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Original article

Development of dental clinic cooperativity predictor instrument for children with autism spectrum disorder

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ABSTRACT

Background: *A survey to identify factors affecting the cooperation of children with autism spectrum disorder (ASD) in Indonesia is crucial for enhancing this group's dental care, oral health, and overall quality of life. However, limited culturally relevant instruments hinder such research.* ***Purpose:*** *This study aims to determine the essential domain needed to design a questionnaire instrument that can predict the cooperativity of children with ASD during dental procedures.* ***Methods:*** *Based on the literature and existing questionnaires, the newly developed questionnaire underwent forward–back translation, before being thoroughly reviewed by an expert committee. The response format, content, and question clarity were evaluated. A cross-sectional study with 30 parents of children with ASD was randomly conducted to test the questionnaire. The validity of each question was measured by the Pearson product-moment correlation coefficient, while its reliability was assessed by Cronbach's alpha.* ***Results:*** *Each question within the domain showed varying degrees of validity: reading ability (r = 0.658), daily communication (r = 0.541), involvement in social activity (r = 0.360), daily self-care ability (r = 0.506), emotional status (r = 0.426), sensory responsiveness (r = 0.615), language comprehension (r = 0.362), and permission to be touched on the head at a barbershop (r = 0.458). The questions were found to be reliable (Cronbach's alpha, r = 0.645 > 0.306).* ***Conclusion:*** *As prediction tools for assessing the cooperativity of children with ASD during dental procedures, the questionnaire should include the following items: communication and reading abilities, daily self-care, social activity, emotional status, sensory responsiveness and permission to be touched on the head at a barbershop.*

Keywords: *autism spectrum disorder; cooperation predictor; dental procedure; questionnaire development*
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INTRODUCTION

The number of children with autism spectrum disorder (ASD) has increased worldwide, as the World Health Organization estimates. It is reported that ASD affects approximately 62 out of every 10,000 individuals, making it a significant global health concern.[1] In the United States, ASD affects 16.8 per 1,000 (one in 59) eight-year-old children.[2,3] The population has a 1:4 females-to-male ratio.[2] Epidemiological data on the current prevalence of ASD in Indonesia has not been clearly reported. Nevertheless, in 2010, Badan Pusat Statistik (BPS, Statistics Indonesia) estimated that 2.4 million individuals in the total population had ASD. According to available data, Yogyakarta Special Province has a 31.72% prevalence of ASD among children under the age of 15. Conversely, data from the Minister of Youth, Education and Sport of Yogyakarta Special Province (2018) revealed that 371 children were studying in specialized schools for ASD.[4]

Dental examinations on children with ASD are challenging due to their impaired communication and social interaction. This often results in uncooperative behavior during dental procedures, sometimes necessitating the use of general anesthesia to ensure cooperation.[5,6] According to Stein et al.,[7] there is an association between oral care cooperativity and sensory over-sensitivities.

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Research revealed a higher prevalence of dental caries and periodontal disease in children with ASD compared to other children.[8–10] Because of the limitations and poor oral health status in children with ASD, it is necessary to identify the factors that influence their cooperation when conducting a dental examination in a clinical setting.

Previous studies recommended certain factors as initial data that could be used to predict cooperativity. Some studies identified that children with ASD frequently need assistance from their parents and caregivers.[11–13] The problem of sensory sensitivities contributes to uncooperative behavior when teeth brushing.[14] Multiple factors, such as the ability to participate in social activities, communicate, comprehend language, mimic, and self-dress, also predicted uncooperative behavior.[15] Nelson et al.[16] stated that cooperativity may be determined by the ability to engage in group activities, communicate effectively, and the level of severity. Dangulavanich et al.[17,18] reported a similar outcome.

Despite attributing the said factors to uncooperative behavior during dental procedures, specific elements related to children with ASD in Indonesia remain unknown. It is important to identify these aspects to define and validate potential domains related to dental cooperation within this target group. The need for a local tool is crucial because complexities and culture can have a significant impact on the quality of life of children with developmental disabilities.[19] Therefore, a local questionnaire must be developed as a tool for predicting cooperation among Indonesian children with ASD to enhance dental care for this group, thereby improving their oral health and overall quality of life. This study aims to determine the essential factors needed to design a questionnaire instrument that can predict the cooperativity of children with ASD during dental procedures.

MATERIALS AND METHODS

The questionnaire was adopted from a past similar study.[20] Prior work has highlighted the wealth of literature available on psychometric principles, methodological concepts, and questionnaire development/translation and validation techniques (Figure 1). The Health Research Ethics Committee, Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta (No.256/EC-KEPK FKIK UMY/IX/2021) approved the ethical clearance.

Domains related to cooperation were selected from previous research.[17,21,22] These will serve as a reference to determine the question items. The questionnaire to be adopted and modified was translated from English to Bahasa Indonesia, then back to English by a professional and sworn translator (forward–back translation). The questionnaire items were then evaluated for linguistic, functional, cultural, and metric equivalence (Figure 1).

Figure 1 demonstrates how the Indonesian questionnaire was evaluated by five researchers and experts who had worked with children with ASD. The content and clarity of the questionnaire items were assessed. During this process, some question items were added in accordance with certain previous studies and removed when they were no longer relevant; the validity was also tested using different viewpoints until the experts reached an agreement.[16,17,23] In addition, the researcher considered the questionnaire's format, length, delivery method, and feasibility of completion.[24] The forward–back translation process enables the questionnaire to be translated back to its original language, allowing for a comparison of the new translation and the original questionnaire to identify any differences in meaning.

Table 1 demonstrates that the questionnaire's internal validity is based on expert agreement and bilingual testing.[25] The questions' internal validity was measured using the Lawshe content validity ratio (CVR). Lawshe (1975) proposed the CVR as a linear transformation of a proportional level of agreement on how many "experts" within a panel rate a questionnaire item as "essential," which is then measured as the formula. The CVR for each question is valid if it is between -1 and 1.[26] To determine the questionnaire's external validity, a reliability test was performed. This is a simple and widely used method.[27]

To check whether the questionnaire was suitable to be used, it was tested on a small population. The purposive

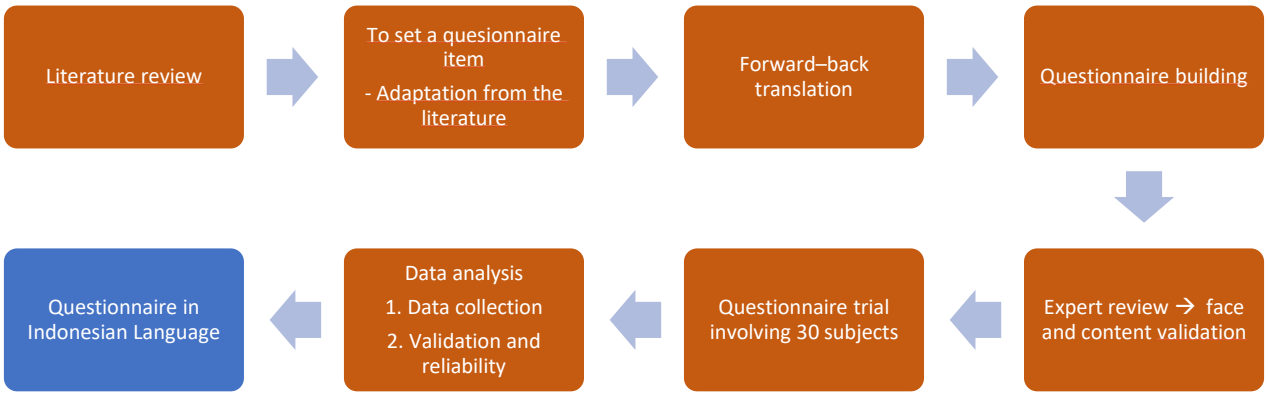

Figure 1. The study flowchart.

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Table 1. Validity of the questionnaire (coefficient content validity – Lawshe's CVR)

Question/domain	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	CVR*	CVR**
Child's age	R	R	R	R	R	Valid	Valid
Gender	R	R	R	R	R	Valid	Valid
Kind of School	R	R	R	R	R	Valid	Valid
Parents' educational attainment	R	R	R	R	R	Valid	Valid
Severity	R	R	R	R	R	Valid	Valid
Permission to be touched on the head	R	R	R	R	R	Valid	Valid
Sensory sensitiveness	R	R	R	R	R	Valid	Valid
Reading ability	R	R	NR	R	R	Not valid	Valid
Communication ability	R	R	R	R	R	Valid	Valid
Emotional status	R	R	R	NR	R	Not valid	Valid
Social ability	R	R	R	R	R	Valid	Valid
Daily self-care	R	R	R	R	R	Valid	Valid
Language comprehension	R	R	R	R	R	Valid	Valid

Notes: R: Relevant; NR: Not Relevant; *CVR (Ayre & Scally[26]); **CVR (Wilson et al.[28])

sampling method was used with a group of 30 parents who have children with ASD and meet the inclusion criteria. These parents gave their informed consent and were invited at random to complete the questionnaire form. The questionnaire was tested on a minor subset of the population to determine if there was confusion with any of the items and whether respondents had suggestions for possible improvement. The inclusion criteria for the subjects included children with ASD, aged between 6 and 18 years old, diagnosed by a psychiatrist, and residents of Yogyakarta Special Region Province. Moreover, the exclusion criteria encompassed parents or caregivers who were uncooperative and children who had other physical and mental disabilities.

Subsequently, each question's validity and reliability were measured to ensure that the questionnaire was usable. To assess construct validity, Pearson's correlation was employed; it is commonly used to verify the intensity of an existing linear association between variables and measure such a link between quantitative variables. This coefficient expresses the degree of linear dependence between two quantitative variables, ranging from −1 to 1. If negative, it indicates that one variable decreases as the other increases; if positive, it means that one variable increases as the other increases.

Pearson's correlation was used to assess construct validity, evaluate the strength of existing linear associations between variables, and measure linear associations between quantitative variables. The coefficient r is classified as follows: r = 0–0.25 implies a very weak correlation; r = 0.26–0.49 denotes a weak correlation; r = 0.5–0.69 signifies a moderate correlation; r = 0.7–0.89 shows a high or strong correlation; and r = 0.9–1.0 illustrates a very high or very strong correlation.

The next step performed was a reliability analysis, which involved retesting the device and assessing its internal consistency. Reliability aims to determine the degree of consistency in the results obtained by the same respondent when the same instrument is used and tested under different circumstances. Trustworthiness must also be considered when determining reliability.

RESULTS

The study produced descriptive data about the children's socio-demographics, as shown in Table 2. Most subjects were male (73.3%), aged 9–12 (40%), and attended a specialized school for children with ASD (53.3%). In addition, the majority of parents who completed the questionnaire had a university degree (86.7 %) and perceived the severity of the subjects as mild (50%).

The study's instrument consists of some domains that require validation. Multiple factors, such as sensory problems, sensory sensitivity, communication ability, daily self-care ability, ASD severity, social care ability, reading ability, age, and gender, could be used as questionnaire items that predict cooperativity. Table 2 shows the experts' evaluation of the questionnaire items and domains.

Table 2. Characteristic of subjects

Characteristic	N (%)
Age	
6–8 years old	1 (3.3)
9–12 years old	12 (40)
13–15 years old	11 (36.7)
16–18 years old	6 (20)
Gender	
Male	22 (73.3)
Female	8 (26.7)
School	
Not enrolled	2 (6.7)
Inclusion school	9 (30)
Specialized school	16 (53.3)
Home-schooling	3 (10)
Severity	
Mild	15 (50)
Moderate	14 (46.7)
Severe	1 (3.3)
Parents' education	
University	26 (86.7)
Senior high school	3 (10)
Not reported	1 (3.3)

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Table 3. Validity and reliability scale of the domain

Domain/question	r > 0.306	Cronbach's alpha
Reading ability How is your child's reading ability?	0.658	0.645
Daily communication What is your child's communication ability?	0.541	
Social ability Please rate your child's ability to take part in the following: (group activities given the opportunity, etc.)	0.360	
Daily self-care ability Please rate your child's self-care skills. (shampooing, wearing clothes)	0.506	
Emotional status In general, what is your child's mood like? (happy, calm, hyperactive, etc.)	0.426	
Sensory sensitivity What are the common things or "triggers" that worsen your child's behavior?	0.615	
Language comprehension	0.362	
Permitting someone to touch their head at a barbershop	0.458	

The questionnaire was administered to 30 parents of children with ASD. The Pearson product-moment correlation coefficient was used to measure the validity of each question item, in which a value of 0.95 is considered significant. Each item's validity criteria must be fulfilled: r measurement > r table (0.306). The r values for different factors are as follows: reading ability (r = 0.658), daily communication (r = 0.541), social activity engagement (r = 0.360), daily self-care (r = 0.506), emotional status (r = 0.426), sensory sensitivity (r = 0.615), language comprehension (r = 0.362), and permission for their head to be touched (r = 0.458). The questions' reliability was also confirmed by Cronbach's alpha coefficient of r = 0.645 > 0.306, which indicates that all the questions are deemed reliable. The details are illustrated in Table 3.

DISCUSSION

A questionnaire, as a tool for predicting cooperativity, must be valid and reliable. This study revealed that the following domains are valid and reliable: ability to read, permission to be touched on the head at the barbershop, communication ability, social ability, daily self-care ability, emotional status, sensory sensitivity, and language comprehension. In quantitative studies, validity refers to the accuracy with which a concept is measured. Furthermore, validity depends on the extent to which meaningful and appropriate inferences or decisions are drawn from the study's instrument scores.[29] There are four kinds of validity tests that are commonly used in questionnaire development: face validity, content validity, construct validity, and criterion validity. However, in this study, the criterion validity was not conducted.[30]

Face validity refers to the investigator's subjective assessment of instrument presentation and relevance, specifically whether the instrument appears relevant, unambiguous, obvious, and logical. However, some researchers argue that this validity does not actually represent the item's efficacy and is the weakest form of validity.[30] This study found that the given questions need feasibility adjustments, as not all of them fit the Indonesian social culture. For example, the question of race is irrelevant to the Indonesian population since most Javanese are of the Asian ethnicity. However, the population consists of heterogeneous tribes, such as Malay, Javanese, Sundanese, and Chinese.

Content adequacy is a theoretical concept focused on the extent to which measurements provide evidence of fair and comprehensive subject matter coverage.[30] In the literature, expert judgment is often to determine proof of content validity. In fact, there are several ways to aggregate reviews into a content presentation index. These include multi-judge scoring, statistical methods, and test-specific methods. This study conducted both face and content validity by having an expert panel examine if an item was "relevant" or "irrelevant," had an objective structure, and could be actively classified into a thematic category. This implies that any corrections or modifications made by the experts must be documented and included in the study's final presentation.

Lawshe's method, initially proposed in 1975, has been widely used to establish and quantify content validity in many areas, including nursing, education, organizational development, human resource psychology, and market research.[26,28,31] In the previous evaluation of coefficient content validity (Lawshe's CVR), which was conducted by Ayre and Scally,[26] it was decided that a minimum of five experts must concur that an item is essential or valid. Based on this criterion, the two items on which not all experts agreed in this study were "emotional status" and "reading ability." However, Wilson et al.'s[28] recalculation of the

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CVR concept proposed that at least four panel members or experts concur on the item's essentiality to determine if it fulfills the given condition.[31]

The 30 subjects' results were also used to determine content validity. During this process, the survey designer can clarify ambiguous items and improve incorrect ones. Content validity also provides a brief overview of the spreading of responses. This helps determine whether the response exhibits enough variability to justify ongoing large-scale pilot testing. Response format, content, and question clarity were evaluated.[24]

Construct validity is a commonly used device in educational research that is based on logical relationships between variables. In addition, it assesses whether a variable's operational definition matches its theoretical meaning. Thus, structural validity indicates the degree to which inferences are legitimately drawn from a study's activities relative to the theoretical structure on which those activities are based. In order to assess this study's construct validity, the Pearson's correlation test was employed.[32–34]

Reliability refers to the consistency of a measure. A participant completing a motivation-measuring instrument should provide approximately the same responses each time. Although it is impossible to give an exact calculation of reliability, various measures can be used to offer an estimate. In this study, the trial questionnaire was administered in different languages and cultures. The findings were comparable to those from a previous study on the factor that influences cooperativity in dental examination in Indonesia. Cronbach's alpha is the most commonly used method for determining an instrument's internal consistency. This test calculates the average of all correlations in every split-half combination. It also allows for the use of instruments with questions that have more than two responses.[33]

The validity and reliability measurements in this study considered some domains that showed a correlation to cooperativity. The Pearson product-moment correlation coefficient is interpreted as valid if the correlation value for each item is $r > 0.306$. Moreover, the method of communication determines how the message is delivered to an individual with ASD in a clinical setting. In this study, all the subjects were able to communicate through voice or sound. Previous research revealed a correlation between cooperativity and all modes of communication, with the exception of communicating by pointing out objects.[16,17] This research found a correlation coefficient of $r = 0.541$ between each communication item and the total score. This exhibits the extent to which communication may have a relation to cooperativity. Meanwhile, daily self-care had a coefficient of 0.506, which is consistent with a previous study that found a correlation between this domain and cooperativity.

Furthermore, reading ability showed a moderate correlation coefficient ($r = 0.658$), and highly functional children possess this skill. According to a recent study, reading ability is associated with cooperativity.[35] Language comprehension also exhibited a promising prognostic factor for cooperativity.[15]

However, social ability had a very weak coefficient result ($r = 0.360$), which is in line with previous research that found an association between this domain and cooperativity.[16] The ability to engage socially, share attention, and do simple activities, such as shopping and playing together, might contribute to cooperativity. Moreover, social care is associated with oral health.[16,17]

Sensory overresponse had a moderate correlation coefficient ($r = 0.615$) and is the domain most considered in this research. Another study revealed a similar finding.[7] The current study found that the activity of cutting hair at a barbershop or hairdressing salon was correlated with cooperativity. Both dentistry and haircutting share the same sensory processing issue related to head manipulation, whereby touching the head may indicate permission to allow sensory stimulation.[7,35]

The subjects' emotional status had a correlation coefficient of $r = 0.426$, indicating that this domain is valid. A dentist can manage children's behavior by considering their emotional state or stress level.[36] As mentioned in a prior study, over 70% of children with ASD experience emotional disturbances, including anxiety and distress. Therefore, this domain is crucial for information retrieval.

Although certain domains yielded valid and reliable results, it is necessary to inquire about specific aspects—age, gender, education, and parental support—due to their scientific relevance to cooperativity. These factors are crucial as initial demographic data, either clinically or demographically, for the study.

Due to the limited number of subjects, the data obtained from parents regarding the subjects' condition must be replicated in a wider scope and with more subjects. Future research should involve psychologists and therapists, including occupational therapists, as well as use more research resources.

Ultimately, we developed a draft instrument with the following domains: (1) communication ability, (2) daily self-care ability, (3) social engagement ability, (4) reading ability, (5) emotional status, (6) sensory sensitivity, (7) language comprehension, and (8) permission to be touched on the head at a barbershop. The results revealed that the domains may be used to predict the cooperativity of children with ASD in Indonesia during dental examinations. In addition, some items mentioned in previous studies must be considered, as relevant crucial information may be associated with cooperativity.

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