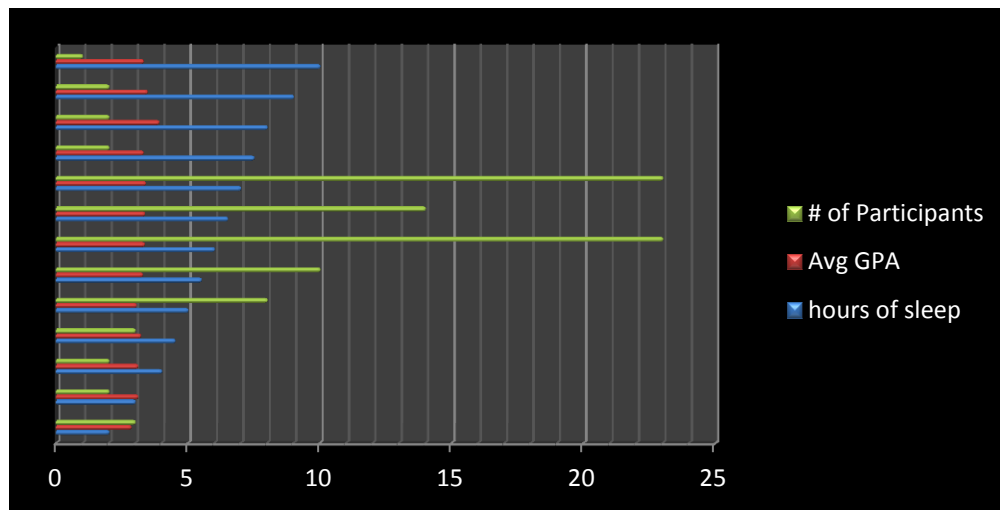
We started with a correlation coefficient between the variables of hours of sleep and GPA.

$$r = \frac{1}{n-1} \sum \left(\frac{x - \bar{x}}{s_x} \right) \left(\frac{y - \bar{y}}{s_y} \right)$$
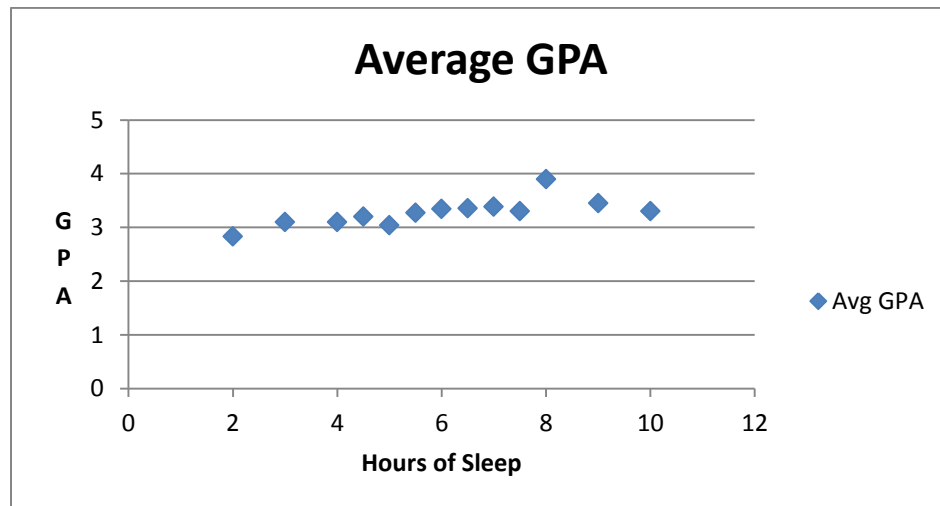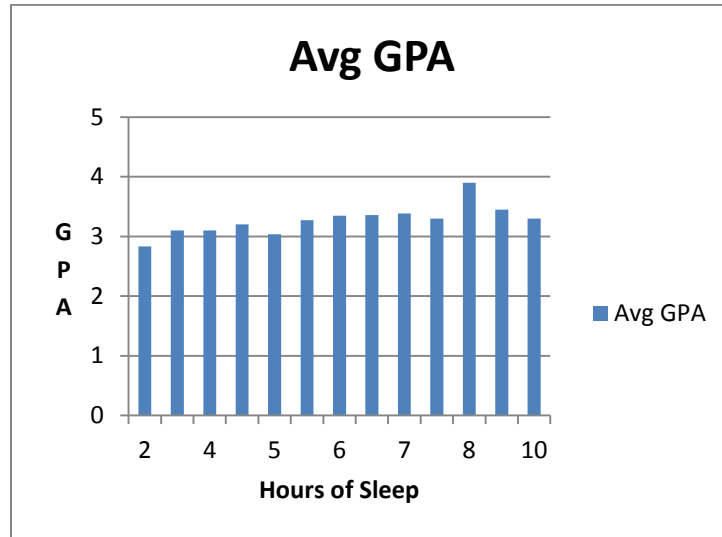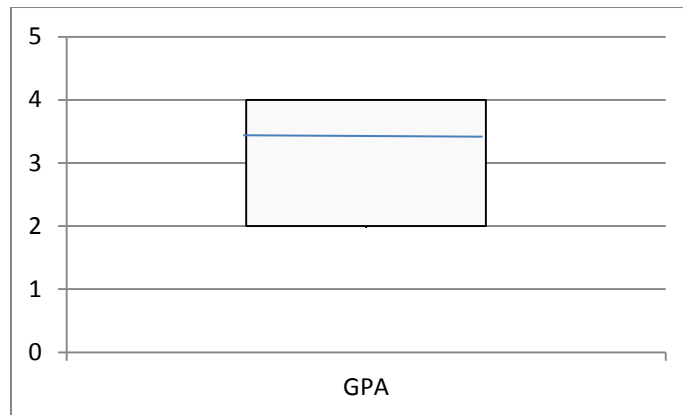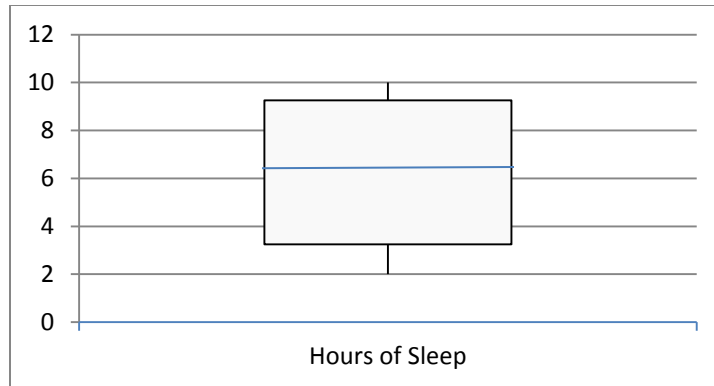
x bar=6.078

std dev of x=1.319

y bar=3.304

std dev of y= 0.474

correlation coefficient=0.269

This shows that there is a weak positive association between the two variables.

Avg GPA

Average GPA

The average hours of sleep each night was 6.07 hours and the average GPA was 3.30 as show in the box plots below.

Hours of Sleep

GPA

To test our hypothesis that sleeping 6 hours will result in an approximate GPA of 3.5 we used the T-score formula with our standard deviation unknown.

H_0: μ = 3.5.
H_1: μ = mean >3.5 or mean <3.5

Level of significance is α = 0.05

$$t_0 = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}} = \frac{3.35 - 3.5}{\frac{.455}{\sqrt{23}}} = -1.581$$

Degree of freedom (n-1)= 22 level of significance is α = 0.05 is 1.717.

With a confidence level of 95% we see the T-score of -1.58 does not fall into the tails of the graph. Therefore we accept the null hypothesis that receiving 6 hours of sleep correlates with a student having an approximate GPA 3.5.

<u>Chi-Square Test</u>

For the Chi-Square test we wanted to see if more slept generally correlated with a higher GPA. We wanted to see if sleep and a higher GPA were independent of one another.

H_0: p is independent

H_a: p is not dependent

observed	Little sleep 1-5 hrs	lots of sleep 6- 10 hrs	total	
high GPA>3.1	16	54	70	
Low GPA<3.0	12	13	25	
total	28	67	95	

$$expected\ count = \frac{(row\ 1\ total)(column\ 2\ total)}{table\ total}$$

expected	Little sleep 1-5 hrs	lots of sleep 6- 10 hrs
high GPA>3.1	20.63157895	49.36842105
Low GPA<3.0	7.368421053	17.63157895

$$x^2 = \sum \frac{(obs - expected)^2}{expected\ count}$$

Chi-Square	Little sleep 1-5 hrs	lots of sleep 6- 10 hrs	
high GPA>3.1	1.039738	0.434519	
Low GPA<3.0	2.911278	1.216654	
		Sum	5.602189

Degrees of Freedom = (row − 1)(col − 1), (2-1)(2-1)= 1

The critical value for alpha = 0.05 is 3.841.

We reject the null because our chi distribution is more than the critical value of 3.841. Therefore we conclude that hours slept and GPA are not independent.

Conclusion & Challenges

The overall conclusion was that there was a correlation between hours of sleep and GPA. We believe a stronger correlation will be found in future studies if they address limitations and challenges found in our study. There were two factors that were a challenge for us. First, a third variable in one's GPA is the amount of time studying. It would be beneficial to ask students how much time they spend studying on average per night coupled with how much sleep they get. Second, to observe if GPA increases with more sleep we would need to survey more students that sleep 7.5 or more hours per night. In our sample population out of 95 students only 7 slept for 7.5 hours or more a night. This did limit us in seeing if getting 7.5 or more hours of sleep correlated with a higher GPA.