

## ORIGINAL ARTICLE

# Cross-cultural Translation and Psychometric Testing of the Mobile Health App Usability Questionnaire (MAUQ) – Indonesian Version

Priyani Haryanti<sup>1</sup>, Santhna Letchmi Pandugaran<sup>2</sup>, Musheer A. Aljaberi<sup>2</sup>

<sup>1</sup> Faculty of Nursing, Bethesda Yakkum Institute of Health Sciences, STIKES Bethesda Yakkum, Jl. Johar Nurhadi No.6, Kotabaru, Kec. Gondokusuman, Kota Yogyakarta, Daerah Istimewa Yogyakarta 55224, Indonesia

<sup>2</sup> Faculty of Nursing, Lincoln University College, Wisma Lincoln, No. 12-18, Jalan SS 6/12, 47301 Petaling Jaya, Selangor D. E., Malaysia

## ABSTRACT

**Introduction:** Health apps are growing rapidly and are being used to improve human well-being. The resulting apps must be validated for usability to be accurate and trustworthy for use by pregnant women. Many instruments are used to measure app usability, according to the literature. However, when analyzing health apps for pregnant women in Indonesia, the authors did not find the Mobile health App Usability Questioner (MAUQ). The purpose of this study was to transcribe, test the validity and reliability of the Mobile health App Usability Questioner (MAUQ).

**Materials and methods:** The translation was conducted by 4 English experts with native Indonesian speakers. The content of the questionnaire was validated by 5 experts in the health sector consisting of doctors, nutritionists, nurses, midwives and nursing doctors. The instrument was tested for reliability by 30 pregnant women. **Results:** The translation involved 4 language experts. The content validity of the index from five experts obtained essential results 1 and relevance 0.99 and face validity results 0.99. Based on the results of Cronbach alpha analysis on 30 participants, the results of the satisfaction statement (0.736), the system arrangement statement (0.758) and the efficiency statement (0.756) were obtained. **Conclusion:** The analysis results show the Mobile health App Usability Questioner (MAUQ) is valid and reliable.

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## Corresponding Author:

Priyani Haryanti, M. Kep

Email: priyani@stikesbethesda.ac.id

Tel : +628156886631

## INTRODUCTION

The development of health apps is growing rapidly. Some literature shows that health apps improve maternal knowledge and behavior (1). Health applications circulating on social media have not all been built based on research results, so the usefulness of health applications, whether they are appropriate or not, cannot be measured. There are several instruments developed to measure the usability of application-based educational tools such as the Mobile Health App Usability Questionnaire (MAUQ), System Usability Scale (SUS), and Post-Study System Usability Questionnaire (PSSUQ) (2). A research instrument is a tool used by researchers to measure a variable to be studied. Research instruments are developed based on literature studies. Instruments used to measure can be test instruments, inventory

instruments, interview guidelines, questionnaires, and interview sheets.

A good instrument must be tested for validity and reliability. The validity test in research is carried out to find out whether the instrument used is correct or not. There are three types of validity measurements, namely content validity, construct validity, and criterion validity (3–5).

The development of an instrument is carried out if the author finds a phenomenon, if the instrument has not been developed, or if the instrument already exists but the applications in different cases. Instrument development is carried out in steps: clear objectives, creating an empirical framework, using literature sources, synthesizing appropriate content and scales, using experts to review accuracy, and recruiting participants to conduct validity and reliability tests (6). Quantitative, qualitative, or combined approaches are ways of conducting content validity tests. The validity test in this study was used to assess the use of the app. An interview guide was used to assess pregnant women's experiences

with anemia. The themes from the interviews will be used as a reference for app development. The health application developed is a website-based application for educating pregnant women about the concepts of anemia, prevention, complications, and nutrition equipped with a reminder to take iron tablets. The developed application needs to be tested on its usability so that it is valid and reliable to be applied to pregnant women.

Based on the literature, many instruments are used to measure application usability. One instrument that has been developed is the Mobile Health App Usability Questionnaire (MAUQ) (2). This instrument has been applied to assess the development of eye self-assessment applications, support breastfeeding and promote eye donation, fall risk, postoperative and cervical cancer patients (7–10). The application has been translated and tested for validity into French, Chinese, German, and Malaysian but no one has translated it into Indonesian. Based on literature study, the author has not found MAUQ applications in assessing health applications in pregnant women in Indonesia. The study aims is to transcribe, validate, and test the Mobile Health App Usability Questionnaire (MAUQ).

## MATERIALS AND METHODS

### Sample

The study involved four linguists for translation, five experts to test validity and 30 pregnant women to test reliability.

The author develops a process that includes 9 steps: (1) preparation, (2) forward translation, (3) synthesis, (4) back translation, (5) back translation review, (6) target language phrase revision, (7) harmonization, (8) pilot testing, and (9) completion. The adoption process of this instrument uses the TRAPD (Translation, Review, Adjudication, Pretesting, and Documentation) steps (11). MAUQ was developed by Zhou et al., (2019) which consists of 21 statement items and 3 dimensions. This instrument consists of eight satisfaction statement items, six system organization statement items, and seven efficiency statement items (12). This instrument uses a Likert scale with a range of one to seven consisting of one (extremely strongly agree), two (strongly agree), three (agree), four (neutral), five (disagree), six (strongly disagree), and seven (extremely strongly disagree) (2,12). The authors obtained permission via email from the original instrument developer. The English questionnaire was translated into Indonesian according to international guidelines for adaptation. The steps in the translation process were: Firstly, the instrument was translated from the original English into Indonesian by involving two language experts. Secondly, two linguists were asked to translate the instrument from Indonesian to English. Then the experts equalized perceptions through if there were any discrepancies for decision makers (13).

The internal validation process involved five health experts. The content validity process was carried out by using a questionnaire to assess the screening and education applications that had been developed. The content validity test involves five experts (Doctor, Midwife, Nurse, Nutritionist, and Maternity Nursing Doctor) (14). The internal validity assessment is said to be good if the value is 0.7 (15).

The reliability of the instrument is determined by conducting a reliability test. This process involved 30 pregnant women at the health center in Yogyakarta, Indonesia. Participants were asked to use a questionnaire to assess the screening application and education tool. Reliability test analysis using Cronbach's alpha with a sample of 30 participants, the Cronbach's alpha coefficient value is set ( $>0.60$ ) (16,17). The process of MAUQ translation, validity, and reliability testing is attached in Figure 1. This research has obtained ethical permission from STIKES Bethesda Yakkum with no. 85/KEPK.02.02/VIII/2023.

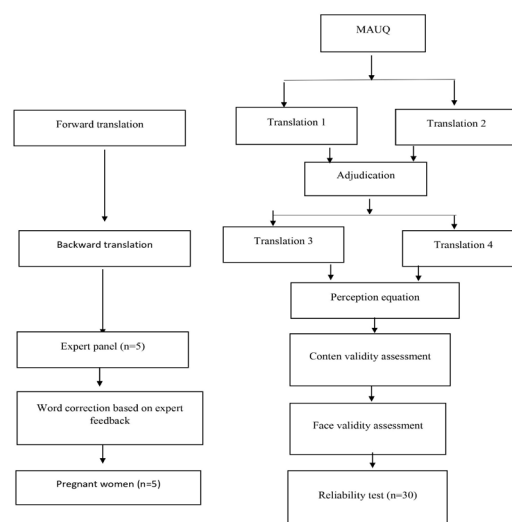


Figure 1. MAUQ translation process, validity and reliability testing

## RESULTS

### Characteristics of the experts

This study involved five linguists in translating the instrument into culturally appropriate Indonesian. The experts involved in the expert panel consisted of five people with bachelors and doctoral education backgrounds. The experts have worked for more than 15 years and have clinical or academic experience. The experts worked in universities, Yogyakarta city health department, and community health centers.

### Respondent Characteristics

There were 30 pregnant women involved in this study, most were aged between 25-35 years 28 (93.2%), secondary education 17 (56.7%), occupation housewife 24 (80%), salary in the range of regional minimum wage (Rp.1,981,782-Rp. 3,000,000), third trimester 18 (60%), multigravida 17 (56.7%), and no history of abortion

25 (83.3%). Meanwhile, the history of childbirth and the number of children had the same number and percentage. The history of first childbirth and never giving birth is the same, namely 11 (36.7%) each. The number of the children was 1-2 and never 11 (36.7%) each. Reliability test participant data is in Table I.

**Table I: Demographic Characteristics of Participants reliability test**

| Characteristic                          | Value n (%) |
|-----------------------------------------|-------------|
| <b>Age</b>                              |             |
| Risky gestational age (<20 and >35year) | 2 (6.7)     |
| normal gestational age (25-35 year)     | 28 (93.2)   |
| <b>Education</b>                        |             |
| Basic education (SD-SMP)                | 2 (6.7)     |
| Middle education (SMA)                  | 17 (56.7)   |
| Higher education (D3-S3)                | 11 (36.7)   |
| <b>Employment</b>                       |             |
| Housewife                               | 24 (80)     |
| Employ                                  | 6 (20)      |
| <b>Household</b>                        |             |
| Less than the regional minimum wage     | 6 (20)      |
| Regional minimum wage ranges            | 14 (46.7)   |
| Over regional minimum wage              | 10 (33.3)   |
| <b>Gestational Age</b>                  |             |
| First Trimester                         | 4 (13.3)    |
| Second Trimester                        | 8 (26.7)    |
| Third Trimester                         | 18 (60)     |
| <b>Gravida</b>                          |             |
| Primigravida                            | 11 (36.7)   |
| Multigravida                            | 17 (56.7)   |
| Grandemultigravida                      | 2 (6.7)     |
| <b>Parity</b>                           |             |
| None                                    | 11 (36.7)   |
| Primigravida                            | 11 (36.7)   |
| Multiparity                             | 8 (26.7)    |
| <b>Abortion</b>                         |             |
| 0                                       | 25 (83.3)   |
| 1                                       | 4 (13.3)    |
| 2                                       | 1 (3.3)     |
| <b>Number of Children live</b>          |             |
| 0                                       | 11 (36.7)   |
| 1-2                                     | 11 (36.7)   |
| >2                                      | 8 (26.7)    |

## Translation

The translation process is carried out from the original English language to Indonesian through two processes. The first translation involved two experts in English who have been teaching for more than 10 years. The researcher conducted a perception equation with the interpreters, who then conducted a perception equation. The backward translation process was continued by involving two native Indonesian speakers, the first was a nursing lecturer and the second was a computer expert. The backward translation that has been done is changing the Indonesian version of MAUQ to English, where the two people who do this translation have never seen the original version of MAUQ in English. Cross-cultural adaptation was carried out with a meeting between linguists, and four statement items needed to be reworded. The corrected statements are numbers 13, 14, 18, and 19. The statements are 13. The application allows me to use all the features, 14. The application

has all the features and capabilities I expect, 18. The application makes it easy for me to communicate with healthcare providers (admin) and no 19. The application makes it easy for me to communicate with health care providers (admin). In this process, an agreement has been made between experts. This process resulted in 21 MAUQ statement items in Indonesian.

## Content validity and Content validity

The content validity of the index in this study was conducted by involving five health experts. The researcher sent formal requesting permission and the instrument. The researcher used the MAUQ instrument to assess the application that the research team had developed. The application that has been developed is called the Screening and Education Tool (SEAT) Application, which is an application that contains the concepts of anemia, nutrition education, reminders to take blood supplement tablets, and discussion menus through WhatsApp. The author developed the screening and education application, which is the development of a previous application used to prevent stunting in newborns (18). This application is web-based and can be applied on a mobile phone without having to be installed. After one week of sending the instrument, the experts returned the researcher then continued with the analysis. The results of the content validity index test show: an essential of 1, relevance of 0.99, and face validity results of 0.99 in Table II and Table III.

**Table II: Assessment of Content Validity Index of M-Health App Usability Questionnaire (MAUQ)**

| No                       | Indicator | V    | Descriptions |
|--------------------------|-----------|------|--------------|
| 1                        | Essential | 1    | Valid        |
| 2                        | Relevance | 0.99 | Valid        |
| Average total assessment |           | 0.99 | Valid        |

**Table III: Results of the validity test analysis of the M-Health App Usability Questionnaire (MAUQ) Index**

| Item | The essential proportions |    |    |    |    | i-CVI | The proportion of relevance |    |    |    |    | i-CVI |
|------|---------------------------|----|----|----|----|-------|-----------------------------|----|----|----|----|-------|
|      | E1                        | E2 | E3 | E4 | E5 |       | E1                          | E2 | E3 | E4 | E5 |       |
| 1    | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 2    | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 3    | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 4    | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 5    | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 6    | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 7    | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 8    | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 9    | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 10   | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 11   | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 12   | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 13   | 7                         | 7  | 7  | 7  | 7  | 1     | 6                           | 7  | 7  | 7  | 7  | 0.96  |
| 14   | 7                         | 7  | 7  | 7  | 7  | 1     | 6                           | 7  | 7  | 7  | 6  | 0.93  |

CONTINUE

**Table III: Results of the validity test analysis of the M-Health App Usability Questionnaire (MAUQ) Index. (CONT.)**

| Item  | The essential proportions |    |    |    |    | i-CVI | The proportion of relevance |    |    |    |    | i-CVI |
|-------|---------------------------|----|----|----|----|-------|-----------------------------|----|----|----|----|-------|
|       | E1                        | E2 | E3 | E4 | E5 |       | E1                          | E2 | E3 | E4 | E5 |       |
| 15    | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 16    | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 17    | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 18    | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 6  | 7  | 7  | 0.96  |
| 19    | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 20    | 7                         | 7  | 7  | 7  | 7  | 1     | 7                           | 7  | 7  | 7  | 7  | 1     |
| 21    | 7                         | 7  | 7  | 7  | 7  | 1     | 6                           | 7  | 6  | 7  | 7  | 0.93  |
| s-CVI |                           |    |    |    |    | 1     |                             |    |    |    |    | 0.99  |

**Reliability**

This study continued with the reliability process to determine the reliability of the MAUQ instrument. Based on the results of the Cronbach alpha analysis on 30 participants, the results are satisfaction statements (0.736), system settings statements (0.758), and efficiency statements (0.756) and the total MAUQ score is 0.914 shown in Table IV.

**Table IV: Reliability test results of Screening and education tool application using MAUQ**

| Subscale of MAUQ             | Cronbach alpha |
|------------------------------|----------------|
| Usefulness                   | 0.736          |
| Ease of use and satisfaction | 0.758          |
| Interface and satisfaction   | 0.756          |
| Overall score                | 0.914          |

**DISCUSSION**

Most of the participants are pregnant women. This study will be used to assess the usefulness of the application built to prevent anemia and its complications in pregnant women. Demographic data shows that the age range of mothers is within normal limits for pregnancy. Most have a regional minimum wage income and were in the third trimester and multigravida. Previous research conducted in one of the regions in Indonesia showed that income, older gestational age, and education were associated with the incidence of anemia (19). In this study, no correlation test was conducted between demographic data and MAUQ psychometrics.

The MAUQ instrument was adopted and translated into the Indonesian version. The process carried out was by previous research, namely TRAPD (Translation, Review, Adjudication, Pretesting, and Documentation) (11). The researcher involved four linguists; two English graduate linguists who have worked for more than 10 years and two native Indonesian speakers who have English language skills. The use of an existing application that was translated into the language of the participants was recommended by previous researchers because it could save costs and time (13). The forward and backward translation process was carried out to ensure that the

instrument was easily understood by the participants. During the process, there was a slight change in the wording of items number 13, 14, 18, and 21. The instrument was improved based on the agreement of the experts. The changes made did not change the meaning of each item. The process of translating to the language used is adjusted to the instrument adopted so that it follows the objectives of the study. The process of translating an instrument must follow the translation and adoption guidelines according to the culture (20).

The validity assessment of the Mobile Health App Usability Questionnaire (MAUQ) related to essential 1 and relevant 0.99, the average overall score is 0.99. Kappa values of more than 0.74 are considered very good, values between 0.60-0.74 are considered good and values between 0.40-0.59 are considered adequate (21). The Mobile Health App Usability Questionnaire (MAUQ) instrument has been used to assess health app usage, translated and shown to be valid in various countries such as the UK, China, France, Malaysia, and Spain (8,15,22,23). This instrument test involved five experts to measure its essentiality and relevance. The overall validity test results in this study are valid (0.99). The results of the content validity test >0.07 mean that the instrument developed is easy to understand according to the target, relevant according to the domain, and clear (24). This research is supported by previous content validity tests where the results are good if the validity value is 0.7 (7,15).

The MAUQ in Indonesian retains the original instrument, consisting of 21 statement items. The instrument has three subscales, which include eight statement items assessing usability and satisfaction, six statement items assessing information system organization and seven statement items assessing efficiency. The Indonesian version of MAUQ applied to assess SEAT applications proved to have the same reliability as the original English version. The usability and satisfaction subscale obtained a result of 0.736, system organization 0.758, and efficiency 0.756, while the total MAUQ score was 0.914. This data shows that the 21 statement items are reliable because they have a value above 0.9, which is similar to previous tests of MAUQ in Spanish, Chinese, German, and Malaysian (7,21,22,25). This study retained 21 statement items from the original language, this is different from the study conducted on German participants. They made changes by reducing some irrelevant question items so that the instrument tested used 18 items (21). The Cronbach alpha score of the Indonesian version of MAUQ is higher than the Malay, German, and Chinese versions. However, this score is lower than the Spanish version of MAUQ, where the test conducted there has a value of 0.89 (8).

**Strengths and Limitations**

The translation process in this study followed the WHO translation guidelines (19, 24, 25). The Indonesian

version of the MAUQ was applied to assess health applications in pregnant women with good validity and reliability scores, however, to test external validity the authors recommend that future research apply the instrument to other health applications.

The limitation of this study is that no bivariate test was conducted to see the effect of demographic data on MAUQ scores. Future research can do further analysis to determine the effect of demographic data on the Indonesian version of the MAUQ score to get a more complex view.

## CONCLUSION

We successfully translated MAUQ into Indonesian culture. The overall validity test showed very good results. The reliability value of Mobile Health App Usability Questionnaire Indonesia version (MAUQ-I) 0.91 shows strong and satisfactory reliability. These results provide recommendations that MAUQ-I can be relied on for further research on health applications in pregnant women in the Indonesian language version or also international researchers to compare to other studies developed in different languages.

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