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Cronbach's Alpha

Cronbach's alpha is a statistic. It is generally used as a measure of internal consistency or reliability of a psychometric instrument.

In other words, it measures how well a set of variables [1] or items measures a single, one-dimensional latent aspect of individuals. Generally, many quantities of interest in medicine, such as anxiety or degree of handicap, are impossible to measure explicitly [2]. In such cases, we ask a series of questions and combine the answers into a single numerical value.

What is It?

For example, let us consider that we are interested to know the extent of handicap of patients suffering from cervical myelopathy.

We first prepare a table with 10 items recording the degree of difficulty experienced in carrying out daily activities. Each item is scored from 1 which means "no difficulty" to 4 which means "can't do". The scores on 10 items are summed to give the final score.

However, when items are used to form a scale they need to have internal consistency [3]. The items should all measure the same thing, so they should be correlated with one another. Cronbach's alpha generally increases when the correlations between the items increase. For this reason the coefficient is also called the internal consistency or the internal consistency reliability of the test.

Range

The value of alpha (?) may lie between negative infinity and 1. However only positive values of ? make sense. Generally, alpha coefficient ranges in value from 0 to 1 and may be used to describe the reliability of factors extracted from dichotomous (that is, questions with two possible answers) and/or multi-point formatted questionnaires or scales (i.e., rating scale: 1 = poor, 5 = excellent).

Some professionals insist on a reliability score of 0.70 or higher in order to use a psychometric instrument. This rule should be applied with caution when ? has been computed from items that are not correlated [4].

Caveats

> Although Cronbach's Alpha is widely used nowadays, there are certain problems related to it.
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> The first problem is that alpha is dependent not only on the magnitude of the correlations among items, but also on the number of items in the scale. A scale can be made to look more 'homogenous' simply by doubling the number of items, even though the average correlation remains the same.
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> This leads directly to the second problem. If we have two scales which each measure a distinct aspect, and combine them to form one long scale, alpha would probably be high, although the merged scale is obviously tapping two different attributes.
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> Third, if alpha is too high, then it may suggest a high level of item redundancy; that is, a number of items asking the same question in slightly different ways.

Citation from: From Health Measurement Scales A Practical Guide to Their Development and Use. Streiner D.L., Norman G.R. (1989) New York: Oxford University Press (pages 64-65).
