**Chi-square Practice Solutions**

1. In a study *When Men Murder Women*, the Violence Policy Center reported that 2129 women were murdered by men in 1996. Of these victims, a weapon could be identified for 2013 of them. Of those for whom a weapon could be identified, 1139 were killed by guns, 372 by knives or other cutting instruments, 158 by other weapons, and 344 by personal attack (battery, strangulation, etc.). The FBI’s Uniform Crime Report says that among all murders nationwide the weapon use rates were as follows: guns 63.4%, knives 13.1%, other weapons, 16.8% and personal attack, 6.7%. Is there evidence that violence against women involves different weapons than other violent attacks in the United States?

|  |  |  |  |
| --- | --- | --- | --- |
|  | Observed | Expected |  |
| Guns | 1139 | 2013\*.634=1276.24 | 14.758 |
| Knives | 372 | 2013\*.131=262.70 | 45.476 |
| Other Weapons | 158 | 2013\*.168=338.18 | 95.936 |
| Personal Attack | 344 | 2013\*.067=134.87 | 324.28 |
| **TOTAL** | 2013 |  | 480.45 |

a) State the type of test that you will conduct and complete the chart above.

**I will conduct a chi-square goodness of fit test with the following null and alternative hypothesis:**

**Ho: The weapons used in violent crimes against women are used at the same rate as other violent crimes in the U.S.**

**Ha: At least one type of weapon in violent crimes against women is used at a different rate than other violent attacks in the U.S.**

b) STATE TWO conditions are need to be met to conduct the test.

**i) The data are in counts and are representative of the population of all crimes**

**ii) The expected counts are greater than 5**.

c) Conduct the test Show all steps for full credit.

MUST show test statistic, state degrees of freedom, chi-square value for =.05.

**Test Statistic = 480.45**

**Df=4**

**The 0.05 cutoff value = 9.488**

**p-value is approximately 0**

**As test statistic exceeds cutoff value we can reject the null hypothesis.**

D) STATE the conclusion in the test of the question.

**There is evidence showing that in** **violent crimes against women the weapon type is different from that used in other violent crimes in the U.S. The largest difference was between the observed and expected number of attacks that used personal attacks. This suggests that these types of crimes are different from other crimes.**

2. Investigators were interested to determine if Xylitol would reduce the number of ear infections in children. They randomly divided 533 children in daycare centers into three groups. One group regularly chewed gum that contained Xylitol, a food sweetener that may also have antibacterial properties, another group regularly took Xylitol lozenges, and the third group regularly chewed gum that did not contain Xylitol. The experiment lasted for three months and for each child they recorded if the child had an ear infection during that period of time. The results are listed below. The expected counts are listed in ( ).

|  |  |  |  |
| --- | --- | --- | --- |
|  | Ear Infection: YES | Ear Infection: NO |  |
| Placebo Gum | 129 (138.93) | 49 ( 37.66) | 178 |
| Xylitol Gum | 150 (139.71) | 29 (39.29) | 179 |
| Xylitol Lozenges | 137 (137.37) | 39 (38.63) | 176 |
| Total | 416 | 117 | 553 |

a) STATE the NULL and ALTERNATIVE HYPOTHESIS for this analysis

**Ho: There is no association between the use of xylitol and the occurrence of ear infections in children.**

**Ha: There is an association between the use of xylitol and the occurrence of ear infections in children**

b) Calculate the missing expected value in the chart above. (117\*178)/553=37.66

c) STATE TWO conditions and assumptions that need to be met to continue with the analysis.

**i) data is given in counts and can be considered a representative sample of the population**

**ii) all expected counts greater than 5**

d) The test statistic was found to be 6.69. Use this information to make a decision about the null hypothesis at . State your conclusion in the context of the question.

Given that the test statistic =6.69 and using df=2 the cutoff value from the table equals 5.991 ( p-value =0.035). As the test statistic of 6.69 exceeds the 0.05 cutoff value we can reject the null hypothesis.

There is evidence to suggest that there is an association between the use of xylitol and the occurrence of ear infections in children at the 0.05 level of significance**.**