Results

Chi-square Test of Independence

Introduction

A Chi-square Test of Independence was conducted to examine whether Heart_Failure and Depression were independent. There were 2 levels in Heart_Failure: No and Yes. There were 2 levels in Depression: No and Yes.

Assumptions

The assumption of adequate cell size was assessed, which requires all cells to have expected values greater than zero and 80% of cells to have expected values of at least five (McHugh, 2013). All cells had expected values greater than zero, indicating the first condition was met. A total of 100.00% of the cells had expected frequencies of at least five, indicating the second condition was met.

Results

The results of the Chi-square test were significant based on an alpha value of .05, $\chi^2(1) = 112.61$, $p < .001$, suggesting that Heart_Failure and Depression are related to one another. The following level combinations had observed values that were greater than their expected values: Heart_Failure (No):Depression (No) and Heart_Failure (Yes):Depression (Yes). The following level combinations had observed values that were less than their expected values: Heart_Failure (Yes):Depression (No) and Heart_Failure (No):Depression (Yes). Table 1 presents the results of the Chi-square test.

Table 1

Observed and Expected Frequencies

	Depression				
Heart_Failure	No	Yes	χ^2	*df*	*p*
No	628[566.43]	89[150.57]	112.61	1	< .001
Yes	162[223.57]	121[59.43]			

Note. Values formatted as Observed[Expected].

References

Intellectus Statistics [Online computer software]. (2023). Intellectus Statistics. https://statistics.intellectus360.com

McHugh, M. L. (2013). The chi-square test of independence. *Biochemia Medica, 23*(2), 143-149. https://doi.org/10.11613/BM.2013.018

Glossaries

Chi-Square Test of Independence

A chi-square test of independence examines the relationship between two nominal variables. It examines the cell counts of each combination of variable and compares the count with the expected value for that cell. The expected value is the value that cell would be if no relationship occurred between the variables. If significance is found, then there was a significant difference between the observed counts and the expected values.

Chi-square Formula:

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

O_i: Observed frequency
E_i: Expected frequency

Fun Fact! *The chi-square test of independence was first tested by Karl Pearson in 1900, who was a mathematician that developed several other statistics that are still used today.*

Chi-Square Test Statistic (χ^2): Used with the df to compute the *p*-value.

Degrees of Freedom (*df*): Determined by multiplying the (number of rows − 1) × (number of columns − 1).

***p*-value:** The probability of obtaining the observed results if the null hypothesis (the frequency of observations is equal across groups) is true; in most social science research, a result is considered statistically significant if this value is < .05.

Cramér's V: A measure of association between two categorical variables, giving a value between 0 and 1. Higher values indicate a stronger relationship.

Raw Output

Chi-square Test of Independence for Heart_Failure and Depression

Included Variables:
Depression and Heart_Failure

Sample Size (Complete Cases):
N = 1000

Contingency Table with Expected Cell Counts and Chi-square Contributions:

	Depression	
Heart_Failure	No	Yes
No		
Observed Count	628.000	89.000
Expected Count	566.430	150.570
Chi-square Contribution	6.693	25.177
Yes		
Observed Count	162.000	121.000
Expected Count	223.570	59.430
Chi-square Contribution	16.956	63.787

Chi-square Test of Independence Results:
$\chi^2 = 112.612$, df = 1, $p = 2.624 \times 10^{-26}$, Cramér's V = 0.336