LIGHTHOUSE

The Modification and Psychometric Test of Anemia Complication Prevention Instruments Based on The Health Belief Model

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ABSTRACT

The high maternal mortality rate in middle-income countries is mostly caused by pregnancy complications, one of which is anemia in pregnancy. Behavioral instruments that use the health belief model are osteoporosis prevention, oral hygiene in pregnant women, and disaster preparedness. This instrument needs to be developed because based on previous literature searches it has not shown how the health belief model concept can be used to help pregnant women prevent anemia complications. This research aims to test the construct validity and reliability of the modified questionnaire for preventing anemia complications based on the health belief model. An internal validity test was conducted in Yogyakarta. Five specialists from different health fields - nurses, midwives, nutritionists, health promotion experts, and medical doctors- participated in the study. Some of the things that were done were as follows: 1) defining appropriate concepts and objectives; 2) defining and identifying domains; and 3) defining and creating items. 4) creating the measuring instrument, 5) finalizing the translation with the help of two native English speakers 7) preparing the test instrument for the content validity test, 6) running the validity test with five medical professionals, 7) Applying the Index of Content Validity (I-CVI) to the analyses. 8) Using Cronbach's alpha to conduct a reliability test on thirty pregnant women. The content validity index of the crucial indicator of behavioral prevention of consequences from anemia is one, and the relevance indicator also returns one, resulting in a total score of 0.99. Expert agreement in English has a kappa value of 0.442. Results of reliability using Cronbach's alpha of 0.807. The instrument for preventing anemia issues in pregnant women is valid and reliable, according to the study's findings.

Introduction

Sustainable development is a challenge in itself to achieve. There is a gap between the number of maternal deaths in developed countries and low-income countries (Kurjak *et al.*, 2023). The highest number of maternal deaths in the MDG region is in Sub-Saharan Africa, 546/100,000 live births, and the lowest in East Asia, 27/100,000 live births, but in developed countries such as the United States, it is 23.8/100,000 deaths (Kurjak *et al.*, 2023; Wang *et al.*, 2023). Abortion, ectopic pregnancy, obstetric problems, eclampsia and preeclampsia, hemorrhage, placenta previa, postpartum difficulties, obstetric embolism, unexplained causes, and obstetric causes are some of the many causes of maternal death (Singh, 2020). According to another study, the causes of death were non-hypertensive complications (22.1% 95% CI = 19.9%-24.2%) and obstetric hemorrhage (28.8% 95% CI = 26.5%-31.2%). Pregnancy-related infections: 11.5% (95% CI = 9.8%-13.2%) and obstetric: 18.8% (95% CI = 16.4%-21.2%) (Musarandega *et al.*, 2021). A study showed that anemia during pregnancy was a predictor of postpartum hemorrhage and postpartum hemorrhage increased the risk of maternal death 5.22 times (95% CI 2.26-12.08) (Lancaster *et al.*, 2020).

One way to avoid some of these issues during pregnancy is to avoid anemia. Pregnancy-related risks and problems can be elevated by anemia. Maternal anemia prevalence was found to be 84.84 in one study with 4473 individuals. Pregnant women may experience anemia due to various factors, including their employment, educational background, and hemoglobin levels (Jasim *et al.*, 2020). It is imperative to treat anemia as a preventive measure because, in addition to causing problems for the mother, it also has an adverse effect on the unborn child, increasing the risk of respiratory issues, small fetus size relative to gestational age, premature birth, and decreased Apgar scores (Jasim *et al.*, 2020).

Anemia during pregnancy can have severe consequences for both the mother and the unborn child, thus the researcher set out to investigate the effects of screening and education in preventing anemia-related disorders. Haryanti, Panduragan, *et al.*, (2024) found seven out of 235 articles discussing the application of the health belief model to pregnant women, but none discussed preventing anemia complications. The results of the literature study show that several disease prevention instruments are using the health belief model theory, such as preventing

osteoporosis, exercise, hypertension, and disaster preparedness (Ali *et al.*, 2020; Azadi *et al.*, 2021; Inal *et al.*, 2017b; Wu *et al.*, 2020). The author uses instruments Inal *et al.*, (2017b) which used a five-item health belief model, but this instrument did not have self-efficacy items so the researchers used the instrument that was developed by Ali *et al.*, (2020) to increase self-efficacy. The second instrument was modified to be applied to pregnant women to measure behavior to prevent anemia complications and a psychometrics test was carried out.. An instrument used by researchers to measure a variable under study is called a research instrument. Studies of the literature are used to construct research instruments. Test instruments, inventory instruments, interview guidelines, questionnaires, and interview sheets are some examples of measuring tools (Yusoff, 2019).

When an author observes an occurrence, an instrument that has not yet been produced or one that currently exists but is used in a variety of situations is developed. Clear objectives, the creation of an empirical framework, the use of literature sources, the synthesis of appropriate content and scales, the use of experts to review accuracy, and the recruitment of participants to conduct validity and reliability tests are the steps involved in the development of an instrument (Kalkbrenner, 2021; Kalkbrenner, 2023). Our initial investigation revealed that anemia still has a significant incidence—more than 20%—in certain Yogyakarta healthcare facilities. An instrument that satisfies validity and reliability standards was considered good.

Literature review

Many articles have applied the health belief model concept in their studies, here are eight of them, namely to assess vaccine hesitancy, activity barriers in pregnant women during COVID-19, breast self-examination psychometric tests for women at risk, osteoporosis prevention, exercise exercise, self-medication behavior, oral hygiene behavior, and nurse behavior in preventing cardiovascular disease (Amraei *et al.*, 2020; Firouzbakht *et al.*, 2022; Gharouni *et al.*, 2020; Juárez-García *et al.*, 2020; Mehtari Taheri *et al.*, 2021; Wu *et al.*, 2020; Xiang *et al.*, 2020; Yu *et al.*, 2022). However, the results of a literature review involving five databases have obtained seven articles that apply this concept to pregnant women, namely nutrition education, anemia prevention education with booklets, preeclampsia prevention, urinary tract infection prevention, influenza vaccine acceptance, and vaccine coverage (Haryanti, Panduragan, *et al.*, 2024). Previous research was almost the same, in this study education was carried out about the concept of anemia using booklets and counselling, then knowledge and eating frequency were measured (Nahrisah *et al.*, 2020). Different from previous research, this research provides education about the concept of anemia but is based on a health application that is equipped with nutritional status screening, daily menus, reminders to take iron tablets, and question-and-answer facilities, then measures behavior to prevent complications.

Method

This research uses a cross-sectional design. Stages of preparing the instrument that has been carried out: defining the concept and objectives, creating question items, carrying out translation, conducting index validity tests, conducting analysis, and conducting reliability tests. This research aims to test the construct validity and reliability of the modified questionnaire for preventing anemia complications based on the health belief model.

Participants

Purposive sampling is the method of sampling that is employed. Thirty expectant mothers were used in the study to evaluate dependability, five specialists evaluated validity, and two linguists performed translation. Thirty pregnant women who met the following requirements were included in the study: they had to be single, literate, willing to participate as respondents and checked out at the Wirobrajan Community Health Center. Women with heart disease, hypertension, hemorrhage, or other pregnancy-related problems are excluded from consideration. Experts in the health field, having worked with pregnant women for more than ten years, and meeting certain other requirements are the requirements for participation. The English lecturers who participated in this study were linguists with postgraduate degrees and over ten years of classroom experience.

Instruments

The investigator developed the instrument's concept and surveyed the literature. Each item's definition was produced along with the domain definitions. The author emailed the principal author to request permission. The definition of the domain and the identification of the indicators came next. The HBM (health health belief model) concept served as the foundation for the development of the tool. The disaster preparedness belief scale development instrument and two instruments for applying the health belief model concept to osteoporosis knowledge and preventive behavior were used to build the pregnant complication prevention instrument (Ali *et al.*, 2020; Inal *et al.*, 2017a). Perceived susceptibility (4 statements), perceived severity (5 statements), perceived barriers (4 statements), perceived benefits (5 statements), intention to act (6 statements), and self-efficacy (10 statements) are the six domains of the health belief model concept that were utilized to develop the instrument. There are seven negative and 27 positive statements in each of the 34 closed-ended statement elements. Likert scales with 1 representing strongly disagree, 2 disagree, 3 neutral, 4 agree, and 5 strongly agree are used for scoring. The opposite is true for negative

assertions in terms of scores. Since each subvariable is computed independently, it will receive a unique score. There are 34 questions total, and each question has a score between 1 and 5, for a total of 34–170.

Quantitative descriptive methodology was employed in this study. The Content Validity Index (I-CVI) was utilized for the analysis in this study. After consulting with five to ten specialists, the Aiken V validity value was found to be > 0.78 (Almanasreh et al., 2019). Cronbach's alpha coefficient was employed in the reliability test, and the total scale score was used to compute the graded alpha. According to Barbera *et al* (2021); Surucu & Maslakci (2020) Cronbach's alpha coefficient values are classified as follows: <5 has no consistency, 5-<6 weak scale internal consistency, 6-<7 acceptable scale internal consistency, 7-<9 has internal consistency, and 9 high internal consistency. The ethical authorization for this research has been granted by STIKES Bethesda under the number No.85/KEPK.02.01/VIII/2023.

Data analysis

The researcher used the following procedures to develop the instrument: Clear concepts and objectives must be established, domains must be defined and identified, items must be defined and generated, the instrument must be constructed, the instrument must be ready to test content validity and validity tests must be carried out with the assistance of health specialists. Utilize the Content Validity Index (I-CVI) for analysis. Analyze the agreement between two linguists using the kappa agreement test. The reliability test uses Cronbach's alpha.

Results

Result Determination Test

The research results here to answer the research question, namely testing the validity and reliability of the modified instrument for preventing anemia complications which includes: expert characteristics, respondent characteristics, translation test results, index validity test results, and reliability test results:

Table 1. The Characteristics of Reliability Test Respondents In Yogyakarta City Health Center

No	Characteristic	Frequency	%
1	**Age**		
	Risky gestational age (<20 and >35year)	2	6.7
	normal gestational age (25-35 year)	28	93.2
	Total	30	100
2	**Education**		
	Basic education (SD-SMP)	2	6.7
	Middle education (SMA)	17	56.7
	Higher education (D3-S3)	11	36.7
	Total	30	100
3	**Employment**		
	Housewife	24	80
	Employ	6	20
	Total	30	100
4	**Household**		
	Less than the regional minimum wage	6	20
	Regional minimum wage ranges	14	46.7
	Over regional minimum wage	10	33.3
	Total	30	100
5	**Gestational Age**		
	First Trimester	4	13.3
	Second Trimester	8	26.7
	Third Trimester	18	60
	Total	30	100
6	**Gravida**		
	Primigravisa	11	36.7
	Multigravida	17	56.7
	Grandemultigravida	2 (	6.7
	Total	30	100
7	**Parity**		
	None	11	36.7
	Primigravida	11	36.7
	Multiparity	8	36.7
	Total	30	100
8	**Abortion**		
	0	25	83.3
	1	4	13.3
	2	1	3.3
	Total	30	100
9	**Number of Children live**		
	0	11	36.7
	1-2	11	36.7
	>2	8	26.7
	Total	30	100

Qualities of the professionals

This study involved the translation of the instrument into a culturally suitable form of Indonesian by five linguists. The expert panel consisted of five individuals with doctorates and bachelor's degrees in education. The experts in the field come from academic or clinical backgrounds and have over 15 years of work experience. The experts worked for the municipal health department of Yogyakarta, universities, and community health centres.

Features of the respondent

The study included thirty pregnant women; the majority were between the ages of 25 and 35 (n = 28), with 17 (56.7%) having completed secondary education, 24 (80%) working as housewives, and salaries within the range of the regional minimum wage (Rp. 1,981,782-Rp. 3,000,000). The women were also in their third trimester (18/60%), multigravida (17 (56.7%), and had never had an abortion (n = 83.3%). In the meantime, the number and percentage of children born and the history of childbirth remained the same. There has been an equal number of first births (11, 36.7%) and no births at all. There were 1-2 children, never 11 (36.7%) per child. Table 1 contains participant data for the reliability test.

Translation

After the update, the translation procedure is complete. The language translation was completed by two linguists. Both instruments were modified during this procedure by a panel of experts and researchers according to theoretical ideas. The goal of language translation is to ensure that the participant's language is appropriate to the research and does not convey any additional meaning. The anemia complication prevention tool that was created was translated backwards into Indonesian. The agreement between the two English language experts was considered to have a sufficient kappa value, namely 0.442.

Validity of content

Five health professionals with more than 15 years of professional experience were included in the validity test. These specialists participated in both the content validity test and the instrument development process. The health belief model concept is used in the instrument that was taken from earlier research to assess osteoporosis patients and prepare them for disasters. An instrument for preventing anemia-related complications was developed using these two tools as well as the idea of the health belief model. Following the completion of the instrument development process, specialists were consulted and asked to perform analyses and internal validity assessments. The content validity index test results were as follows: face validity, essential 1, and relevance 0.99.

Reliability

In October 2023, thirty pregnant women participated in the reliability test, which was carried out at the Wirobrajan Community Health Center. The goal of the study was presented to pregnant women who met the inclusion criteria, and if they agreed to participate, they were asked to sign a consent form. In 45 minutes, the researcher went over the goal of the exercise and how to complete as many as 34 items on the instrument. once the instrument has been finished and given back. After verifying that the filling was complete, the researcher examined 0.80. This result's interpretation falls within a significant range.

Discussion

The instrument's internal content validity was tested and developed by the researcher with the assistance of five experts. Table 1 illustrates the multidisciplinary backgrounds of the experts who measured content validity, the experts included the nutritionists, midwives, doctors, and nurses. The experts have worked with a range of 18–20 years and have doctorate, master's, and bachelor's degrees. They are also experts in clinics that often interact with expectant mothers. The expert panel was chosen to assess the content validity of the instrument and offer feedback. When assessing an expert's ability to contribute to the instrument, work experience is crucial. When testing an instrument, it's critical to involve professionals to assess the instrument's quality (Almanasreh *et al.*, 2019). To boost trust, construct validity was investigated in this study to ascertain the instrument's adequacy and utility for measurement (Almanasreh *et al.*, 2019). Five experts participated in this study, which is in line with other research that suggests an instrument should be developed by five to 10 experts (Almanasreh *et al.*, 2019).

According to one of the sources, an instrument is created if the author discovers a phenomenon while the instrument is undeveloped or when the instrument is produced but is used in a different situation. Clear objectives, the creation of an empirical framework, the use of literature sources, the synthesis of appropriate content and scales, the use of experts to review accuracy, and the recruitment of participants to conduct validity and reliability tests are the steps involved in the development of an instrument (Kalkbrenner, 2021; Kalkbrenner, 2023). Research instruments are tools that scientists use to measure a variable of interest. The research instrument was created through a literature study. Some examples of measuring instruments are test instruments, inventory instruments,

interview guides, questionnaires, and interview sheets (Yusoff, 2019). The health belief model concept was used in the construction of the instrument for preventing anemia problems, which measures the implementation of screening and education tools. The program was created as an extension of an earlier program that focused on screening and teaching to prevent stunting among children in Yogyakarta (Haryanti *et al.*, 2023; Haryanti *et al*, 2024).

The health belief model served as the basis for the development of the instrument used to measure complication-prevention behavior. The researchers created this tool because the researchers on reviewing the literature could not find any measurement tool for behavior related to preventing complications. Instruments that had already been produced were accepted and improved by researchers (Ali *et al.*, 2020; Inal *et al.*, 2017). The researcher used theoretical ideas such as perceived vulnerability, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action in the development of this instrument (Ali *et al.*, 2020).

In research, the purpose of the validity test is to ascertain the accuracy of the instrument being employed. Construct validity, criteria validity, and content validity are the three categories of validity measurements. The content validity index (CVI), kappa modification, and content validity ratio (CVR) can all be used to measure expert judgment (Almanasreh *et al.*, 2019). The development of behavior shapes one's personality and affects how decisions are made (Pratami *et al.*, 2021). It is anticipated that intervention or education will change someone's behavior more positively or healthfully. It is imperative to reassess if an educational program fails to influence participants' behavior. To change their behavior and prevent problems from anemia, study participants received information using a web-based application. Clearly defining concepts and objectives is the first step in the development of an instrument. The process begins with a literature review using the idea of health belief models. Furthermore, two instruments have been adopted and adapted based on participants' needs.

The aggregate validity value of each item is displayed in Tables 3 and 4. Table 4's item number 3 (items 4, 6, 8, 10, 11, and 12) has a value of 0.93, while the other items have 1. The process of evaluating each research instrument item is used to calculate the content validity index. Each of the seven questions has an evaluation of 0.93. "I am not susceptible to anemia complications and My diet and lifestyle protect me from anemia complications" were the statements that were included in the Perceived susceptibility domain. A statement like "Moderate anemia in pregnant women does not cause complications" is part of the domain of perceived severity.

Three more statements, all of which have a perceived benefit score of 0.93, are "I can easily change my unhealthy habits," "I do not have enough money to consume foods high in iron because they are expensive, like chicken liver, nuts, and meat," and "Preventing anemia complications in pregnancy is difficult." However, based on advice from experts, the validity test's findings fell between 0.93 and 1. Every item on the anemia prevention behavior questionnaire was legitimate (Kalkbrenner, 2021). The validity of each item can be evaluated individually and collectively using the content validity index (CVI) (Mm & Jahangiri, 2018).

The two English language specialists' agreement test results fell within the 0.44 range. These findings demonstrate that the instrument may be effectively employed in Indonesian and that there is good agreement among researchers. The translation procedure was done in such a way as to ensure that participants did not encounter any unclear or misleading terms; experts have previously indicated that a score of four falls into the moderate range (Zhao *et al.*, 2022).

With a Cronbach alpha of 0.80, the reliability test results in this study were obtained. According to Azadi *et al.*, (2021); Jasim *et al.*, (2020) other experts, the reliability value interpretation is within the considerable range. For this study, test-retest reliability was assessed. The valid reliability coefficient for the 60-item scale after three weeks of testing is 0.73 (Inal *et al.*, 2017). This outcome is comparable to that of hypertension patients treated with the health belief model, who saw a 0.70 Cronbach's alpha result (Azadi *et al.*, 2021).

Conclusion

The findings of this study show that the modified instrument for preventing anemia complications is valid and reliable. Researchers only involved five health experts in developing this questionnaire, so it is possible that this questionnaire could be developed better in the future.

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