

Chapter 16: Is there a relationship between two variables? Spearman's correlation.

Full answers to study questions

1. Don't forget that $df = n - 2$. The critical values are:
 - 1.1. .466
 - 1.2. .521
 - 1.3. .425
2. The p values should be:
 - 2.1. $p = .020$
 - 2.2. Not significant
 - 2.3. $p = .010$
3. The exact wording of the interpretation may vary, but you need to mention two things: if the result is significant or not, and if it is interpret the direction of the relationship (positive or negative).
 - 3.1. There is a significant positive correlation between the two variables ($r_s(15) = .523, p < .050$).
 - 3.2. There is a significant negative correlation between the two variables ($r_s(22) = -.644, p < .001$).
 - 3.3. There is no significant correlation between the two variables ($r_s(28) = -.359, p > .050$).

Full answers for additional dataset

The social support variable has tied scores, and therefore the Pearson's equation should be used on the rank scores to analyse the relationship between social support and cold likelihood. Neither the hugs variable nor the cold likelihood variable have tied scores, and therefore Spearman's correlation can be used to examine this relationship. Both of the analyses below assume a two-tailed hypothesis.

Correlation between social support and cold likelihood

1. What method of analysis will you use?

A non-parametric Spearman's correlation was conducted to examine the relationship between levels of social support and cold likelihood. As there are tied ranks, the statistic is calculated using the Pearson's correlation equation on ranked scores.
2. Suggest a suitable hypothesis.

There will be a significant relationship between levels of social support and cold likelihood. (Note, this is a two tailed hypothesis, but either one or two tailed would be ok.)

3. Calculate the test statistic determine whether it is significant.

Social support (a)	Cold likelihood (b)	Social support rank (a)	Cold likelihood rank (b)	a*b	a ²	b ²
20	2	6.5	2	13	42.25	4
6	9	1.5	7	10.5	2.25	49
13	4	5	4	20	25	16
6	5	1.5	5	7.5	2.25	25
8	7	3	6	18	9	36
20	3	6.5	3	19.5	42.25	9
12	1	4	1	4	16	1
		$\Sigma = 28$	$\Sigma = 28$	$\Sigma = 92.5$	$\Sigma = 139$	$\Sigma = 140$

Steps 1-4 of the calculations are completed within the table.

5: Calculate $(\Sigma a)^2$ and $(\Sigma b)^2$

$$(\Sigma a)^2 = 28^2$$

$$(\Sigma a)^2 = 784$$

$$(\Sigma b)^2 = 28^2$$

$$(\Sigma b)^2 = 784$$

Values from variable a	Values from variable b	Other values needed
$\Sigma a = 28$ $\Sigma a^2 = 139$ $(\Sigma a)^2 = 784$	$\Sigma b = 28$ $\Sigma b^2 = 140$ $(\Sigma b)^2 = 784$	$\Sigma a*b = 92.5$ $N = 7$

6: Put the values from the table above into the equation.

$$r = \frac{(7 * 92.5) - (28 * 28)}{\sqrt{((7 * 139) - 784) * ((7 * 140) - 784)}}$$

7: Complete the multiplication sums within the brackets on the lower part of the equation.

$$r = \frac{(7 * 92.5) - (28 * 28)}{\sqrt{((973) - 784) * ((980) - 784)}}$$

8: Now do the remaining sums within brackets, the multiplications on the top part and the subtractions on the lower part.

$$r = \frac{(647.5) - (784)}{\sqrt{(189) * (196)}}$$

9: Next, do the subtraction on the top part and the multiplication on the lower part.

$$r = \frac{-136.5}{\sqrt{37044}}$$

10: Now calculate the square root on the lower part.

$$r = \frac{-136.5}{192.468}$$

11: Finally, calculate the division to calculate the Pearson's *r* value.

$$r = -.709$$

4. Interpret and write up your findings using APA standards.

There is no significant correlation between social support and cold likelihood ($r_s(5) = -.709, p > .050$).

Correlation between hugs per week and cold likelihood

1. What method of analysis will you use?

A non-parametric Spearman's correlation was conducted to examine the relationship between levels of number of hugs per week and cold likelihood.

2. Suggest a suitable hypothesis.

There will be a significant relationship between the number of hugs per week that someone receives and cold likelihood. (Note, this is a two tailed hypothesis, but either one or two tailed would be ok.)

3. Calculate the test statistic determine whether it is significant.

Hugs per week (X)	X ranked (Xr)	Cold likelihood (Y)	Y ranked (Yr)	d (Xr - Yr)	d ²
32	5	2	2	3	9
6	1	9	7	-6	36
43	7	4	4	3	9
12	3	5	5	-2	4
10	2	7	6	-4	16
29	4	3	3	1	1
36	6	1	1	5	25

Steps 1-3 of the calculations are completed within the table.

Step 4: You then need to sum all of the squared difference scores (Σd^2).

$$\Sigma d^2 = 9 + 36 + 9 + 4 + 16 + 1 + 25$$

$$\Sigma d^2 = 100$$

Step 5: You are then ready to enter the values into the equation.

$$r_s = 1 - \frac{6 * 100}{7^3 - 7}$$

Step 6: Do the multiplication on the top part of the equation and the n3 on the lower part.

$$r_s = 1 - \frac{600}{343 - 7}$$

Step 7: Calculate the subtraction on the lower part of the equation.

$$r_s = 1 - \frac{600}{336}$$

Step 8: Do the division sum.

$$r_s = 1 - 1.7857$$

Step 9: Calculate the subtraction to find out the r_s value.

$$r_s = -.7857$$

4. Interpret and write up your findings using APA standards.

There is a significant negative correlation between hugs per week and cold likelihood ($r_s(5) = -.786, p < .050$). This shows that the more hugs a person has, the less likely they are to develop a cold.

Methodological question

5. Design a follow up study using an experimental design.

To make this study into an experimental design we would need some form of IV manipulation. There are lots of options, but my idea is to have two independent groups of participants, so an independent measure IV. One will be asked not to hug anyone for a month and the other will be told to hug someone else at least five times a day for a month. At the end of the month participants are asked to rate how likely they think they are to develop a cold. This is the DV. These data could be analysed using an independent measures t test.