JNK

JURNAL NERS DAN KEBIDANAN
(JOURNAL OF NERS AND MIDWIFERY)
http://jnk.phb.ac.id/index.php/jnk

Reduction of Jitanti PTM Questionnaire: Principal Component Factor Analysis

Suprajitno[1], Sri Mugianti[2], Bastianus Doddy Riyadi[3], Juin Hadi Suyitno[4], Puguh Yudho Trisnanto[5]
[1,2]Department of Nursing, Poltekkes Kemenkes Malang, Indonesia
[3,4]Department of Nutrition, Poltekkes Kemenkes Malang, Indonesia
[5]Department of Medical Record and Health Information, Poltekkes Kemenkes Malang, Indonesia

Article Information

History Article:
Received, 02/02/2023
Accepted, 17/07/2023
Published, 30/08/2023

Keywords:
reduction, questions, jitanti ptm, factor analysis

Abstract

69 questions in the JITANTI PTM application with the logo, can be employed to measure an individual's risk of suffering from non-communicable diseases. The 69 questions in the app can tire the user's eyes, as can the app user's comments. The objective of the study was to reduce questions in order to be more effective. The research design used cross-sectional. The sample who volunteered to fill out the JITANTI PTM application were 324 people using simple random sampling. The inclusion criteria was people who were living in Blitar Raya who have a risk of suffering from non-communicable diseases, and frequently consuming fast food and drinks. The data collection was administered from April to June 2022. The data analysis was then performed to calculate validity using Pearson Product Moment, reliability by administering Cronbach's □, and factor loading employing principal component factor analysis. The software for calculations utilized SPSS. The validity test values obtained were between 0.234 – 0.708 which was greater than r table at □ = 0.05 and degrees of freedom > 300 = 0.113, meaning the questions met the validity requirements. The reliability test scores obtained were between 0.783 – 0.907 which met the minimum reliability requirements of 0.7. Based on the Eigenvalue, which is more than 1.0, 19 new questions can be generated (7 for knowledge, 7 for attitude, and 5 for action). Reducing the number of questions in the JITANTI PTM application can reduce user visual fatigue and speed up charging time, thereby reducing the accommodation power of vision.

✉Correspondence Address:
Poltekkes Kemenkes Malang – East Java, Indonesia
Email: suprajitno_skp@poltekkes-malang.ac.id
P-ISSN : 2355-052X
E-ISSN : 2548-3811
DOI: https://doi.org/10.26699/jnk.v10i2.ART.p154-160

INTRODUCTION

Questions are an essential attribute in the questionnaire administered to describe a variable that is expected. Questions describe the sub variables to be measured, where questions can be utilized if they possess good validity and reliability values. Questionnaires that describe variables can be answered directly by users in paper format or electronic format, both of which have their own advantages and disadvantages. The choice of how to fill is based on the expected goals.

Questionnaires that were answered in paper format tended not to be completed immediately due to the long filling time. However, answering electronic or digital format questionnaires can be visually tiring as it requires visual accommodation. Research on students in South Africa revealed that employing an iPad (a digital device) can stimulate more accommodation, and require vision correction (Devenier et al., 2021). This condition illustrates that digitization affects the accommodation power of vision.

One of the android applications, which is JITANTI PTM with the logo used to a healthy a person's risk of suffering from non-communicable diseases based on CERDIK behavior (periodic health checks, stopping smoking, being diligent in physical activity, a balanced and healthy diet, adequate rest, and managing stress). The application contains 69 questions consisting of 20 questions of knowledge, 29 questions of attitude, and 20 questions of action (Suprajitno & Mugianti, 2020). The verbal responses of android application users were "... the number of questions is too much.", "... many questions are similar and repetitive.", "The sentence is too long.", and "It takes more than 15 minutes to fill out the questionnaire". The number of good digital questions in a questionnaire is 25-30 questions with a maximum filling time of 30 minutes (Sharma, 2022).

Therefore, for the effectiveness of filling in the application, it is necessary to reduce the number of questions in JITANTI PTM, so as not to tire eyesight.

METHODS

The design employed was cross-sectional. There were 324 respondents selected by simple random sampling and volunteers, with the criteria being people who were residing in Blitar Raya who have a risk of suffering from non-communicable diseases and frequently consuming fast food and drinks. The data collection was conducted from April to June 2022. The data was collected by filling out a questionnaire in the JITANTI PTM application with the logo (Poltekkes-Kemenkes-Malang, 2022). The validity analysis employed the Pearson Product Moment, the reliability administered Cronbach's α, and the question reduction used principal component factor analysis with SPSS software. This research had been declared ethically feasible by the Health Research Ethics Committee of Poltekkes Kemenkes Malang Number: 305 / KEPK-POLKESMA / 2022 dated January 19, 2022.

RESULTS

The reliability value of the knowledge, attitude, and action questionnaire was calculated using Cronbach's Alpha, and the validity value was calculated using Pearson Product Moment. Meanwhile, the value of r table at $\alpha = 0.05$ and degrees of freedom > 300 = 0.113 (n.n., 2022). The reliability and validity values of the questionnaire are presented in Table 1.

Table 1: The value of the reliability and validity of the knowledge, attitude, and action questionnaire

No	Questionnaire	Number of Items	Minimum r Value	Maximum r Value	Cronbach's Alpha
1	Knowledge	20	0.234	0.557	0.783
2	Attitude	29	0.347	0.708	0.907
3	Action	20	0.383	0.558	0.828

Principal component analysis for knowledge, attitude, and action questionnaires was described by employing Kaiser-Meyer-Olkin (KMO) and Bartlett's test, principal component extraction method in accordance with Eigenvalue > 1, and Varimax rotation. The results of the principal component factor analysis are demonstrated in Table 2.

Table 2: The analysis result of the principal components of the knowledge, attitude, and action questionnaires

No.	Test value	Knowledge	Attitude	Action
1	Test value:			
	- Kaiser-Meyer-Olkin (KMO)	0.778	0.904	0.816
	- Bartlett's chi-square test	1034.175	3130.149	1431.414
	- Significance	0.000	0.000	0.000
2	Varimax extraction loading factor values:			
	- Minimum	0.314	0.429	0.312
	- Maximum	0.716	0.689	0.708

The Eigenvalue results using the principal component analysis for the knowledge, attitude, and action questionnaires with Varimax extraction are illustrated in Table 3.

Table 3: Eigenvalue of the principal component analysis for the knowledge, attitude, and action questionnaires

Com-ponent	Knowledge			Attitude			Action		
	Eigen-value	% Variance	Cumulative %	Eigen-value	% Variance	Cumulative %	Eigen-value	% Variance	Cumulative %
1	4.016	20.082	20.082	8.531	29.418	29.418	4.875	24.377	24.377
2	1.730	8.648	28.730	1.800	6.205	35.623	1.681	8.404	32.782
3	1.344	6.718	35.448	1.450	5.001	40.625	1.446	7.230	40.012
4	1.191	5.955	41.403	1.249	4.308	44.933	1.244	6.220	46.232
5	1.094	5.469	46.872	1.222	4.212	49.145	1.097	5.486	51.718
6	1.037	5.187	52.059	1.147	3.955	53.100	0.948	4.740	56.458
7	1.003	5.013	57.072	1.066	3.678	56.778	0.942	4.712	61.170
8	0.939	4.695	61.767	0.985	3.395	60.173	0.883	4.414	65.584

Based on the loading factor value for each new question (factor), grouping questions are demonstrated in Table 4.

Table 4: Grouping of new questions in accordance with the value of the principal component analysis factor loading

Questioner	New question	Question (Q) number (loading factor value)
Knowledge	Question 1	Q 13 (0.714), Q 12 (0.659), & Q 16 (0.489)
	Question 2	Q 10 (0.721), Q 9 (0.716), Q 5 (0.454), & Q 7 (0.442)
	Question 3	Q 3 (0.733) & Q 2 (0.510)
	Question 4	Q 4 (0.743), Q 6 (0.692), & Q 8 (0.436)
	Question 5	Q 1 (0.771), Q 17 (0.625), & Q 18 (0.529)
	Question 6	Q 20 (0.646) & Q 19 (0.599)
	Question 7	Q 11 (0.678), Q 14 (0.633), & Q 15 (0.435)
Attitude	Question 1	Q 2 (0.698), Q 4 (0.632), Q 11 (0.586), Q 1 (0.523), Q 3 (0.505), Q 10 (0.496), & Q 13 (0.465)
	Question 2	Q 17 (0.684), Q 16 (0.680), Q 15 (0.673), Q 18 (0.635), & Q 20 (0.390)
	Question 3	Q 7 (0.748), Q 9 (0.685), Q 6 (0.675), Q 8 (0.599) & Q 5 (0.537)
	Question 4	Q 27 (0.714), Q 29 (0.596), & Q 26 (0.507)
	Question 5	Q 24 (0.719), Q 23 (0.719), & Q 21 (0.626)
	Question 6	Q 12 (0.670), Q 28 (0.604), Q 25 (0.582), & Q 19 (0.471)
	Question 7	Q 22 (0.669) & Q 14 (0.515)

Questioner	New question	Question (Q) number (loading factor value)
Actions	Question 1	Q 17 (0.634), Q 18 (0.583), Q 15 (0.577), Q 13 (0.562), Q 11 (0.536), & Q 12 (0.412)
	Question 2	Q 20 (0.669), Q 6 (0.617), Q 19 (0.570), Q 16 (0.456), Q 7 (0.452), & Q 14 (0.382)
	Question 3	Q 1 (0.773) & Q 2 (0.763)
	Question 4	Q 4 (0.746), Q 5 (0.737), & Q 3 (509)
	Question 5	Q 10 (0.817), Q 9 (0.751), & Q 8 (0.476)

DISCUSSION

The use of an application does not only consider the results of the contents, but also needs to consider the verbal response of the application user. Application users are like consumers, they also act as promoters for other users, thus, verbal responses need to be a concern for JITANTI PTM android application developers. One study elaborated that the consumer's verbal response as an anchor to promote an item to other potential consumers (Phillips, 2013). Thus, the verbal responses obtained by researchers need to be a concern for simplifying the questionnaire, hence, it is simple but does not reduce the expected goals.

Increasing users of the JITANTI PTM application requires some concern regarding the intake provided by users. Efforts were performed to reduce the questions in the questionnaire so as not to cause user fatigue through factor analysis. In theory, the objectives of factor analysis are (1) reducing the number of variables, (2) identifying the structure or relationship between variables, (3) evaluating the construct validity of the instrument, (4) identifying multicollinearity, and (5) utilizing it to prove the theory (Härdle & Simar, 2019; Mindrila, 2017; Watkins, 2021; Williams et al., 2010). There are two identified factor analyzes, which are exploratory and confirmatory factor analysis. In order to obtain good analysis results, a principal component factor analysis is conducted. Five stages (see Figure 1 below) cited by William et al. (Williams et al., 2010) as a principal component factor analysis protocol for decision making. Some of the textbooks cited by Comrey and Lee (Comrey & Lee, 1992) provide guidance on sample size in factor analysis, encompassing 100 is insufficient, 200 is sufficient, 300 is good, 500 is very good, and 1000 or more is tremendously very good (Williams et al., 2010). The sample size for this factor analysis for the reduction of the JITANTI PTM question was 324 respondents, thus, it was in the good category for analysis. Analysis that can provide information.

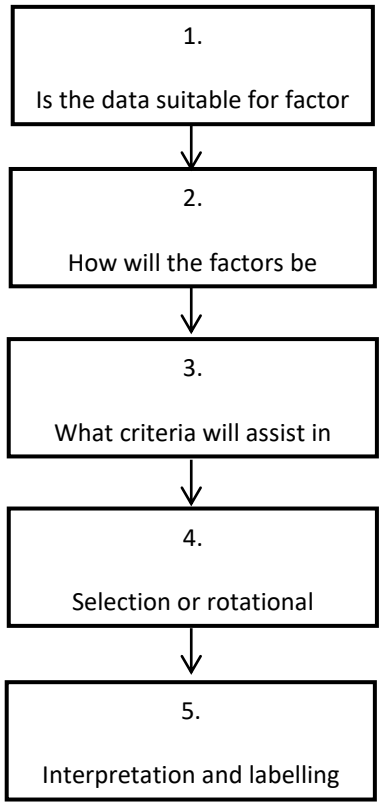

Figure 1. The 5-step Exploratory Factor Analysis Protocol

Question reduction was administered by taking into account the results of the validity and reliability tests using SPSS. The validity test originates from the Pearson Product Moment correlation value, the minimum r count value of the knowledge questionnaire was 0.234, the attitude was 0.347, and the action was 0.383 (Table 1). The calculated r value (Table 1) is at least greater than the r table at $\alpha = 0.05$ and df > 300 of 0.113 (n.n., 2022), hence, the knowledge, attitude, and action questionnaires are declared valid. The reliability test employed Cronbach's α, the reliability test value of the knowledge questionnaire was 0.783, the attitude was 0.907, and the action was 0.828 (Table 1). The Cronbach alpha value of the questionnaire (Table 1) is between 0.783 – 0.907. In order for a questionnaire to be declared reliable it needs to be greater than 0.70 (Griethuijsen et al., 2014; Taber, 2017) as this indicates that the Cronbach alpha value qualifies as a reliable questionnaire.

Reliability and validity (Mohajan, 2017) are required for a questionnaire. Reliability was employed to evaluate questions used at different times for the same individual or the equivalence of sets of questions from the same questionnaire. The reliability coefficient ranges from 0.00 to 1.00. A high reliability coefficient indicates a high level of reliability of the questionnaire (Kimberlin & Winterstein, 2008). Validity is frequently defined as the extent to which an instrument measures what it is intended to measure. Validity requires an instrument to be reliable, but an instrument to be reliable without validity (Kimberlin & Winterstein, 2008). The reliability of a questionnaire can be studied through interval consistency and interrater reliability. Meanwhile, the validity of a questionnaire incorporates construct validity, content validity, and criteria-related validity.

The Kaiser-Meyer-Olkin (KMO) value is a test value to test the strength of the partial correlation between variables. KMO values close to 1.0 are considered ideal while values less than 0.5 are unacceptable (Analysis-INN, 2020; Nkansah, 2018; Reddy & Kulshrestha, 2019). The KMO value of the knowledge, attitude, and action questionnaire (Table 2) is more than 0.5, implying that it is possible to reduce the number of questions. Meanwhile, the KMO value category (Table 2), the knowledge questionnaire is 0.778 in the Medium category, the attitude questionnaire is 0.904 in the Very Good category, and the action questionnaire is 0.816 in the Good category (Reddy & Kulshrestha, 2019). The test results indicate that the questions in the questionnaire have a relationship with one another, thus the number of questions can be reduced (simplified). The KMO value is supported by the significance value of Barlett's test from the Sphericity questionnaire of knowledge, attitudes, and actions of 0.000 which is less than α which is set at 0.05. Based on KMO and Barlett's test values, it is followed by analysis of the principal component factors.

Factor analysis extraction method utilizing Varimax SPSS. The consideration of using Varimax is that it can produce a loading factor as a solution for simple structures in real data sets (Komalasari, 2015; Weide & Beauducel, 2019), and produce a component that does not change when the component is rotated (Acal et al., 2020). The value of the loading factor by employing the Varimax extraction of the knowledge questionnaire is 0.314 – 0.716, attitude is 0.429 – 0.689, and action is 0.312 – 0.718 (Table 2). The loading factor resulting from Varimax extraction can be accepted as a new forming factor if it has a minimum value of 0.3 (Field, 2018; Samuels, 2017).

Eigenvalue greater than 1.0 is administered as a determinant in formulating the common factor of the questionnaire (Komalasari, 2015). The eigenvalue of more than 1.0 of the components indicates the number of statistically suggested reductions in the number of questions (Table 3), resulting in 7 components for the knowledge questionnaire, 7 components for the attitude questionnaire, and 5 components for the action questionnaire. The components that are generated based on the Eigenvalue also describe the cumulative variance of each questionnaire. It means that (1) the knowledge questionnaire can be summarized into 7 new questions with a cumulative variance of 57.072%, (2) the attitude questionnaire can be summarized into 7 new questions with a cumulative variance of 56.778%, and (3) the action questionnaire can be summarized into 5 new questions with a cumulative variance of 51,718%. The cumulative variance describes the number of questions that need to be maintained in a questionnaire based on the Eigenvalue and elaborates the spread of the data obtained if a questionnaire with the number of questions is employed (O'Brien, 2007).

Grouping the number of questions based on the value of the loading factor resulted in 7 new knowledge questions, 7 new attitude questions, and 5 new action questions (Table 4). Statistically, from the results of the principal component factor analysis, the number of new questions for the JITANTI PTM application resulted in 19 questions. New questions prepared based on merging questions are in the appendix. Such a number of questions can be categorized as ideal for a digital application so as not to be tiring (Devenier et al., 2021). If

there is no reading fatigue through digital screens, it can lead to pleasure in utilizing the application, which is expected to be a promoter for other users of the application.

CONCLUSION

Reducing the questions of a questionnaire in a digital application can reduce user visual fatigue, but does not eliminate the meaning of the questions. The reduction method can use the principal component factor analysis by taking into account the Eigenvalue. Questions about the JITANTI PTM application with the logo based on Eigenvalue factor analysis, resulted in 19 new questions (7 for knowledge, 7 for attitudes, and 5 for attached actions) derived from 69 existing questions with a cumulative variance of around 57%.

SUGGESTION

The android application of JITANTI PTM can be used by the community for early detection of individual risks of suffering from Non-Communicable Diseases.

ACKNOWLEDGEMENT

Thanks to Director of Poltekkes Kemenkes Malang, Kepala Dinas Kesehatan Kota Blitar as an application user in their work area, and all respondents.

FUNDING

The funding of this research comes from a grant from the Indonesian Ministry of Health through Poltekkes Kemenkes Malang.

CONFLICTS OF INTEREST

All authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Sp as a contributor of ideas, data analysis, preparation of manuscripts, and publications. SM, BDR, and JHS as developers of research methods carried out, data collection, data editing, and manuscript preparation. PYT has the role of data collection, data editing, data analysis, and manuscript preparation.

REFFERENCES

Acal, C., Aguilera, A. M., & Escabias, M. (2020). New Modeling Approaches Based on Varimax Rotation of Functional Principal Components. *Stochastic Statistics and Modeling*, *8*(11: 2085), 15. https://doi.org/10.3390/math8112085

Analysis-INN. (2020, 9 May 2020). *KMO and Bartlett's test of sphericity*. Analysis Inn. Retrieved 29 November from https://www.analysisinn.com/post/kmo-and-bartlett-s-test-of-sphericity/

Comrey, A. L., & Lee, H. B. (1992). *A First Course in Factor Analysis* (2nd ed.). Lawrence Erlbaum Associates, Inc., Publishers. http://library.lol/main/F28C0F19D73B6C3F47DAE6CE7928C931

Devenier, M., Hansraj, R., & Rasengane, T. A. (2021). The response of the accommodation system to digital and print images. *African Vision and Eye Health*, *80*(1), 5. https://avehjournal.org/index.php/aveh/article/view/662/1686

Field, A. (2018). *Discovering Statistics Using IBM SPSS Statistics* (5th ed.). Sage Publication Ltd. http://library.lol/main/6D9BAB4CA6ED1409CD04DDE97C0D8959

Griethuijsen, R. A. L. F. v., Eijck, M. W. v., Haste, H., Brok, P. J. d., Skinner, N. C., Mansour, N., Gencer, A. S., & BouJaoude, S. (2014). Global Patterns in Students' Views of Science and Interest in Science. *Research in Science Education*, *45*, 23. https://doi.org/10.1007/s11165-014-9438-6

Härdle, W. K., & Simar, L. (2019). *Applied Multivariate Statistical Analysis* (Fifth Edition ed.). Springer. https://doi.org/10.1007/978-3-030-26006-4

Kimberlin, C. L., & Winterstein, A. G. (2008). Validity and reliability of measurement instruments used in research. *American Journal of Health-System Pharmacy*, *65*(23), 9. https://doi.org/10.2146/ajhp070364

Komalasari, D. (2015). Rotasi Varimax dan Median Hirarki Cluster Pada Program Raskin di Kabupaten Lombok Barat. *Jurnal Matematika*, *5*(1), 12. https://doi.org/10.24843/JMAT.2015.v05.i01.p55

Mindrila, D. (2017). *Exploratory Factor Analysis: Application in School Improvement Research* (D. Mindrila, Ed.). Vova Science Publihers. http://library.lol/main/B0724DAB1AD734D50C85989D1C820A36

Mohajan, H. K. (2017). Two Criteria for Good Measurements in Research: Validity and Reliability. *Annals of Spiru Haret University*, *17*(3), 32. https://mpra.ub.uni-muenchen.de/83458/1/MPRA_paper_83458.pdf

n.n. (2022). *Table of Critical Values: Pearson Correlation*. https://www.statisticssolutions.com/free-resources/directory-of-statistical-analyses/pearsons-correlation-coefficient/table-of-critical-values-pearson-correlation/

Nkansah, B. K. (2018). On the Kaiser-Meier-Olkin's Measure of Sampling Adequacy. *Mathematical Theory and Modelling*, *8*(7), 25. https://iiste.org/Journals/index.php/MTM/article/view/44386/45790

O'Brien, K. (2007). *Factor Analysis: An Overview in the Field of Measurement*. University of Toronto. Retrieved 29 December from https://ihpme.utoronto.ca/wp-content/uploads/2021/10/Factor-Analysis-Paper-PTCanada-2007.pdf

Phillips, B. J. (2013). The Impact of Verbal Anchoring on Consumer Response to Image Ads. *Journal of Advertising*, *29*(1), 11. https://doi.org/10.1080/00913367.2000.10673600

Poltekkes-Kemenkes-Malang. (2022). JITANTI PTM. In Suprajitno, S. Mugianti, & P. Y. Trisnanto (Eds.), (pp. Android version 5). Blitar: https://play.google.com/store/apps/details?id=org.apxdev.jitantiptm.

Reddy, L. S., & Kulshrestha, P. (2019). Performing the KMO and Bartlett's Test for Factors Estimating the Warehouse Efficiency, Inventory and Customer Contentment for E-retail Supply Chain. *International Journal for Research in Engineering Application & Management*, *5*(9), 15. https://doi.org/10.35291/2454-9150.2019.0531

Samuels, P. (2017). Advice on Exploratory Factor Analysis. In B. C. University (Ed.), (pp. 7). London UK: Centers of Acdemic Success.

Sharma, H. (2022). How short or long should be a questionnaire for any research? Researchers dilemma in deciding the appropriate questionnaire length. *Saudi Journal of Anaesthesia*, *16*(1), 4. https://doi.org/10.4103/sja.sja_163_21

Suprajitno, & Mugianti, S. (2020). CERDIK Behavior as a Risk Factor for Individuals with Non-Communicable Diseases. *Systematic Reviews in Pharmacy*, *11*(10), 350-360. https://www.sysrevpharm.org/abstract/cerdik-behavior-as-a-risk-factor-for-individuals-with-noncommunicable-diseases-66252.html

Taber, K. S. (2017). The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Research in Science Education*, *48*(2018), 24. https://doi.org/10.1007/s11165-016-9602-2

Watkins, M. W. (2021). *A step-by-step guide to exploratory factor analysis with SPSS*. Routledge. http://www.routledge.com/9780367710316

Weide, A. C., & Beauducel, A. (2019). Varimax Rotation Based on Gradient Projection Is a Feasible Alternative to SPSS. *Quantitative Psychology and Measurement*, *10*, 14. https://doi.org/10.3389/fpsyg.2019.00645

Williams, B., Onsman, A., & Brown, T. (2010). Exploratory factor analysis: A five-step guide for novices. *Journal of Emergency Primary Health Care (JEPHC)*, *8*(3), 13. https://typeset.io/pdf/exploratory-factor-analysis-a-five-step-guide-for-novices-4w1voztx0i.pdf.