Factor Analysis of Construct Validity: A Review of Nursing Articles

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Abstract

Background and Purpose: *Use of valid and reliable instruments is the important way for collecting data in quantitative researches. This study was conducted to examine the extent of factor analysis use for specifying construct validity of instruments in quantitative research papers published in an internationally recognized journal.*

Methods*: An internationally recognized journal, Nursing Research, was chosen for the review. All articles published in 2003 in this journal were reviewed. Only quantitative research articles that used instruments in need of construct validity verification were included. Each article was completely reviewed to identify the methods of instrument validation.*

Results: *Among 55 research articles, 40 (73%) were quantitative. Among these 40 articles, 8 articles (20%) were dealing with developing an instrument and one article was a meta-analysis and these 9 articles were excluded. Of the other 31 articles, only 4 (12.9%) used a method for specifying the construct validity of the instrument in the study, and 2 (6.5%) used factor analysis for establishing construct validity of the instrument.*

Conclusion: *Although factor analysis is a well recognized method in establishing the construct validity but its use is much less than expected.*

Key words: *Construct VALIDITY, FACTOR ANALYSIS, NURSING RESEARCHES, QUANTITATIVE RESEARCH*

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Introduction

Valid and reliable instruments are an integral part of any research. Since interpretation of results depends on the validity of instruments used in studies, researchers should be certain about it (1). Validity is a significant and complex issue which is considered by authors as well as readers (2).Validity is investigated in several aspects including face validity, content validity, validity by contrasting groups, convergent validity, divergent validity, discriminating analysis, factor analysis, validity by prediction of future events, and validity by successive verifications (3).Some books classify validity into three types including; content, prediction, and construct. It can be stated that all other types of validity relate to construct validity (4). These types are related to one another, e.g., measuring content validity supports construct validity (1).

Validity of an instrument denotes how much it measures what is supposed to (5). Validity is not an absolute concept to be considered full or null, i.e., it lies in a range. Many instruments which have been used in nursing, was developed and validated for other studies. Therefore, these

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instruments should be validated again if the researchers want to use them in nursing research (2). The more the evidence showing the validity of an instrument, the more the confidence of a researcher on measured values of variables in the study (6).

Construct validity of an instrument is the theoretical frame or feature of a concept that the instrument measures such as intelligence, sorrow, or prejudice. Its measuring is difficult and challenging and takes a lot of time. Construct validity can be calculated by different methods including contrasting groups, convergence and divergence analyses or discriminate and factor analyses. Among these, factor analysis is considered one of the strongest which is more commonly used for establishing the construct validity measured by an instrument. In this method, many variables can be grouped and each group is designated to a factor. The process is based on correlation matrices. For example, in assessing patients' satisfaction, it first seems that the sole variable is "patients' satisfaction from delivered care" but issues such as "competency of caregiver," "desirability of environment," "comfort of patient" etc. are influential, and researchers face with many different variables and data. In such cases, factor analysis can be useful in classifying these variables (7).

This study was conducted to examine the construct validity of instruments in 31 quantitative research papers published in Journal of Nursing Research during 2003 by factor analysis.

Methods

An internationally recognized journal, Nursing Research, was chosen for the review. All articles published in 2003 in this journal were reviewed. Only quantitative research articles were included. Each article was completely reviewed to identify the methods of instrument validation they use.

Results

Of 55 articles published in Journal of Nursing Research in 2003, 40 (73%) articles were quantitative research. In these 40 articles, 8 articles (20%) were related to developing an instrument and one article was meta-analysis, and these 9 articles were excluded.

Of 31 articles, 30 articles (97%) mentioned their instruments. Of these 30 articles, 18 articles (57%) either did not mention anything regarding their instrument validation or referred to previous studies. Thirteen articles of these stated that the validity of their instruments was verified by the authors. Of the 13 articles above, 4 papers (30.8% of these 13, and 12.9% of all) used a method for specifying the construct validity of the instrument and 2 (15.4% of these 13, and 6.5% of all) used factor analysis for establishing construct validity of the instrument.

Table 1 shows the features of the 31 articles. As stated before, researchers used factor analysis for instrument validation only in 2 articles described below.

In an article under the title of "Modifying factors in controlling hesitancy in men with local prostate cancer," researchers used a self-report instrument with 5 statements to assess "client-caregiver (physician, nurse, and other health personnel) relationship" as an outcome variable. Each statement was ranked in order from 1 "not at all" to 5 "very much". Factor analysis was used for construct validity of the instrument.

Results showed that all statements were classified in one category with a coefficient of correlation more than 0.50 (8). As described before, this type is acceptable in factor analysis but since the instrument was developed by researchers, using other validation methods such as context validity seems necessary. Content validity can support construct validity. In fact, stating the validation process can assure readers as well as other researchers regarding instrument/s of a study (1).

In the other article "Visiting adolescent mothers by nurses," researchers aimed to assess maternal-child health from birth until two years by home visits of community health nurses. In this study, one of the instruments to identify 'social competencies of adolescent mothers was devised by incorporating 6

standard instruments for self-esteem, feeling of competency, depression, stress, social life skills and social skills. Factor analysis was used for psychological features of the instrument. This method with a total score of 6 for the instruments of self-esteem, feeling of competency, depression, stress, social life skills and social skills verified their proposed model in the study with two factors of internal and external competencies. Factor load indicated that of the psychological instruments, 4 instruments were related to internal social competency of mothers at birth of their children and 6 weeks thereafter and 2 instruments had relation with their external social competency (9).

Factor analysis can be a correlational matrix in a group of tests pertaining to a psychological aspect or a special capability. In other words, one of the aims in factor analysis is to recognize and measure the performance of individuals in a group of tasks (7). In the above article, factor analysis calculations such as correlation figures of each factor were not presented in detail but the two major internal and external social factors calculated were compatible with theoretical model of the study.

Table 1. Instruments characteristics of published articles in Journal of Nursing Research, 2003.

Researcher/s	Instrument/s	Type of validity	Type of Construct validity	Notes
Anderson, R. A. et al. (2003) **(10)**	1. Communication Openness 2. Participation in Decision Making Instrument 3. Relationship Oriented Leadership 4. Formulization	Based on other studies for all of the instruments	Just mentioned that others had determined construct validity by factor analysis	-
McDougall, G. and Holston, E. C. (2003) **(11)**	1. Mental Statues Questionnaire (SPMSQ) 2. Mini Mental State Exam (MMSE)	Not mentioned	-	-
Adachi, K., et al. (2003) **(12)**	Visual Analog- Scale (VAS)	Not mentioned	-	-
Port, C. L. et al. (2003) **(13)**	Not mention	-	-	-
Cho, S.H. et al. (2003) **(14)**	1. ICD-9-CM 2. LOS 3. Cost	1:Face validity 2 & 3: Not mentioned	-	-
Resnick, B. and Nigg, C. (2003) **(15)**	1. Self-Efficacy Expectations (SEE) 2. Outcome Expectations for Exercise Scale (OEE) 3. Exercise 4. Health Status 5. Fear of fall 6.Stage of Change Related to Exercise	1 & 2: Concurrent Validity 3:Not mentioned 4 & 5& 6: based on other studies	-	-

Table 1. Continued

Mishel, M. H. et al. (2003) **(8)**	1. Multidimensional Health Locus of Control Scale (MHLC) 2. Extrinsic Religiosity 3. Source of Information 4. Cancer Knowledge **5.** Patient – Provider Communication	1 &2: Based on other studies 3: Content Validity 4: Not mentioned **5: Construct Validity**	**5:** Factor Analysis	**5:** Alpha coefficients>0 .50 is suitable in factor analysis. But it is recommended to determine content validity before construct validity
DiMattio, M. J. K. and Tulman, L. (2003) **(16)**	1. The Inventory of Functional Status in them Elderly (IFSIT) 2. Medical Outcomes Study Patient Assessment Questionnaire (MOSPAQ)	**1:Construct Validity** 2:Based on other studies	1: Contrasted groups validity	1: Statistical meaningful between groups with correlation 0.26-0.58 that are very low for validity
- DeVone, H. A. and Zerwic, J.J. (2003) **(17)**	1. The Unstable Angina Symptômes Questionnaire (UASQ) 2. Canadian Cardiovascular Society (CCS) 3. The Hospital Anxiety and Depression Scale (HADS)	1: Content validity 2: Not mentioned 3: Based on other studies	-	-
McConnell, E. S. et. al. (2003) **(18)**	1. Minimum Data Set (MDS) 2. Cognitive Performance Scale (CPS) 3. ADLs	1: Based on other studies 2&3: Not mentioned	-	-
Koniak-Griffin, D. et. al. (2003) **(9)**	1. Structured Interview 2. The Shortened Acculturation Scale 3. The Nursing Child Assessment Teaching Scale (NCATS) 4.The Home Scale **5.** Social Competence	1: content validity 2: Not mentioned 3&4: based on other studies **5: construct validity**	**5:** Factor analysis	**5:**Alpha coefficients didn't mentioned but two main factors (internal & external social competencies) have been obtained by this method which are congruent with theoretical framework of this study
Landis, C. A. et. al. (2003) **(19)**	1. Self-Reported Sleep Quality and Fatigue 2. Actigraphy Recording 3. Sleep/ Wake Scoring of Activity Data	1 & 2: Not mentioned 3:Content validity	-	-

Table 1. Continued

Dodgson, J.E. et. al. (2003) **(20)**	1. The Minnesota Infant Feeding Questionnaires (MIFQS) 2. Breastfeeding Difficulty Index (BDI)	Not mentioned	-	-
Zerwic, J.J. et. al. (2003) **(21)**	-The Myocardial Infarction Symptoms Profile (MISP)	Content validity	-	-
Ulrich, C. M. et al. (2003) **(22)**	1. Ethical Conflict in Practice Scale 2. Ethical Concern 3. Ethical Ideology 4. Mc Daniel's Ethics Environ ment Scale 5. Governmental Intervention	1 & 2: Content validity 3 : Not mentioned 4: based on other studies 5: Content validity	-	-
LaMontagne, L.L. et al. (2003) **(23)**	1. Spielberger's State- Trait Anxiety Inventory 2. Visual Analogue Scale (VAS)	1:Based on other studies 2: Not mentioned	-	-
Tang, S.T. (2003) **(24)**	1. Symptom Distress Scale (SDS) 2. Enforced Social Dependency Scale (ESDS)	Based on other studies	-	-
Giuliano, K.K. et al. (2003) **(25)**	1. Simplified Acute Physiology Score II (SAPS-II) 2. Positive End-Expiratory Pressure	1: Based on other studies 2: Not mentioned	-	-
Rivers, D. L. et al. (2003) **(26)**	1. Organizational Predictors 2. Dependent Variables	1: Not mentioned 2: Based on other studies	-	-
Huber, D. L. et al. (2003) **(27)**	Addiction Severity Index (ASI)	Based on other studies	-	-
Lusk, S. T. et al. (2003) **(28)**	Hearing Protection Device(HPD)	Face validity and based on other studies	-	-
Holditch- Davis, D. et al. (2003) **(29)**	Self-structured Questionnaire	Not mentioned	--	-
Goodfellow, L. M. (2003) **(30)**	1. Depression Status 2. Socio-mental instruments	Based on other studies	-	-
Motzer, S. A. et al. (2003) **(31)**	1. Sense Of Coherence (SOC) 2. Quality Of Life(QOL) 3. Bowel Disease Questionnaire (BDQ)	1: Concurrent validity 2& 3: Based on other studies	-	-
Dormire, Sh. L. and Ream, N. K. (2003) **(32)**	Three instrument without name	Not mentioned	-	-
Miles, M. Sh. et al. (2003) **(33)**	1. CEDS 2. Mood Status (POMS) 3. Stigma 4. Concern about HIV 5. Medical outcomes of HIV (MOS_HIV)	1&2&3&5:Based on other studies 4: Not mentioned	-	-

Table 1. Continued

Lorig, K. R. et al. (2003) **(34)**	Health Outcome Evaluation	**Construct validity**	Convergent validity and discriminant analysis	-
Armer, J.M. et al. (2003) **(35)**	Lymph edema Breast Cancer Questionnaire (LBCQ)	Face and content validity	-	-
Garvin, B. J. et al. (2003) **(36)**	1. Anxiety Measures 2. Information Prefer & Anxiety Control (KHOS)	Based on other studies	-	-
Gift, A. G. et al. (2003) **(37)**	1. Self- report of Physical Signs 2. Survival Status	Not mentioned	-	-
Smith, C. E. et al. (2003) **(38)**	1. Depression 2. Mood	Not mentioned	-	-

Discussion

Appropriateness of instruments and stated type of validity has a significant influence on internal as well as external validity of a study. Invalid instruments may show incorrect relations between variables and affect internal validity. They may also lead to erroneous generalizations to the population under study. Therefore,it affects on external validity and implications of research findings. Accordingly, it becomes evident that measuring validity is an important issue in studies (4).

As stated before, validity is different from one sample or situation to another. Therefore, measuring validity determines the appropriateness of an instrument to be used for a special group or aim since an instrument may be significantly valid in a condition while not being so in another.

It can be concluded that although researchers put a great emphasis on methodology and statistical analysis, they pay less attention to the validity of their instruments and often refer to previous studies in this regard. This can be to some extent reasonable but some questions still remain unanswered: First, have these instruments been validated in a correct and scientific way? Second, to what extent the validity of instruments can be trusted for new samples or in new situations? The authors of this article hope to draw the attention of investigators to the importance of measuring construct validity and the role of factor analysis in this regard.

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