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Developing an Instrument to Measure Maternal Knowledge and Attitude of Oral Health on Children Under 3 Years

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Abstract

Objective Parental knowledge, belief, and attitude about oral health affect children's dental cleaning behavior. Further research on maternal knowledge and attitude about early-age children's oral health has been suggested to identify factors related to pediatric dental and oral health. For that purpose, a measurement instrument is needed. The research aimed to develop an instrument to measure maternal knowledge and attitude about under 3-year-old children's oral health.

Materials and Methods Using a validity-based approach, we held a series of basic consultation (workshops and interviews) to identify the conceptually different domains. Instrument items were derived from relevant theories. Cognitive interviews were conducted to ensure that the items were properly understood. The items were first tested among the population calibration samples (n = 150). All instrument items were analyzed for reliability and validity.

Results In total, 15 items were derived from Bloom's theory of learning and were developed for the knowledge instrument, while 10 others were developed for the attitude instrument. The reliability analysis yielded Cronbach's α scores of 0.620 for the knowledge instrument and 0.565 for the attitude instrument. All items were considered valid based on Pearson's correlation test results.

Conclusion The instruments on maternal knowledge and attitude about under 3-year-old children's oral health consisted of three dimensions, respectively. Both instruments have been tested and analyzed and therefore are applicable for use.

Keywords
- knowledge
- attitude
- maternal
- oral health
- children under three

Introduction

Some theories of attitude, including the Health Belief Model and the Theory of Reason Action, have confirmed the central role of knowledge and attitude in describing behavioral change.[1,2] These aspects are specifically highlighted in assessing the role of parental knowledge and attitude about their children's health. Parents play a crucial role in giving their children the information and support needed to live a healthy life.[3]

Parental knowledge, belief, and attitude about oral health affect children's dental cleaning behavior.[4] Furthermore, parental attitude brings a significant positive impact on children's dental caries condition and gingival health.[5,6] Maternal role in promoting their children's oral habits and health has been emphasized.[7-9] Despite possible shift of role and responsibility in their family,[10] mothers still play an essential role in shaping their children's lifestyle, particularly their oral health.[7,9]

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To identify the factors related to children's oral health, further research on maternal knowledge and attitude about dental and oral health in early age children has been suggested.[11] A body of research has been conducted to study the vital impact of parental knowledge and attitude about their oral health on preschool children's oral health.[12,13] Similar studies have also been conducted on school-age children.[14,15] Information from these studies is important, especially in societies where mothers play a crucial role in raising children. Currently, several instruments to measure maternal knowledge and attitude about oral health in children have been developed though still very general. Unfortunately, a similar tool that focuses on early-age children (under 3 years) has yet to be developed. This study aimed to develop a measurement instrument to assess maternal knowledge and attitude about oral health in children under 3 years.

Materials and Methods

This research attempted to design a measurement instrument using a descriptive approach and a survey to obtain data from 150 mothers who live in Bandung Municipality, Indonesia and have children under 3 years.

Measurement Instrument

The measurement instrument developed in this research was designed to obtain information about maternal knowledge and attitude about oral health in children under three (►**Table 1**). The development of the instrument followed the following steps: measurement instrument design, content validity, formulation of psychometric characteristics, namely their validity and reliability. Items concerning knowledge were derived from Bloom's theory, based on which knowledge can be broken down into three dimensions: translation, interpretation, and extrapolation.[16] The items for the attitude instrument were derived from the cognitive-affective-conative behavioral model.[17]

Assessment

The instrument consists of 25 items and were grouped into knowledge (15 items) and attitude (10 items). The knowledge instrument used a true-false design (►**Table 2**), whereas the attitude instrument used the following Likert 5-point scale: strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD) (►**Table 3**). The instruments were thus designed to achieve the instrument's aim, namely practicality and time efficiency. In the knowledge instrument, scores are 1 for a correct answer and 0 for a wrong answer. The total score for the respondent knowledge was built by adding 15 items (ranging from 0 to 15). A higher score indicates a more positive knowledge. In the attitude instrument, for item number 1, 5, 9, and 10, the scores are as follows SA = 5, A = 4, N = 3, D = 2, and SD = 1. As for item number 2, 3, 4, 6, 7, and 8, the scores are reverse as follows SA = 1, A = 2, *n* = 3, D = 4, and SD = 5. The total score for the respondent attitude was built by adding items (ranging from 10 to 50). A higher score indicates a more positive attitude.

Statistical Analysis

Item Analysis

Item analysis is required to determine whether the items in the instrument have been well formulated. In this research, item analysis was done by calculating each item's distinguishing feature based on the item-total correlation. In calculating distinguishing feature, item-total correlation was used to determine the consistency between an item's score and the total score. Consistency was determined based on the coefficient of correlation between an item and the total score. Since each item in this research was scored based on Likert scale, correlation coefficient was obtained by using Pearson's correlation formula:

Where:

$$r_{xx} = \frac{(\sum X_1 X_2) - (\overline{X_1})(\overline{X_2})}{(\sigma_{X1})(\sigma_{X2})}$$

X_1 = total first set score
X_2 = total second set score
$\overline{X}_1$ = average X_1 score
$\overline{X}_2$ = average X_2 score
σ_{x1} = standard deviation of X_1
σ_{x2} = standard deviation of X_2

Table 1 Maternal knowledge and attitude construct

Dimension	Operating definition	Indicator	Items
Knowledge instrument			
Translation	Ability to understand a nonliteral statement	Mention differentiate	2. 3. 4. 5. 12
Interpretation	Ability to recognize information	Exemplify	1. 6. 7. 8. 14
Extrapolation	Ability to conclude information	Use a concept	9. 10. 11. 15
Attitude instrument			
Cognitive aspect	The aspect of recognizing thought, that is, knowledge and belief, based on information related to dental health	Knowledge about disease Knowledge about healthy life	1. 8. 10
Affective aspect	The aspect of emotion related to dental health	Attitude toward disease	2. 3. 5
Conative aspect	The aspect of attitude involving the tendency to act	Attitude toward disease	4. 6. 7. 9

Table 2 Items in the knowledge instrument

No.	List of statements	True	False
1	The ideal toothbrushing frequency for children between 2 and 3 years of age is once a day or whenever they are willing.		
2	The ideal toothbrushing time for children between 2 and 3 years of age is during morning and afternoon baths.		
3	High frequency of snacking on foods and drinks with high sugar content (chips, biscuits, sweets, chocolate, and boxed/bottled drinks such as juice/soda/tea) among children will affect their health and growth.		
4	The toothbrushing method for children between 2 and 3 years of age is to brush the entire surface of their upper and lower teeth with repeated backward and forward movements.		
5	Mothers must guide their children when they are brushing their teeth because, with their still limited motoric skills, children at such an age have yet to develop ideal brushing movements.		
6	To brush your teeth, you must use fluoride toothpaste, placing it along the bristles' top surface.		
7	It is recommended to give children foods that they like.		
8	After brushing their teeth, children must rinse their mouth to remove the remaining toothpaste from their mouth.		
9	Frequent snacking (on sugary foods) will accelerate dental cavity formation.		
10	Oral health will not significantly affect children's overall health and growth.		
11	Visiting a dentist regularly every 6 months is important to prevent dental decay despite the absence of toothache.		
12	In preventing dental decay, it does not matter how often my child eats as long as there is no sugar in his/her food.		
13	Frequent toothbrushing can prevent dental decay/cavity.		
14	Dental cavity with no pain in children between 2 and 3 years of age is not a source of worry because their deciduous teeth will be replaced with permanent teeth when they grow up.		
15	Dental cavities in children can be prevented only by frequent toothbrushing.		

Table 3 Items in the attitude instrument

No.	List of statements	Possible answers				
		SA	A	N	D	SD
1	It is important to maintain oral health by brushing teeth twice a day from the age of 2 to 3.					
2	In my opinion, children between 2 or 3 years of age should not always be attended when they are brushing their teeth.					
3	In my opinion, types of food will not affect my child's oral health.					
4	I let my child have snacks when he or she refuses to eat.					
5	It is recommended to brush teeth every day after breakfast and at night before sleep.					
6	For mothers, letting their children eat foods of their choice is better than letting them eat nothing at all.					
7	I seldom pay attention to my child's dental condition if there is no complaint.					
8	It is not important for my child to drink milk once a day.					
9	I give my child a balanced diet (rice, meat/fish, vegetable, fruit, and milk) every day.					
10	Dental pain will affect children's growth.					

Abbreviations: A, agree; N, neutral; D, disagree; SA, strongly agree; SD, strongly disagree.

Validity

Validity indicates whether or not a research instrument can measure the object it has been designed to measure. The higher its validity, the more accurate the instrument in measuring its object. Before being put into trial, the instrument had been assessed by three dentists from the Department of Pediatric Dentistry, a dentist from the Department of Community Dentistry, and a psychologist from the Department of Social Psychology. To assess the instrument's validity, a test was conducted by using Pearson's bivariate correlation (Pearson's product-moment correlation) in SPSS 25.0 software, by which the score of each item was correlated with the total score. The total score was the total sum of all item scores. Instrument items that correlate significantly with the total score would indicate their plausibility to support and illustrate what they had been designed to express (valid). If r-count was greater than or equal to (≥) r-table (two-tailed test with sig. 0.05), the instrument or the instrument items correlated significantly with the total score (valid).[18,19]

Reliability

The internal consistency method was used to test the instrument's reliability. A test was conducted by measuring the different items of the same instrument. The instrument has only one measurement version. Therefore, the method was well suited for the test.

Conceptually, the instrument would not result in a total score. Instead, it would yield the total score for each dimension. Thus, reliability coefficient was to be calculated as per dimension. Considering that each dimension had only a few items (10 items per dimension), reliability coefficient was calculated by using the following α coefficient equation:

Where:

$$r = \frac{k}{k-1}\left(1 - \frac{\Sigma\sigma^2 i}{\sigma^2_x}\right)$$

Where :

k = number of item

σi^2 = Variance in every item

$\sum\sigma_i^2$ = number of every variance

σ^2_x = item variance

Results

Item Analysis

The distinguishing feature of each item was calculated via intercorrelation Pearson's product-moment correlation) by using SPSS 25.0 software, and the results are presented in ►**Table 4**.

Reliability

The reliability test results yielded a Cronbach's α score of 0.620 for the knowledge instrument and 0.565 for the attitude instrument. ►**Table 5** below shows the Cronbach's α scores yielded if certain items were deleted.

Validity

As shown in ►**Table 6**, Pearson's correlation test yielded valid results for all items.

Discussion

In this research, we attempted to generate a concept, as well as develop and test a new set of instruments to measure maternal knowledge and attitude about oral health in children under three. We developed two instruments, that is, knowledge instrument and attitude instruments, consisting of 15 and 10 instrument items, respectively (►**Tables 2** and **3**). A measurement instrument is considered solid if it meets these three requirements: well-formulated items, reliability, and validity. A crucial step required in developing a measurement instrument is item analysis. The term refers to the statistical calculation and test performed on individual item scores to obtain reliability and validity.[20] The item analysis results showed that the highest-scoring items still fell under the "medium correlation" category. No items showed a strong correlation.

Table 4 Item analysis

Dimension	Item	R	Correlation
Knowledge			
Translation	2	0.493	Moderate
	3	0.307	Low
	4	0.464	Moderate
	5	0.060	Very low
	12	0.042	Very low
Interpretation	1	0.479	Moderate
	6	0.494	Moderate
	7	0.441	Moderate
	8	0.075	Very low
	14	0.441	Moderate
Extrapolation	9	0.179	Very low
	10	0.414	Moderate
	11	0.253	Low
	15	0.187	Very Low
Attitude			
Cognitive aspect	1	0.365	Low
	8	0.321	Low
	10	0.117	Very Low
Affective aspect	2	0.405	Medium
	3	0.309	Low
	5	0.236	Low
Conative aspect	4	0.547	Moderate
	6	0.510	Moderate
	7	0.409	Moderate
	9	0.021	Very low

Table 5 Measurement instrument reliability

Dimension	Item	Cronbach's α if item deleted	Criteria
Knowledge instrument			
Translation	2	0.586	Quite reliable
	3	0.611	Reliable
	4	0.590	Quite reliable
	5	0.622	Reliable
	12	0.643	Reliable
Interpretation	1	0.594	Quite reliable
	6	0.586	Quite reliable
	7	0.595	Quite reliable
	8	0.636	Reliable
	14	0.629	Reliable
Extrapolation	9	0.618	Reliable
	10	0.604	Reliable
	11	0.616	Reliable
	15	0.629	Reliable
Attitude instrument			
Cognitive aspect	1	0.559	Quite reliable
	8	0.554	Quite reliable
	10	0.584	Quite reliable
Affective aspect	2	0.539	Quite reliable
	3	0.555	Quite reliable
	5	0.569	Quite reliable
Conative aspect	4	0.510	Quite reliable
	6	0.518	Quite reliable
	7	0.539	Quite reliable
	9	0.606	Reliable

Although the other items could produce quite self-explanatory results, further tests are still required with more respondents.

Reliability was tested by means of Cronbach's α method, using a mathematical equation to assess measurement reliability level. Reliability test is required to test the consistency of an instrument and ensure its reliability.[18,19] A measurement instrument's reliability is determined by the α score yielded. The overall α scores of both the knowledge and attitude instruments were 0.620 (reliable) and 0.565 (quite reliable). The test results showed that, by and large, all the items in the knowledge instrument were reliable and those in the latter were quite reliable.

►**Table 5** presents each item's α score in both instruments and the α score when a particular item was deleted. An instrument's reliability can be improved by deleting a less valid item. As shown in the table, deletion of item number 12 item in the translation dimension of the knowledge instrument yielded a new α score of 0.643. In the attitude instrument, deletion of item number 9 in the conative dimension resulted in a new α score of 0.606. However, item deletion would necessitate reconsideration of the adequacy of the items in the dimension concerned to make the instrument more representative.[19]

Validity test is needed to assess the accuracy of an instrument in performing its measuring function. In addition, validity refers to the property of an instrument which indicates that the variable measured is precisely the variable it is designed to measure.[19] As shown in ►**Table 6**, the validity of an item is distinguished by its correlation with the total score. The test results revealed that all the items in both instruments were valid. In other words, all the items are feasible for use in measurement.

Conclusion

Using a basic systematic method and a validity-based approach, we developed instruments to measure maternal knowledge and attitude about the maintenance of dental health in children under three. The knowledge and attitude instruments are each a three-dimensional instrument whose purpose is to reflect important elements of maternal' perspectives concerning the maintenance of their under 3-year-old children's oral health. The instruments are now applicable for use.

Table 6 Pearson's correlation test results

Knowledge															
n	150														
rs	0.48	0.49	0.31	0.46	0.06	0.49	0.44	0.07	0.18	0.41	0.25	0.04	0.44	0.44	0.19
t-hit	6.63	6.90	3.93	6.38	0.73	6.92	5.98	0.91	2.22	5.54	3.19	0.51	6.03	5.98	2.32
p-Value	3E-10	7 E-11	7E-05	1E-09	0.232	7E-11	8E-09	0.1823	0.014	7E-08	0.0009	0.3047	6E-09	8E-09	0.011
Category	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid
Attitude															
n	150														
rs	0.36	0.40	0.31	0.55	0.24	0.51	0.41	0.32	0.02	0.12					
t-hit	4.77	5.39	3.95	7.95	2.95	7.20	5.45	4.12	0.26	1.43					
p-Value	2E-06	1E07	6E-05	2E-13	0.0018	1E-11	1E-07	3E-05	0.3979	0.0774					
Category	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid					

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Conflict of Interest
None declared.

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