In this issue, Garcia and colleagues (2019) reported on the methodological testing of a questionnaire. They used various types of analysis to examine their Surgical Fear Questionnaire, but one may be unfamiliar to readers. Factor analysis is used to support construct validity. The authors used confirmatory factor analysis and exploratory factor analysis. In this column, I will provide a brief nonstatistical introduction for readers who may be unfamiliar with construct validity and factor analysis. Factor analysis is complex, so only a brief explanation can be provided in this column.

**Construct Validity**

Construct validity is the fit of the instruments with the concepts or constructs that compose the theory behind the instrument. It is also the degree to which all aspects of the concept or concepts measured by the instrument are included (Gray, Grove, & Sutherland, 2017). Construct validity depends on how well researchers operationalized the concepts through, in this case, developing and writing the items on the instrument. Both types of factor analysis are performed on data collected from people who normally would complete the scale or questionnaire. Factor analysis examines the structure of the instrument, which can vary from population to population. Because results of factor analysis are not fixed attributes (Polit & Yang, 2016), it makes sense to test the instrument construct validity with Brazilian surgery patients before it is used in a study in that country.

**Confirmatory Factor Analysis**

Confirmatory factor analysis is a quantitative method used to determine how well the observed data (data collected from patients) fit with the theoretically grounded model decided beforehand (Lewis, 2017) (thus the “confirmatory” nature of the analysis). The reported statistics are fit indices; they indicate how well the data fit with the theory or model (also called a measurement model) used to develop the instrument. Confirmatory factor analysis tests a hypothesis that the data will fit the proposed measurement framework. However, it should not be the only means of determining construct validity. The factors structure may not be the same as the measurement model.

First, researchers need to decide what variables they will use as the basis for their instrument. These variables are known as latent variables as they are not measured directly. Items that measure the latent variables are known as manifest variables (Polit & Yang, 2016). Garcia and co-authors (2019) used an instrument developed by Theunissen and colleagues (2014) in the Netherlands with two latent variables: fear of immediate consequences of surgery and fear of the long-term consequences of surgery, each operationalized with four items on the questionnaire. In the case of the Surgical Fear Questionnaire, results indicated the questionnaire did not fit adequately with the measurement model. Because of this, authors conducted an exploratory factor analysis to determine if they could identify a better model for the questionnaire.

**Exploratory Factor Analysis**

Exploratory factor analysis is used to discover the structure of a set of items by analyzing intercorrelations among them (thus the exploratory nature of this type of analysis). This type of factor analysis does not require an initial hypothesis or measurement model. The underlying dimensions are called factors, the latent trait the authors hope to measure. The analysis determines the weight of each item in the questionnaire on a factor (also called factor loadings). Factor scores can be interpreted similar to correlation coefficients; the higher the score for an item, the more it fits with a factor. An item generally should be at least 0.40 for its possible fit with a factor (Polit & Yang, 2016). Table 2 of the article by Garcia and colleagues (2019) identifies the factor loading for the items in the questionnaire. Each factor will have an eigenvalue indicating how much variance is explained by a given factor.

Ideally, results of the exploratory factor analysis will be a small number of factors that can be interpreted and are meaningful as dimensions of the construct of interest (Polit & Yang, 2016). The authors then have the task of naming the factors. In this case, the authors used the same two variables indicated in the original measurement model; however, instead of four items each, the fear of long-term consequences of surgery had five items on the factor and the fear of immediate consequences of surgery had three items loaded on the factor. Item 8 loaded strongly on both factors but had more weight on Factor 1 (fear of long-term consequences of surgery). As noted in the article, this item addressed fear of pain and conceivably could overlap into both areas depending on how the item was worded.

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Issues

As mentioned earlier, methodological research including factor analysis is an ongoing process and is not a fixed attribute of any scale or questionnaire. Researchers need to conduct testing when using a scale or questionnaire in a new patient population. The factor analysis process is complex and requires strong interpretative skills of the researchers. Some scales have many factors, also making them more complicated. Two statistical tests were mentioned by Garcia and colleagues (2019); the Kaiser-Meyer-Olkin (KMO) test is used to determine sampling adequacy and the Bartlett’s sphericity test is used to determine if factor analysis is appropriate for the data (Polit & Yang, 2016). If further information is needed, the references may be of help.

REFERENCES


