Statistics Research Project

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**Rate of Referrals in School Screens**

Statement of Problem

Are referral rates for hearing, vision, and speech screens equal to one another, or are referrals more likely for one type of screen over the others? To answer this question, I used existing data from schools screens conducted by the Marion Down’s Center KidScreen staff during a twelve month period in 2015. An outsider’s opinion may believe that rates of referral is higher for vision testing, than hearing or speech, but I wanted to examine the data more closely to see if there was a significant difference between the referral rates.

Methods

The population for my research was all students who were screened at KidScreen. Since KidScreen has been screening students for over thirty years and of course we do not have accurate data of all the screening results over the entire existence of the KidScreen program, I used a sample of the students screened in the year 2015. Because I had no other data determining any other factors such as advancement in screening technology or screening protocol, I had no reason to believe that the data from 2015 would be different from any other year. Therefore, I concluded that my sample was representative of the population.

The data was originally collected from a KidScreen staff member who pooled the findings from the program’s database, NewOrg. There was some variability in the number of screens throughout the year due to scheduling factors determined by summer vacation, which saw the least amount of screens, and the “back to school” months, which saw the most screens. Because of the large sample size from the population, I believed that the mean of all samples from the sample population is approximately equal to the mean of the population, therefore satisfying the Central Limit Theorem. Further, I believed that the sample was going to be close to the true value of the number of students who have been referred for hearing, vision and speech.

Because I had an overall sample size of 5,833 total screens for 2015, the total students sampled easily satisfied the Law of Large numbers. I had no reason to believe that the data would be skewed. It should also be noted that I changed the rates for each categories to percent’s in order to make the data a bit easier to understand.

Because I believed that the rates of referral for vision, hearing and speech were not equal to one another, I set my alternate hypothesis Hₐ: µhearing ≠ µvision ≠ µspeech. The null hypothesis that I hope to reject was that the referral rates for vision, hearing, and speech are equal to each other and reads as follows: Ho: µhearing = µvision = µspeech. I set my alpha level at α = 0.05.

Results

In order to calculate the p-value, I ran an ANOVA test in Excel using the “ANOVA: single factor” test for the data analysis. The results are listed below in Table 1.

Table 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ANOVA |  |  |  |  |  |  |
| *Source of Variation* | *SS* | *df* | *MS* | *F* | *P-value* | *F crit* |
| Between Groups | 0.003757346 | 2 | 0.001878673 | 0.632873336 | 0.537386 | 3.284918 |
| Within Groups | 0.097959895 | 33 | 0.002968482 |  |  |  |
|  |  |  |  |  |  |  |
| Total | 0.101717241 | 35 |  |  |  |  |

For my data analysis, I calculated descriptive statistics using Excel followed by a confidence interval analysis plotted using the high-low-close graph in Excel. The results of my descriptive data analysis are summarized in Table 2.

Table 2

|  |  |  |  |
| --- | --- | --- | --- |
|  | *Referral rate - Hearing* | *Referral rate - Vision* | *Referral rate - Speech* |
|  |  |  |  |
| Mean | 0.108769421 | 0.094007939 | 0.083888902 |
| Standard Error | 0.013357828 | 0.016718719 | 0.01685744 |
| Median | 0.101256281 | 0.089854943 | 0.063419118 |
| Mode | #N/A | #N/A | #N/A |
| Standard Deviation | 0.046272874 | 0.057915343 | 0.058395884 |
| Sample Variance | 0.002141179 | 0.003354187 | 0.003410079 |
| Kurtosis | 0.573719692 | -1.015802684 | -1.579447966 |
| Skewness | 0.503351192 | 0.121098343 | 0.431436908 |
| Range | 0.16969697 | 0.181818182 | 0.160930736 |
| Minimum | 0.03030303 | 0 | 0.014069264 |
| Maximum | 0.2 | 0.181818182 | 0.175 |
| Sum | 1.305233048 | 1.128095272 | 1.006666825 |
| Count | 12 | 12 | 12 |

The results of the confidence interval analysis are summarized in Table 3.

Table 3

|  |  |  |  |
| --- | --- | --- | --- |
|  | *Hearing* | *Vision* | *Speech* |
| Upper 95% CI | 0.135485077 | 0.127445378 | 0.117603781 |
| Lower 95% CI | 0.082053764 | 0.060570501 | 0.050174023 |
| Mean | 0.108769421 | 0.094007939 | 0.083888902 |

The hi-low-close plot is shown below as Graph 1.

Graph 1

Based on the results that Excel calculated for the ANOVA test (Table 1), the p-value was calculated as p = 0.537. I set my alpha level as α = 0.05 and because the calculated p-level of my findings was greater than that, I have failed to reject the null hypothesis that the rates of referrals for each screening types are equal.

Conclusions

As we can see from the hi-low-close plot (Graph 1), the rates of referral are very similar to one another. However, upon closer inspection, hearing rates were the highest of all three, vision rates were the second highest, and speech rates were the lowest. Because the rates of referral were so close to one another, it would make sense that based on my calculations, I fail to reject the null hypothesis. However, I was surprised by these findings: it would make more sense that the rates would not be equal to one another. Of course, the best way to change these findings and to successfully reject the null hypothesis in a future, more elaborate data study, would be to increase the sample size. A further study might be done by testing the rates of referrals over the course of ten years in order to gather more accurate findings.

References

“Central Limit Theorem.” Investopedia.com. ttp://www.investopedia.com/terms/c/central\_limit\_theorem.asp

Appendix