Original Article

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Development and Validation of a Revised VAS-Anxiety Measurement Tools for Preschool Hospitalized Children

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ABSTRACT

Background: The visual analogue scale (VAS) instrument is proven to be reliable in measuring anxiety. Experts argue, however, that measuring the aspect of psychosocial trauma in a different language has limitations, especially among hospitalised children under the age of six. As a result, the study sought to revise and validate a trustworthy, child-friendly VAS for use in Indonesia. **Methods:** A preliminary survey was conducted among 81 respondents that met the inclusion criteria. An expert committee reviewed and revised the VAS-Anxiety-Indonesia for sensitivity and content validity. Thus, the Centre of Indonesia Language was charged with forward and backward translation from English to Indonesian and vice versa. In this study, data were collected in two phases. The first was the preliminary data collection from 21 respondents for face and content validity. The second phase recruited 60 respondents with retests and confirmations of modified items and components of VAS-A-Indonesia. Statistical analysis used a Pearson correlation coefficient of 0.05. The second test performed the content validity index, item correlation analysis, internal consistency for reliability testing, and Exploratory Factor Analysis. **Results:** The instrument consists of 12 items. With three factors to measure anxiety, they accounted for 65.2% of the overall variance. The content validity index was 0.825 (Aiken's V), item correlations ranged from 0.354 to 0.686, and Cronbach's alpha was 0.837. **Conclusion:** The Indonesian version of the VAS-A was a valid and reliable instrument for assessing the anxiety of preschoolers admitted to hospitals.

Keywords: Visual Analog Scale; Anxiety; Children; Hospitalization; Validity and Reliability

INTRODUCTION

Hospitalization for pre-schoolers is very stressful and potentially traumatising due to the hazardous new environment and medical procedures that can trigger anxiety, rage, powerlessness, and a loss of control (Godino-Iáez *et al*., 2020; Islaeli *et al.*, 2020). The child is unable to do his routine activities Nurse Key (2020), and the worst scenario is when the children watch strangers in white uniforms in an unfamiliar environment (Kleye *et al.*, 2021) and are afraid of needles and syringes (Leibring & Anderzén-Carlsson, 2022). A preschooler also experiences fears at a child's developmental stage, such as fear of darkness (Csonka, 2021). Fear can be reflected in the child's behavior in the form of anxiety, increased resistance, or attempts to escape. Aggression, trouble sleeping or eating, or fear can be expressed through children's facial expressions and gestures and physiological changes in their bodies (Salmela, Aronen, & Salanterä, 2011). However, the response is highly individualised and dependent on the child's developmental age, previous illness history, and coping skills in the hospital (Kleye *et al.*, 2021; Leibring & Anderzén-Carlsson, 2022).

Hospitalization causes children to be separated from their parents and frequently results in substantial emotional changes in children, including such anxiety, which can result in both short- and long-term trauma (Handayani & Daulima, 2020). Anxiety is the most frequently reported adverse reaction since elevated anxiety impairs children's psychological health and hinders their success in medical care. The anxiety also increases children’s uncooperative attitudes and

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negative feelings toward health care professionals while concurrently lowering patient satisfaction (Kleye *et al*., 2021; Mahakwe *et al.*, 2021). Therefore, it is crucial to understand the level of anxiety felt by children during hospitalization. There have been several instruments measuring anxiety in the world. The most comprehensive measurements of anxiety are currently self-report instruments that provide the most direct access to the subjective experiential states of an individual in assessment situations. Its strong psychometric properties are relatively inexpensive and easy to manage and score (Mahakwe *et al*., 2021). The Visual Analog Scale-Anxiety (VAS-A) instrument is not difficult to administer, is easy to understand for children, and is a reliable method for evaluating subjective feelings, and is suitable for aged 3-7 years (Jiang *et al.*, 2021; Li *et al.,* 2016). VAS-Anxiety is a standard assessment tool instead of many other VAS versions. With one question item, this instrument is reliable and valid in measuring anxiety, VAS of a computerized version(Abend *et al.*, 2014), VAS can assess perioperative patient anxiety (Croke, 2020), as the VAS dental anxiety (Takemura *et al.,* 2021). In another study, the validity and reliability of the Anxiety instrument found differences in the characteristics of the VAS instrument. The other two anxiety instruments demonstrate that the VAS instrument validated and used globally is simple, easy to understand, and takes only one minute to complete. However, some experts explain that the more items on the measurement scale, the higher the level of reliability value will be (Budiastuti Dyah, 2018).

Therefore, this research aimed to develop and test a VAS-Anxiety Instrument for hospitalized children based on hospitalization theory and an anxiety instrument that focuses on children's fears and signs of anxiety. The presence of an anxiety sign item is intended to confirm the responses of participants to the first item question. The Visual Analog Scale for anxiety-revised (VAA-R) assessing anxiety in children and adolescents with school refusal has long been developed by revising the original VAS to eleven question items(Bernstein & Garfinkel, 1992), and the VAS Voice consists of four items (Naunheim *et al.*, 2020). These items scale showed the symptoms and cause of the anxiety during care in children.

METHODOLOGY

The scale-development process was carried out in three phases. The first phase develops the instrument items based on literature reviews and pre-existing instruments. The second involves the expert panel, and the third is the psychometric analysis(Acosta-Banda *et al.*, 2021; Morgado *et al.*, 2017).

The First Phase : Development of VAS-Anxiety Items

This instrument item was developed from three sources: The first is the original VAS instrument, the second is a literature review, and the third is a review of existing instrument items. The original VAS for anxiety was a 100-mm horizontal line at the opposite end ("jittery/nervous" versus "steady"). unpublished instrument and other references ("anxious" and "calm"), (left, least extreme, and right, most extreme), children should mark the lines to indicate their anxiety level (Bernstein & Garfinkel, 1992), and the horizontal line should be pointed to show their situation (Mahakwe *et al.*, 2021).

The revised VAS-Anxiety instrument develops twelve items in Indonesian. which consists of three components. Component 1 (fear with five items), component 2 (anxious mood or worry with three items), and component 3 (physiological response with four items) Each item is a 100-mm horizontal line. At the end of the line, 0 indicates no anxiety; the other side shows anxiety, and the ratings account for anxiety level. In addition, the instrument was developed in Indonesian. The translation was carried out at the Center of Language at Mandala Waluya University. With the permission of the book's author, who published the instrument and translated it into Indonesian, this study included excerpts from the questionnaire (Nursalam, 2013; Ramdan, 2019). The items were translated forward and backward by expert translators to ensure that the meaning of each item remained consistent and accurate throughout the publication process.

The Second Phase: Expert Panel

Expert judgement determines the validity of the content. In an expert review, some grammatical and spelling issues, as well as the correction of some answer descriptors, were fixed to improve the instrument's quality (Acosta-Banda *et al.,* 2021). The content validity is assessed based on how well the instrument content represents the overall subject, and the knowledge level (aspects) will be measured. Three experts conducted the content validity test: pediatricians, clinical psychologists, and senior nurses with over twenty years of experience. Apart from serving patients in the hospital, the

experts are also a teaching team in their respective fields. The content validity was determined using the content validity index (CVI) with a 4-point rating system of relevance level (from 1 = irrelevant and 4 = highly relevant), then re-recorded as 1 (relevance scale 3 or 4) and 0 (relevance scale 1 or 2). The CVI (I-CVI) judgement of the item is calculated as the number of experts giving the relevant rating divided by the total number of experts; the I-CVI is not lower than 0.78 (Yusoff, 2019) or 0.75 (Acosta-Banda *et al.*, 2021). In this study, the instrument was approved after the experts' revision process. Aiken's V:0,825 content validity index was confirmed (Acosta-Banda *et al*., 2021). Experts advise to more specific questions so that child is easier to understand, such as the content "Does Your sleep is disturbed?" revised content "Have you ever had a nightmare at the hospital?".

The Third Phase: Psychometric Analysis

After the expert panel's assessment, a preliminary test was conducted with a convenient sampling method on 21 respondents who met the inclusion criteria. Preliminary tests were conducted to determine whether the items were understood. The trial showed that participants (n = 21) had no difficulty understanding all items. Most of the participants were men (n = 16). The interviews showed that these items were understood by the participants, as was the intention of the research team. Further analysis of the revised Indonesian version of the VAS-Anxiety was carried out later on 60 respondents. The analysis method of item correlation evaluates the validity of the constructs (Igwesi-Chidobe *et al.*, 2021; Yusoff, 2019), the exploratory factor analysis (EFA), and Cronbach's alpha coefficient for internal consistency reliability reflecting the questionnaire items for each other (Igwesi-Chidobe *et al.*, 2021; Tsang, Royse & Terkawi, 2017).

Setting and Samples

In this study, two groups of participants were obtained using a convenience sampling method. Twenty-one and sixty respondents were recruited for the preliminary and exploratory tests, respectively. The reliability coefficient was determined through a pilot test by collecting 20 (Acosta-Banda *et al.*, 2021), 13 participants in a preliminary study (Takemura *et al.*, 2021), and 20 to 30 subjects not included in the research samples (Bolarinwa, 2015) Based on (Tsang, Royse & Terkawi, 2017), respondent-to-item ratio advice ranged from 5:1 there were a total of sixty respondents. The inclusion criteria of this study were children aged three to six years, having their first experience of being hospitalized, receiving intravenous therapy, and not having a diagnosis of a chronic disease. Each child is directed and accompanied by the parent during the process of filling out the instrument. This study was conducted at hospitals considered the first line of service from September 2020 to February 2021.

Data Analysis

The descriptive analysis summarizes the characteristics of the sample. All statistical tests were conducted with an alpha level of 0.05. Analysis performance was measured by the content validity index (CVI) with a four-point scoring system (from 1=not relevant to 4 = highly relevant). Item-total correlation coefficients and Cronbach's alpha after item revisions: items with a weak total item correlation coefficient or less than 0.30 will be revised or removed (Cannavan *et al.*, 2021; Tsang, Royse, & Terkawi, 2017). The Indonesian revised VAS-Anxiety factor structure was determined using principal component analysis and varimax rotation.An absolute value was set above 0.40. the data were analyzed by SPSS software version 20.

Ethical Consideration

In this study, researchers obtained ethical approval from the hospital ethics commission on September 28, 2020, with the number: 462/RSA-III/SK/IX/2020. This survey maintained anonymity, and the data collected was kept private and used for research purposes only. The parents of the participants signed informed consent forms before the research process began.

RESULTS

Characteristics of Participants

A preliminary test was carried out with 21 respondents, and the second validity was performed with 60 respondents. The preliminary tests tested the construction, face, and content of the items. The second validity test used an exploratory test. The results of the characteristics of patients are shown in Table 1.

Table 1: Characteristics of Participants (Preliminary tests: n=21, Second for EFA: n=60)

Characteristics	n		%	
	Preliminary test	Second Test Exploratory	Preliminary test	Second Test Exploratory
Gender				
Male	16	35	76.2	58.3
Female	5	25	23.8	41.7
Age (Years)				
3-4	9	38	42.9	63.3
5-6	12	22	57.1	36.7
n: number of participants EFA: Exploratory factor analysis				

Item Analysis

The corrected item-total correlation value determined the validity of each question item. A correlation coefficient of <0.30 indicates a weak correlation (Cannavan *et al.*, 2021). Table 2 shows the results of the item-total correlation of the preliminary and second validity tests. The correlation between each question item on the children's anxiety variable was from Q1 to Q12. This table shows that any items should be revised.

Table 2: The Item Analysis and Reliability of The VAS-Anxiety Revised

Item	Item-Total Correlation	Cronbach's Alpha If Item Deleted Test	Item-Total Correlation	Cronbach's Alpha If Item Deleted Test
	Preliminary Test		Secondary Test Exploratory	
Cronbach's Alpha	0.804		0.837	
Q1	0.496	0.786	0.354	0.834
Q2	0.805	0.750	0.466	0.828
Q3	0.428	0.792	0.506	0.824
Q4	0.174	0.812	0.421	0.831
Q5	0.140	0.824	0.515	0.823
Q6	0.333	0.800	0.527	0.823
Q7	0.530	0.783	0.436	0.830
Q8	0.141	0.810	0.449	0.829
Q9	0.469	0.789	0.488	0.826
Q10	0.402	0.795	0.486	0.826
Q10	0.674	0.765	0.659	0.812
Q11	0.761	0.756	0.686	0.809
Q12	0.761	0.756	0.686	0.809

Weak Correlarion : <0.03 Cronbach's alpha : >0.70

On preliminary tests, items Q4, Q5, and Q8 showed findings with weak correlation (<0.30). Items having a weak correlation with the overall questionnaire score should be removed or revised (Tsang, Royse & Terkawi, 2017). Other reference argue that the higher the number of items on the measurement scale, the higher the reliability value(Bolarinwa, 2015). Therefore, in researcher decided to save and revise the context of the question. The items were revised as the advice from the three experts. (Q4: "Do your hands sweat?" was revised to "Are your palm sweaty?"), (Q5: "Do you feel dizzy?" revised to "Does your head feel dizzy?), (Q8: "Are you afraid of being alone" was revised to "Are you afraid when you are alone?). As the second validity test, all revised items indicated a higher correlation coefficient ranging from 0.354 to 0.686, showing moderate correlation (Cannavan *et al.*, 2021).

Construct Validity

The Kaiser-Meyer-Olkin (KMO) values were 0.69, and Bartlett's test of value was X2 = 389.64 (p <0.001). Both KMO and Bartlett's tests presented that the data had adequate sampling and could be analyzed with EFA. This test had a minimum acceptable score of 0.50(Kaiser, 1974), above 0.60 (Howard, 2016). The EFA showed a three-factor solution in our sample, which accounted for 65.2% of the total variance. After the Varimax rotation using the Principal Component Analysis method, this study found that the variables/items were closely related to the factor. So, the first factor included five items, the second had three items, and the third had four items. Each items loading factor varies between 0.463 and 0.941. At least three items with loading greater than 0.40 should be retained factors. Other factors should not be overloaded by these(Samuels, 2016). Show in table 3.

Table 3: Exploratory Factor Analysis (EFA) test of the final VAS-Anxiety Revised

No	Items	Factors		
		1	2	3
1	How anxious are you feeling now?			0.711
2	Do you feel palpitations?			0.463
3	Do you feel congested?			0.553
4	Are your palms sweaty?		0.525	
5	Does your head feel dizzy?	0.7		
6	Are you afraid of the dark?		0.897	
7	Do you lack appetite?			0.724
8	Are you afraid when you are alone?	0.824		
9	Do you feel trembling?	0.603		
10	Are you afraid to sleep alone?		0.941	
11	Have you ever had nightmares during at hospital?	0.859		
12	Are you afraid of doctors/nurses?	0.861		
	Initial Eigenvalues			
	% Of Variance	36.707	16.707	11.844
	% Cumulative	36.707	53.414	65.258

Factors: 1: Fear, 2: Anxious Mood, 3: Physiological Response, Loading factor: >0.40

Reliability Test

Item analysis showed that the internal consistency of the revised VAS-Anxiety instrument with the Cronbach's alpha coefficient value of 0.837 was more significant than 0.70. Therefore, the developed VAS-Anxiety instrument was

considered reliable. The questionnaire was used as a research instrument if it had a reliability coefficient of 0.70 and above (Chung *et al.*, 2021; Igwesi-Chidobe *et al.*, 2021).

DISCUSSION

The study aimed to develop an instruments and perform its reliability tests. The instrument development resulted in 12 scale items, one item was the original question from the VAS-Anxiety instrument and eleven questions collected from a popular theory, tested for validity and reliability. The VAS-Anxiety instrument was revised in Indonesian with appropriate psychometric properties and proven through validity and reliability tests. The final version has a correlation coefficient between 0.354 to 0.686 and internal consistency with Cronbach's alpha 0.837. These results were consistent with previous studies. The reported valid evidence has been used in several different studies, with a correlation coefficient (r) of 0.44-0.60 between the VAS and the State-Trait Anxiety Inventory (STAI) (Abend *et al.*, 2014), The change in HAMA scores was strongly linked with Clinical Useful Anxiety Outcome Scale-D (CUXOS-D) scores (r =0.61, p <0.001) (Zimmerman *et al.*, 2019). The correlation coefficient for item construct validity range from 0.529 to 0.727, and Cronbach's alpha reliability was 0.756 (Ramdan, 2019).

The Preliminary test for the first item question (how anxious do you feel right now?) has an item correlation value (0.49) and decreased in the second test (0.35). However, both were in the moderate category(Cannavan *et al.*, 2021; Igwesi-Chidobe *et al.*, 2021). The experts agreed that the relevant item was the anxiety that the researcher wanted to know. However, the result was possible for the respondent to deny the feeling of anxiety (Salmela, Aronen & Salanterä, 2011). The hospitalized pre-school children interpreted a form of anxiety with rejection where they expressed their anxiety in contradictory ways or denied it. It can be seen in Cronbach's alpha if the item on the deleted column increase from (0.786 to 0.834). This column is considered necessary, representing the reliability coefficient of the Cronbach alpha scale for internal consistency with an increase in Cronbach alpha if items deleted on each item will cause the value of the Cronbach alpha coefficient to increase (Gliem & Gliem, 2003).

This study also found that the preliminary test items (Q4, Q5, and Q8) were weak in correlation value of <0.30. However, revisions were made according to the previous discussion on the results item analysis points. In the second test, there was an increase in the value of both the item-total correlation and Cronbach's alpha if item deleted column. Moreover, Cronbach's alpha coefficient value increased from the preliminary and second tests (0.804 to 0.834), meaning acceptable reliability (Acosta-Banda *et al*., 2021).

The four components with eigenvalues are more than one in EFA analysis. However, Rotation sum of Square Loadings had three factors. So this study used the rotated eigenvalues (Igwesi-Chidobe *et al.*, 2021). No items were deleted due to the three-component rotated matrix, with a loading factor of more than 0.40. Furthermore, each item only had a high factor loading on one factor. This factor was labeled factor 1 (fear), factor 2 (Anxious mood), and factor 3 (Physiological). Similar to the factors on the RSMC instrument (Bernstein & Garfinkel, 1992). Factor 1 was appropriate in the study (Marja Salmela *et al.*, 2010) that hospitalized children would cause fear of separation from family and fear of being left alone, fear of doctors /nurses, and nightmares. So, the question items became "Does your head feel dizzy"? In addition, "Do you feel trembling"? had a significant factor loading in the factor 1 group, so that these two items were included in the fear factor. In the HAM-A instrument, these two items are distinguished on their autonomic symptoms and behavior. Factor 2, as the developmental theory indicating the typical fear in preschool-age development (6, 32) was fear of darkness and fear of sleeping alone. The two fears were interrelated that the rooms darkness could "ghosts", which made the child more worried.

Moreover, Factor 3 was a physiological response. When someone experiences feelings of anxiety with the question item "do you lack appetite?", "how anxious do you feel right now?", "do you feel getting short of breath?" and "does you feel palpitations?". One of the disadvantages of EFA analysis is the difficulty in defining the factors. The names of factors may not accurately reflect the variables that make up the factor (An Gie Yong, 2013). However, Variables with higher loadings are seen as more significant. They have an enormous impact on the name or label chosen to describe a factor (Hair *et al.*, 2014).

However, this research was limited to the Covid 19 pandemic. The researcher had less contact with patients and used

personal protective equipment, e.g., eye patches, gogles, surgical masks, gowns, and gloves. Such a condition was ineffective in communicating with children who appeared more anxious. The question items were 12 items to be more flexible in determining more specific items. There is still a lack of experts who give judgments.

CONCLUSION

The Indonesian version of the VAS-Anxiety instrument was based on review and expert judgment literature consisting of 12 question items. The preliminary test results found three items with a weak correlation (<0.30). All three items were based on expert advice. Secondary test showed excellent validity and reliability results (0.837) in the appropriate sample. The exploratory factor analysis (EFA), after varimax rotation with the principal component analysis method, found at least three items with loading factor (>0.40), others factor did not burden each factor. This instrument formed three factors, namely factor 1 (fear : 5 items), factor 2 (worry : 3 items), and factor 3 (physiological response:4 items), that can measure the anxiety of pre-schoolers who are hospitalized.

Conflict of Interest

The authors declare that they have no conflict of interests.

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