Research Article

Calculating and interpreting Cronbach's alpha using Rosenberg assessment scale on paediatrician's attitude and perception on self esteem

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ABSTRACT

Background: Items used in a questionnaire should have internal consistency, which reflects its reliability. The most common and useful measure for internal consistency is cronbach's alpha. Though it is the most widely used tool in qualitative medical research, it is also the most commonly misunderstood statistic. A misinterpreted cronbach's alpha may lead to the question about the reliability of an item or scale. So this study has been undertaken with an objective of calculating and interpreting cronbach's alpha for evaluation of the internal consistency of items by using Rosenberg Assessment Scale (RAS) on attitude and perception of paediatricians' about self-esteem.
Methods: A cross-sectional survey was done in bhubaneswar during a CME. Responses of 50 paediatricians were taken by close ended, pretested RAS.
Results: The result of the reliability measure was good: α=0.724 in our study that means all the items in our survey were internally consistent and reliable to assess the attitude and perception of paediatricians.
Conclusions: It was concluded that measure of internal consistency, Cronbach's alpha (α) was easy to calculate, had a direct interpretation & less time consuming.

Keywords: Attitude, Cronbach's alpha, Internal consistency, Perception, Reliability

INTRODUCTION

Reliability of an item is very much important when establishing the validity of the inferences one makes based on scores from summated scales used as predictor components for assessing attitude and perception on medical research.[1] Since summated scales are an assembly of interrelated items, variables derived from such instruments are declared to be reliable only when they provide stable and reliable responses. It is important to make sure that the instrument we used to measure particular object is indeed accurately measuring the variable i.e., we are actually measuring the concept that we supposed to measure. If a measurement device or procedure consistently assigns the same score to individuals or objects with equal values, the instrument is considered reliable.[2]

There are three strategies for estimating reliability: (a) test-retest reliability (b) parallel forms reliability and (c) internal consistency reliability.[2] Internal consistency describes the extent to which all the items in an instrument measure the same concept and hence connected to the inter-relatedness of the items.[3,4] It should be determined before a test can be employed for research or examination purposes to ensure validity.[4] Clearly, it is

the easiest way to know the reliability as it does not require administering the test twice or having two forms of the test. There are various ways of calculating internal consistency reliability. The most familiar are the (a) Split-half adjusted (b) Kuder-Richardson formulas 20 and 21 (c) Cronbach's alpha.[5]

Although cronbach's alpha is the most widely used tool in measuring multiple items in a conceptual or constructive study, it is also the most commonly misunderstood Statistic as noted by Cronbach's himself.[3-6] Under any conditions that violate the assumptions or prerequisites of reliability coefficient, might lead to substantively deflated reliability score which in turn, might potentially entail misinformed inferences, such as discarding a test due to its seemingly low reliability.[7]

However, in spite of the widespread use in the literature and various research the concept, use and inference of alpha is not properly interpreted. Therefore, this study has been undertaken with an objective of calculating and interpreting Cronbach's alpha by Rosenberg Assessment Scale and to know the attitude and perception of Paediatricians about self-esteem by applying this scale upon them.

METHODS

A cross-sectional survey was undertaken in the month of December 2015 among 50, MD Pediatrics attending a CME course in IMA house in Bhubaneswar by consecutive sampling method after taking their informed consent. We measure their response in the Rosenberg assessment Scale, which is a type of ordinal response scale, a variant of likert scale. This scale is very well known for measuring self-esteems, developed by Morris Rosenberg which comprises of 10 close ended, pretested, highly reliable questionnaires (Test-retest correlations: 0.82 to 0.88).[8] Paediatricians were asked to respond to each statement in terms of their own level of agreement or disagreement. Typically they were instructed to select one of five responses- strongly agree, agree, neither agree nor disagree, disagree or strongly disagree. After getting their response cronbach's alpha was calculated using SPSS 22 version.

RESULTS

The items were responded by 50 paediatricians of which, 12 (24%) were the female and 38 (76%) were the male respondent. According to age, wise distribution of 23 (46%) were more than 60 years while 27 (54%) were less than 60 yrs. It was found in our study 73%, 68% and 60% of respondents was satisfied with themselves, admitted to take a positive attitude and wished for a more respect respectively. About negatively approach items 60% respondent disagreed with the thought of no good at all. Whereas 40% respondent thought that they have numbers of good qualities.

Table 1: Scale statistics.

Mean	Variance	SD
25.93	26.924	5.189

Overall it was observed that good numbers of paediatricians were satisfied with their perspectives, had the positive attitude about their life and had high self-esteems.

Table 2: Item statistics.

	Mean	SD	N
At times I think I am no good at all	1.47	0.640	50
On the whole, I am satisfied with myself.	3.60	0.737	50
I feel that I'm a person of worth, at least on an equal plane with others.	3.07	1.280	50
I take a positive attitude toward myself.	2.87	1.356	50
I feel I do not have much to be proud of	2.80	1.207	50
I am able to do things as well as most other people.	2.40	1.298	50
I wish I could have more respect for myself	3.33	0.900	50
I certainly feel useless at times	1.47	0.516	50
I feel that I have a number of good qualities	3.67	0.724	50
All in all, I am inclined to feel that I am a failure.	1.27	0.458	50

Calculating Cronbach's Alpha Co-efficient for Internal Consistency

Cronbach's alpha requires only a single test administration to provide a unique estimate of the reliability.[9] It is mathematically calculated as follows:

$$\alpha = \frac{k}{k-1}\left(1 - \frac{1}{S_T^2}\sum_{i=1}^{k} s_i^2\right)$$

Where k is the number of items, s2i is the variance of ith item, and s_i^2 is the variance of the total score formed by summing all items.[3,11] Assumption behind this formula is that the expected variance within variables (s²) should be small in comparison with the covariance between scale items in order to have an internally consistent measure.[12] If the items making up the score are all identical and so perfectly correlated all the s2i are equal and $s_T^2 = k^2 s_i^2$, so that $\sum \frac{s_i^2}{s_T^2} = 1/k$. Thus, alpha will be One if the items are all the same and Zero if none is related to another.[10]

Referred to above formula we had k = 10 (the number of items), which leads to 10 item variances from s^2_1 to s^2_{10}. Each of the 10 item variances calculated in SPSS in each item's column. And the total variance s^2_T was calculated using data in the total column.[3]

Table 3: Item total statistics.

	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Squared multiple correlation	Cronbach's alpha if item deleted
At times I think I am no good at all.	24.47	24.267	0.356	0.843	0.709
On the whole, I am satisfied with myself.	22.33	25.810	0.076	0.672	0.740
I feel that I'm a person of worth, at least on an equal plane with others.	22.87	18.695	0.595	0.631	0.659
I take a positive attitude toward myself.	23.07	18.067	0.609	0.813	0.655
I feel I do not have much to be proud of	23.13	18.124	0.714	0.821	0.633
I am able to do things as well as most other people.	23.53	17.552	0.706	0.780	0.632
I wish I could have more respect for myself	22.60	26.543	0.046	0.448	0.762
I certainly feel useless at times.	24.47	26.267	0.074	0.572	0.735
I feel that I have a number of good qualities	22.27	23.352	0.436	0.810	0.698
All in all, I am inclined to feel that I am a failure.	24.67	26.095	0.132	0.674	0.730

Table 4: Reliability statistics.

Cronbach's alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.724	0.659	10

Table (1 to 4) shows the item-analysis output from SPSS for the multi-item scale of paediatrician attitude towards self-esteem. The terms used in this study can be interpreted as follows:

Scale statistics: These are summary statistics for the 10 items comprising the scale.

Item mean: These are summary statistics for the 10 individual item means.

Item variances: These are summary statistics for the 10 individual item variances.

Inter-item correlations: This is the information about the correlation of each item with the sum of all other items.

Item-total statistics

Scale mean if item deleted: All items is summed and the mean of the summated items calculated excluding the listed item to be discarded.

Scale variance if item deleted: Excluding the individual item counted, all other scale items are summed for all individuals and the variance of the summated items.

Corrected item-total correlation: This is the correlation of the item designated with the summated score for all remaining items.

Squared multiple correlations: It is the predicted Multiple Correlation Coefficient squared calculated by regressing the selected individual item on all the remaining items.

Alpha if item deleted: This represents the Cronbach's alpha reliability coefficient if the individual item is discarded from the scale. This value is then compared to the value of Cronbach's alpha present at the bottom of the table to see if anyone wants to delete the item.

Alpha: The Cronbach's alpha coefficient of internal consistency.

Standardized item alpha: It represents the alpha when all scale items have been standardized. It is used only when the individual item scale are not scaled the same.

DISCUSSION

Interpretation of Cronbach's alpha

The range of Cronbach's alpha normally is between 0 and 1.[11] In exactly that will not be possible always especially when the samples in an experiment are less[3,11] The value of Cronbach's alpha could take a negative value if there will be negative inter-item covariance with a large absolute value.[6] The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale.[12]George and Mallery had provided the rules of thumb e. i. if the value of alpha is >0.9 = Excellent, >0.8 =Good, >0.7 = Acceptable, >0.6 = Questionable, >0.5 =Poor, and <0.5 = Unacceptable.[13]

When we wish to discard an item and if the α increases a lot after that, one should consider deletion.[12] The same counts for items which decrease the average correlation coefficient a lot. Although cronbach's alpha provides an estimate of the internal consistency, however, it does not indicate the stability of the test over time, which would be better, estimated using the test-retest reliability methods. Normally distributed test scores are more likely to have high cronbach's alpha reliability estimates than tests with positively or negatively skewed distributions.[5]

A high coefficient alpha also needs a proper interpretation because it does not mean a high degree of internal consistency or reliability always as it is also affected by the length of the test. Too short test leads to low alpha while[4,14] a longer test increases the internal consistency reliability regardless of whether the test is homogenous or not. A high value of alpha (>0.90) may suggest redundancies and show that the test length should be shortened.[4]

CONCLUSION

The mean found in our study was 25.93, with variance and standard deviation of 26.92 and 5.19 respectively. Though a questionnaire is accepted as reliable by getting a good level of cronbach's alpha, we cannot claim that the same questionnaire is valid. We simply know that the items measure the same underlying construct.

However, Cronbach's alpha was easy to calculate, had a direct interpretation, less time consuming as it only requires one test administration and important tool for assessing internal consistency and reliability. The result of the reliability measure was good: α=0.724 in our study and it was concluded that all items in our survey were internally consistent and reliable to assess the attitude and perception of paediatricians.

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