

The 1-Sample Median Test -- Analysis of a Single Quantitative Variable

Application: To test whether a sample median is equal to a hypothesized population value

H0: The population represented by the sample has the expected distribution across the categories of the variable.

To reject H0: is to say that the distribution of scores is somehow different from the expected distribution.

H0: The median of the sample equals the hypothesized median of the population.

To reject H0 : is to say that the sample median is different from (either larger or smaller) than the hypothesized population median.

The data: You have collected the age of each participant in your study.

Research Hypothesis: You intend the sample to represent a population with a median age of 20 years.

The RH: and H0: are often the same for this analysis !

H0: for this analysis : The median age of the sample is equivalent to (not significantly different from) 20 years.

The data: The researcher wanted to investigate the distribution of number of reptiles in the sample. The number of reptiles for each of the 12 stores is shown below.

12 14 15 12 7 4 10 4 4 4 5 10

Research Hypothesis (it is often the case that the researcher's hypothesis is the statistical null, something more common for this statistical model than for most others): The researcher expected that the median number of reptiles would be 10.

H0: for this analysis: Pet stores will have a median of 10 reptiles per store.

Step 1 Those cases with fewer than the hypothesized median are coded as "0". Those with more than the hypothesized median are coded as "1". Those who have the hypothesized median are not used in the analysis.

12 14 15 12 7 4 10 4 4 4 5 10
1 1 1 1 0 0 0 0 0 0 0

Step 2 Rearrange the data into a 2-cell table showing the obtained frequency (of) for each category. Remember not to use the cases with values equal to the hypothesized median.

< 10 reptiles	> 10 reptiles
6	4

Step 3 Determine the number of subjects in the sample

$$N = 10$$

Step 3 The expected frequency of each cell is $\frac{1}{2}$ of the number of cases.

$$ef = \frac{1}{2} * N = \frac{1}{2} * 10 = 5$$

< 10 reptiles		> 10 reptiles	
of	ef	of	ef
6	5	4	5

Step 4 Compute Chi-square

$$X^2 = \sum \frac{(\text{of} - \text{ef})^2}{\text{ef}} = \frac{(6 - 5)^2}{5} + \frac{(4 - 5)^2}{5} = .20 + .20 = .40$$

Step 5 Compute the degrees of freedom (df). There will always be 2 cells in the gof analysis.

$$\text{df} = 1$$

Step 7 Use the Chi-square table to determine the critical Chi-square value for $\text{df} = 1$ and $\alpha = .05$

$$X^2(\text{df}=1, \alpha = .05) = 3.84$$

Step 8 Compare the obtained X^2 and critical X^2 , and determine whether or not there is a statistically significant relationship between the two categorical variables.

- if the obtained X^2 is less than the critical X^2 , then retain the null hypothesis -- conclude that the distribution of scores across the conditions of the variable was as expected.
- if the obtained X^2 is greater than the critical X^2 , then reject the null hypothesis -- conclude that the distribution of scores across the conditions of the variable was different than was expected.

For the example data, we would decide to retain the null hypothesis, because the obtained Chi-square value of .40 is smaller than the critical Chi-square value of 3.83.

Step 9 Reporting the results

As hypothesized, the median number of reptiles in these stores was not significantly different from 10, $\underline{X}^2(1) = .40, \underline{p} > .05$.

Critical values of X^2

df	$\alpha = .05$	$\alpha = .01$
1	3.84	6.63
2	5.99	9.21
3	7.81	11.34
4	9.49	13.28
5	11.07	15.09
6	12.59	16.81
7	14.07	18.48
8	15.51	20.09
9	16.92	21.67
10	18.31	23.21
11	19.68	24.72
12	21.03	26.22
13	22.36	27.69
14	23.68	29.14
15	25.00	30.58
16	26.30	32.00
17	27.59	33.41
18	28.87	34.81
19	30.14	36.19
20	31.41	37.57
21	32.67	38.93
22	33.92	40.29
23	35.17	41.64
24	36.42	42.98
25	37.65	44.31
26	38.89	45.64
27	40.11	46.96
28	41.34	48.28
29	42.56	49.59
∞	43.77	50.89