ORIGINAL ARTICLE

Development and Validation of Knowledge and Attitude Questionnaire on Health Issues and Accessibility to Primary Healthcare Services of Adolescents With Intellectual Disabilities (KA-IDA)

Nur Akmal Ismail[1], Azriani Ab Rahman[1], Anis Kausar Ghazali[2], Surianti Sukeri[1], Mohd Zulkifli Abdul Rahim[3], Noran Hashim[4]

[1] Department of Community Medicine, School of Medical Sciences, Universiti Sains Malaysia, 16150, Kubang Kerian, Kota Bharu, Kelantan, Malaysia
[2] Unit of Biostatistics and Research Methodology, School of Medical Sciences, Universiti Sains Malaysia, 16150, Kubang Kerian, Kota Bharu, Kelantan, Malaysia
[3] Disability Transformation Centre, School of Health Sciences, Universiti Sains Malaysia, 16150, Kubang Kerian, Kota Bharu, Kelantan, Malaysia
[4] Family Health Unit, Kelantan State Health Department, Jalan Bayam, 15590 Kota Bharu, Kelantan, Malaysia

ABSTRACT

Introduction: Adolescents with intellectual disabilities experience greater health problems and encounter more challenges to receiving appropriate primary healthcare than their peers. This study aimed to develop and validate a questionnaire assessing primary healthcare providers' knowledge and attitudes regarding the health issues and accessibility of intellectually disabled adolescents to primary healthcare services. **Materials and methods:** The development and validation processes were applied to this questionnaire. In addition to qualitative research, content validation, face validation and pretesting were also incorporated into the development process. During the validation phase, item response theory (IRT), exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were implemented. A cross-sectional study was conducted among 444 healthcare providers recruited via multistage sampling from 20 primary health clinics in Kelantan. **Results:** The development phase produced 49 knowledge items and 52 attitude items. In the validation phase, the knowledge section utilized the two-parameter logistic IRT, while EFA and CFA were applied to the attitude section. Knowledge items had adequate difficulty, and items with discrimination values above 2.5 were retained for their significance and expert recommendations. EFA revealed a three-factor model composed of cognitive, affective, and behavioral. CFA confirmed this model with a good fit (χ^2 [df = 347] = 639.34, $p < 0.001$; CFIrobust = 0.92; TLIrobust = 0.91; RMSEArobust = 0.07; SRMR = 0.06). **Conclusion:** The Knowledge and Attitude Questionnaire on Health Issues and Accessibility to Primary Healthcare Services of Adolescents with Intellectual Disabilities (KA-IDA) demonstrated strong reliability and valid psychometrics comprising 38 knowledge items and 28 attitude items.
Malaysian Journal of Medicine and Health Sciences (2025) 21(3): 157-170. doi:10.47836/mjmhs.21.3.19

Keywords: Attitude, Intellectual disabilities, Knowledge, Questionnaire development, Questionnaire validation

Corresponding Author:
Azriani Ab Rahman, Master
Email: azriani@usm.my
Tel : +609-767 6626

INTRODUCTION

The prevalence of intellectual disabilities in the general population has been estimated to range between 1% and 3% worldwide (1, 2). According to Olusanya et al. (3) there were approximately 6.3% adolescents with intellectual disabilities globally in 2017. In Malaysia, intellectual disabilities fall under the broader category of learning disabilities. According to the latest statistics from 2021, there are 102,696 children aged 6 to 18 years with learning disabilities which include intellectual disabilities, accounting for 0.3% of the total population in Malaysia (4). Adolescents with intellectual disabilities often face challenges with cognitive impairments such as deficits in intellectual functioning, memory, attention, language, and communication. They are also struggle with adaptive functioning in areas like understanding, social interaction, safety awareness, emotional regulation and practical daily skills (5).

In terms of healthcare, adolescents with intellectual disabilities are a population that requires special consideration. They encounter a greater frequency of

health issues and encounter greater barriers in accessing necessary healthcare in comparison to their peers (6, 7). This is because adolescents with intellectual disabilities often have complex health needs due to multiple co-occurring conditions such as epilepsy, sensory impairments, and mental health disorders, as well as communication challenges and difficulties in self-care, all of which necessitate a coordinated, multidisciplinary approach to effectively manage their physical, mental, and social well-being (8, 9). Moreover, the inflexibility and lack of personalised care in the healthcare services can result in inequitable care for these adolescents, preventing them from receiving the same standard of healthcare as normal populations. Communication barrier may complicate the diagnosis and treatment for adolescents with intellectual disabilities by leading to misdiagnosis due to incomplete symptom reporting and restricting accurate expression of symptoms. These barriers may also undermine therapeutic relationships, hinder treatment adherence and contribute to emotional distress, thereby adversely affecting the quality of overall care. Hence, understanding the limited communication abilities of these adolescents is important (10). The healthcare services must adapt to better accommodate and care for these adolescents, ensuring they are not neglected. The challenge is more complex when healthcare providers lack the specialised training required to comprehend and cater to their unique needs (11).

Despite the numerous challenges faced by adolescents with intellectual disabilities, including health issues and limited access to healthcare, there remains a notable gap in research focused on this population. Existing studies often concentrate on specialised settings rather than primary care environments (12). Research in primary care settings is needed to understand the general healthcare services address the needs of adolescents with intellectual disabilities and to identify areas for improvement. There is a lack of validated questionnaires in Malaysia for evaluating healthcare providers' knowledge on intellectually disabled adolescents' health issues and their attitudes towards these adolescents' accessibility to primary healthcare services. Certain instruments used in previous research were not suitable for the Malaysian context due to varying levels of understanding and diverse backgrounds (13, 14). Therefore, this study aimed to develop and validate a tool for assessing healthcare providers' knowledge and attitudes on those challenges. The outcomes may guide improvements in primary healthcare services and addressing the unmet healthcare needs of adolescents with intellectual disabilities.

MATERIALS AND METHODS

The methodology employed in this study comprised two distinct stages: questionnaire development, and construct validation.

Questionnaire Development

The development of questionnaire began with the items and domains development. A comprehensive review of the literature was performed to find available materials on knowledge and attitude, as well as relevant questions and domains in present questionnaires on health issues of adolescents with intellectual disabilities and the challenges they face in accessing primary healthcare services. The researchers also conducted in-depth interviews with 12 caregivers of adolescents with intellectual disabilities, including eight parents and four community-based rehabilitation (CBR) centres. Besides, the interviews also involved the healthcare providers who provide care for adolescents with intellectual disabilities, which included ten primary healthcare providers and four health and medical experts in the management of adolescents with intellectual disabilities. The in-depth interviews aimed to qualitatively explore participants' initial understanding of health issues in adolescents with intellectual disabilities and investigate their accessibility to primary healthcare services. Semi-structured interviews were used, with open-ended questions designed to explore participants' experiences and perspectives. Participants who agreed to the study were given a detailed overview of the research and provided informed consent. Interview arrangements were made according to their preferences and conducted face-to-face using probing questions to enhance dialogue and explore topics thoroughly. Data collection and analysis occurred concurrently until data saturation was reached. These interviews were recorded, transcribed, and analysed using thematic analysis by Saldana (15). This process involved identifying recurring themes and patterns in the data, which were then used to inform the development of the questionnaire. Next, the content validation was done by seven panel experts, including two public health physicians, three family medicine specialists, a child psychiatrist, and an occupational therapist, were involved in the content validity assessment of the KA-IDA questionnaire. The Content Validation Index (CVI) was assessed by the panel for the relevancy and representativeness of each item in a specific domain. The experts feedback was taken into consideration and resulted in a revised version of the KA-IDA questionnaire. Then, face validation was performed among ten primary healthcare providers to examine the acceptability and appropriateness of the knowledge and attitude items. Additional elements that were evaluated also encompassed responses, comprehension, structure of instructions, and questionnaire layout. Before data collection starts, pretesting of a survey is performed to the 30 healthcare providers working in primary health clinics in the state of Kelantan. The goal is to guarantee that the questions asked correctly to represent the information required by the researcher and that the respondent is able and willing to answer the questions. Following the completion of answering questionnaire, the researcher proceeded to inquire about the participants' responses to the questions in person to obtain their feedback.

Construct Validation

The second stage of the study was the construct validation. The analysis included item response theory (IRT), exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). For two-parameter logistic item response theory (2-PL IRT) analysis, a sample size of 222 participants was chosen, considering a 10% anticipated non-response rate (16). Similarly, for both Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA), a sample size of 222 participants was selected for both EFA and CFA, while accounting for an expected 10% non-response rate (17). For two-parameter logistic item response theory (2-PL IRT) analysis, a sample size of 222 participants was chosen, considering a 10% anticipated non-response rate, in line with the general recommendation of ranging between 100 to 500 samples by Edelen, Reeve (16). Similarly, for both EFA and CFA, a sample size of 222 participants was selected, adhering to the recommended range of 200 to 400 individuals by Jackson (17) for both EFA and CFA, while accounting for an expected 10% non-response rate.

Multistage sampling was used to select those 444 participants from 20 primary health clinics under the Ministry of Health (MOH) Malaysia in four districts in north-eastern state in Malaysia. These districts were purposively chosen to represent the rural and urban communities within the state. For each district, five clinics were selected through simple random sampling. Then, using purposive sampling, participants were selected proportionately to actual number of healthcare providers of each clinic. The inclusion criteria for this study were family medicine specialists (FMS), medical officers, medical officer assistants, and nurses working in primary health clinics. Non-Malaysian and those who cannot communicate and understand Bahasa Malaysia were excluded from the study. Before initiating data collection at the clinics, the Medical Officers in Charge (MOICs) received a study briefing. Eligible participants underwent individual briefings, completing questionnaires independently with the researcher available for queries. Data entry was conducted using IBM SPSS version 26 (18), and the analysis was carried out using both SPSS and R software (19).

The analysis of the knowledge aspect of the questionnaire was conducted utilizing the 2-PL IRT approach, employing R software version 4.3.1 (19) and the *psych, ltm, irtoys* and *mirt* package within the R Studio environment (20). To evaluate the quality of the questionnaire items, parameters for discrimination and difficulty were established. Acceptable ranges were set with a difficulty index spanning from -3 to +3 and a discrimination index ranging from 0.35 to 2.5 (21, 22). The fit of each item was assessed using the chi-square goodness-of-fit test while the model fit was evaluated using the root mean square error of approximation (RMSEA) with a value of 0.08 or less and a Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) of 0.9 or higher to indicate a good fit (23). The assumption of unidimensionality was explored through modified parallel analysis. A Cronbach's alpha coefficient greater than 0.65 was regarded satisfactory for internal consistency reliability (24).

The EFA was conducted specifically to assess the construct validity of the attitude component of the questionnaire, given its ordinal nature, utilizing IBM SPSS software, version 26 (18). To determine the adequacy of the questionnaire for sampling, both the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity were employed. A KMO value greater than 0.7 and a significant p-value (less than 0.05) in Bartlett's Test of Sphericity indicated the suitability of the sample for factor analysis (25, 26). The Principal axis factoring was used for extracting components, and Promax rotation with Kaiser normalization was applied as an oblique adaptation of the varimax technique, as per Thompson (27). The number of factors retained were determined based on parallel analysis and scree plot evaluations (28). Items with a loading factor 0.3 and above were deemed to have acceptable loading (29). Regarding internal consistency reliability, a Cronbach's alpha coefficient greater than 0.65 was considered satisfactory, following the guidelines by DeVellis, Thorpe (24).

The analysis of the attitude component of the questionnaire was conducted using Confirmatory Factor Analysis (CFA) through the *lavaan, psych, semTools* and *semPlot* package, employing R software version 4.3.1 (19) in R studio environment (20). To assess the model fit, several fit indices were employed along with their corresponding threshold values: a p-value greater than 0.05 for the chi-square (χ^2) test, a Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) of 0.9 or higher, a Root Mean Square Error of Approximation (RMSEA) of 0.08 or less, and a Standardized Root Mean Square Residual (SRMR) of 0.08 or below (23, 30, 31). The areas of the model that did not fit well were carefully examined using standardised residuals (SRs) and modification indices (MIs). Based on the given criteria, which include MIs exceeding 3.84, factor loadings (FLs) falling below 0.5, and SRs greater than the absolute value of 2.58, it has been concluded that certain items should be eliminated in order to improve the fit of the model (31). Additionally, it was necessary to maintain factor correlations below 0.85 in order to guarantee that each factor was different. For assessing composite reliability, Raykov's rho was utilised via the *sem-Tools* package. A composite reliability score of 0.7 or higher was deemed satisfactory.

Ethical Clearance

This study was approved by the Human Research Ethics Committee of Universiti Sains Malaysia with the reference number USM/JEPeM/22060428 and the Medical Research & Ethics Committee (MREC), Ministry of Health Malaysia (NMRR ID-22-01464-TA7 (IIR)). Permission

was obtained from the key authorities of Kelantan State Health Department, Social Welfare Department, and the higher committees of non-government organisations (NGOs) before conducting the study at their facilities. Participation was voluntary and participants received an overview of research goals, objectives, and benefits before being provided with a written informed consent form. Participants could withdraw from the study at any time without consequences. The research process was conducted with cultural sensitivity, ensuring respect for the participants' backgrounds and experiences. Confidentiality of information was protected. Access to the database was limited to only the researchers. Only group data were presented in the research; no individual data were reported.

RESULTS

Questionnaire Development

The application of a comprehensive literature review, in conjunction with in-depth interviews based on health concerns and the accessibility of primary healthcare services for adolescents with intellectual disabilities, had resulted in many valuable concepts and insights. These were used to create the items and domains for the questionnaire. The initial draft of the questionnaire was written in the Malay language and included a total of 59 knowledge-based items and 61 attitude-based items together with the 14 items on participants' socio-demographics. In the knowledge section, there was six domains pertaining to the health issues of adolescents with intellectual disabilities. The domains were as follows: 1) medical problems (eight items); 2) mental health problems (ten items); 3) developmental disabilities problems (ten items); 4) high-risk behaviours (eight items); 5) nutrition related health problems (nine items); and 6) sexual and reproductive health problems (14 items). In the attitude section, three domains were identified, concerning to the attitude of primary healthcare providers towards the accessibility of primary healthcare services for adolescents with intellectual disabilities namely: 1) cognitive (18 items); 2) affective (23 items); and 3) behaviours (20 items). The questionnaire was created as self-administered questionnaire. In the content validation, the panel agreed that the included domains and questions were consistent with the targeted areas of focus after examining the questionnaire. According to item-level content validation index (I-CVI), one item in the knowledge domain and six items in the attitude domain were less than 0.83. However, since the panel expert comments were considered, four items in the attitude domain and four items in the knowledge domain were indicated for removal. The remaining items were 55 questions for measuring the knowledge section and 57 items for assessing the attitude section. The item-level face validation index (I-FVI), which was utilised to measure the level of clarity and comprehensibility of all items in each domain based on the respondents' ratings, was discovered to be below 0.83 for a total of seven items in both domains. Eleven items were eliminated as a consequence of I-FVI and participant feedback. Six items were from the knowledge domain and five items belonged to the attitude domain. The knowledge domain retained a total of 49 items, whereas the attitude domain retained a total of 52 items. Several changes were also be made based on the participants input on other components to enhance the clarity, structure, and words of the questionnaire, increasing its overall comprehensibility. Next, in the pretesting, positive reception was shown by the participants' feedback. They considered the questionnaire to be acceptable and suitably timed with the duration to complete the questionnaire ranged from 20 to 30 minutes. The item content was regarded as clear, straightforward, and simple to understand. Following revisions, the finalised version of the questionnaire comprised of nine sections with a total of 115 items. These included 14 items for general information, 49 items addressing knowledge, and 52 items pertaining to attitude. The general information section gathered data on various demographics such as age, gender, ethnicity, religion, marital status, level of education, household income, job category, involvement in adolescent-friendly services, participation in training related to adolescents and disabilities, and experience in managing or treating adolescents with disabilities. The knowledge section was structured using a three-point Likert scale, offering options of "yes," "no," and "don't know" to address health issues in adolescents with intellectual disabilities. The attitude section focused on the primary healthcare providers' attitudes towards accessibility of primary healthcare services for adolescents with intellectual disabilities, utilizing a five-point Likert scale ranging from 1 to 5 (5 = strongly agree, 4 = agree, 3 = unsure, 2 = disagree, 1 = strongly disagree).

Construct Validation

In this study stage, all selected participants completed the questionnaire. The demographic profile revealed that the majority were females (82%), Muslim community (99.3%), with Malay ethnicity (99.3%), with an average age of 40.6 years (SD = 6.88). A significant portion of the respondents (92.3%) were married, and nearly half (42.6%) held a diploma in education. The predominant household income category was middle income, ranging between RM 4850 and RM 10,959. Regarding professional roles, most participants were nurses, including 1.6% were matrons or sisters, 27.7% were staff nurses, and 26.3% were community nurses. About half of them were working in clinics with FMS. Nearly half of them (43%) had experience working in adolescent-friendly clinic services, and 43.7% had received training in adolescent health. Only 17.8% had participated in disability training, and 44.1% had experience in treating adolescents with intellectual disabilities. Notably, 14 respondents reported having children with intellectual disabilities (ID). Table I displays the characteristics of participants.

Table I: Characteristics of participants (n = 444)

Characteristics	n (%)		
	Overall (n = 444)	IRT and EFA (n = 222)	CFA (n = 222)
Age (year)*	40.60 (6.88)	41.09 (6.89)	39.99 (6.85)
Gender			
Male	80 (18.0)	37 (16.7)	43 (19.4)
Female	364 (82.0)	185 (83.3)	179 (80.6)
Ethnicity			
Malay	441 (99.3)	220 (99.1)	221 (99.5)
Non-Malay	3 (0.7)	2 (0.9)	1 (0.5)
Religion			
Muslim	441 (99.3)	220 (99.1)	221 (99.5)
Non-Muslim	3 (0.7)	2 (0.9)	1 (0.5)
Marital status			
Married	410 (92.3)	203 (91.4)	207 (93.2)
Single	20 (4.5)	10 (4.5)	10 (4.5)
Divorced	14 (3.2)	9 (4.1)	5 (2.3)
Education level			
Certificate	112 (25.2)	54 (24.3)	58 (26.1)
Diploma	189 (42.6)	93 (41.9)	96 (43.3)
Degree	136 (30.6)	70 (31.5)	66 (29.7)
Master	7 (1.6)	5 (2.3)	2 (0.9)
Household income			
RM 10,960 and above	81 (18.2)	46 (20.7)	35 (15.8)
RM 4850-10,959	240 (54.1)	114 (51.4)	126 (56.7)
RM 4849 and below	123 (27.7)	62 (27.9)	61 (27.5)
Job category			
FMS	3 (0.7)	2 (0.9)	1 (0.5)
Medical officer	127 (28.6)	64 (28.8)	63 (28.4)
Assistant medical officer	67 (15.1)	34 (15.3)	33 (14.9)
Matron/sister	7 (1.6)	4 (1.8)	3 (1.3)
Staff nurse	123 (27.7)	61 (27.5)	62 (27.9)
Community nurse	117 (26.3)	57 (25.7)	60 (27.0)
Involvement in adolescent's friendly clinic			
Yes	191 (43.0)	107 (48.2)	84 (37.8)
No	253 (57.0)	115 (51.8)	138 (62.2)
Training on adolescents			
Yes	194 (43.7)	108 (48.6)	86 (38.7)
No	250 (56.3)	114 (51.4)	136 (61.3)
Training on disabilities			
Yes	79 (17.8)	38 (17.1)	41 (18.5)
No	365 (82.2)	184 (82.9)	181 (81.5)
Primary health clinic with FMS			
Yes	231 (52.0)	120 (54.1)	111 (50.0)
No	213 (48.0)	102 (45.9)	111 (50.0)
Have treat adolescents with ID			
Yes	196 (44.1)	97 (43.7)	99 (44.6)
No	248 (55.9)	125 (56.3)	123 (55.4)
Have children with ID			
Yes	14 (3.2)	7 (3.2)	7 (3.2)
No	430 (96.8)	215 (96.8)	215 (96.8)

*mean (SD)

The IRT analysis of the knowledge section as shown in Table II, revealed the psychometric characteristics of the domains. Following the IRT analysis and based on expert recommendations, 11 items (K8, K13, K15, K22, K27, K33, K42, K45, K47, K48, and K49) were excluded. The exclusion was due to their scores extremely exceeding the acceptable ranges for discrimination and difficulty. Subsequent to these removals, the remaining items fell within the acceptable difficulty range of -3 to +3. In terms of discrimination, items K4, K9, K26, K28, K36, K40, and K41 exceeded the threshold value of 2.5. However, based on expert advice, considering their significant relevance to the study and contribution to assessing participant knowledge, these items were retained. The goodness-of-fit analysis indicated that most items except for items K4, K16, K19, K26, K28, K31, K38, K40, and K46 had p-values below 0.05, suggesting an inadequate fit. Nonetheless, these items were retained in the questionnaire as they met the acceptable criteria for difficulty and discrimination values. Despite poor model fit, items in the knowledge section were also retained based on expert opinion and their relevance to the study objectives. Additionally, these items were considered essential for covering the breadth of the knowledge domain and ensuring comprehensive content validity. The items were retained to maintain the balance and integrity of the questionnaire, providing a well-rounded assessment of participants' knowledge. Across the six sub-domains of the knowledge section, the items within the -3 to +3 difficulty range captured between 79.52% and

97.86% amount of the total information. The assumption of unidimensionality for these items was corroborated in all six domains, as evidenced by the results of the modified parallel analysis, with p-values of 0.050, 0.059, 0.158, 0.178, 0.208, and 0.654 respectively. In regard to the fitness of the models, certain domains displayed less than satisfactory fit indices. These indices include RMSEA values ranging from 0.01 to 0.14, M2 values ranging from 3.33 to 72.63, TLI values ranging from 0.57 to 1.01, and CFI values ranging from 0.71 to 1.00. Additionally, the internal consistency reliability of each sub-domain, as indicated by Cronbach's alpha values, was found to be acceptable, with scores of 0.57, 0.63, 0.67, 0.8, 0.56, and 0.7, respectively.

Table II: Result of the IRT analysis in the knowledge section in validation study (n = 222)

	Items	b (SE)	a (SE)	λ	χ2 (df)	P values
	BAHAGIAN A: MASALAH PERUBATAN (PART A: MEDICAL PROBLEMS)					
	Masalah perubatan yang biasa dialami oleh remaja ID adalah: (Common medical problems experienced by ID adolescents are:)					
K1	*jangkitan kulat pada kulit* (fungal infection of the skin)	-1.65 (0.45)	1.08 (0.38)	0.73	46.68 (9)	**<0.001**
K2	*jangkitan saluran pernafasan atas (URTI)* (upper respiratory tract infection (URTI))	-1.20 (0.30)	1.34 (0.50)	0.80	36.27 (9)	**<0.001**
	***Faktor penyebab** masalah perubatan di kalangan remaja ID adalah:* (Factors causing medical problems among ID adolescents are:)					
K3	*sukar memberitahu gejala penyakit yang dialami* (difficult to tell the symptoms of the disease)	-2.37 (0.59)	1.74 (0.38)	0.87	48.48 (9)	**<0.001**
K4	*sukar meluahkan kebimbangan terhadap kesihatan mereka* (difficult to express concern for their health)	-1.88 (0.34)	**3.22 (1.99)**	0.96	14.59 (9)	0.675
K5	*sukar menguruskan rutin penjagaan kebersihan diri sendiri* (difficult to manage personal hygiene routine)	-2.11 (0.41)	1.86 (0.65)	0.88	46.65 (9)	**<0.001**
K6	*kurang mendapat pendedahan tentang keperluan penjagaan kesihatan* (less exposure to healthcare needs)	-1.84 (0.34)	1.97 (0.70)	0.89	33.87 (9)	**<0.001**
	BAHAGIAN B: MASALAH KESIHATAN MENTAL (PART B: MENTAL HEALTH PROBLEMS)					
	Masalah kesihatan mental yang biasa dialami oleh remaja ID adalah: (Common mental health problems experienced by ID adolescents are:)					
K7	*keresahan* (anxiety)	-1.08 (0.17)	1.91 (0.46)	0.89	53.77 (14)	**<0.001**
K9	*tekanan* (stress)	-0.75 (0.12)	**3.53 (1.48)**	0.96	24.82 (14)	**0.002**
K10	*masalah tingkah laku* (behaviour problem)	-1.71 (0.26)	2.13 (0.63)	0.91	17.55 (14)	**0.025**
	Masalah tingkah laku yang biasa dialami oleh remaja ID adalah: (Common behaviour problems experienced by ID adolescents are:)					
K11	*merosakkan harta benda* (damage property)	-1.31 (0.34)	0.93 (0.27)	0.68	46.84 (14)	**<0.001**
K12	*Mengamuk* (tantrum)	-1.88 (0.42)	1.15 (0.34)	0.75	37.18 (14)	**<0.001**
	Faktor penyebab masalah kesihatan mental di kalangan remaja ID adalah: (Factors causing mental health problems among ID adolescents are:)					
K14	*sukar meluahkan perasaan* (difficult to express feelings)	-3.04 (0.89)	1.33 (0.56)	0.80	15.84 (14)	**0.045**
K16	*kurang sokongan sosial* (lack of social support)	-3.07 (0.96)	0.95 (0.37)	0.69	6.36 (14)	0.607
	BAHAGIAN C: MASALAH KETIDAKUPAYAAN PERKEMBANGAN (PART C: PROBLEMS OF DEVELOPMENTAL DISABILITIES)					
	***Ciri-ciri** ketidakupayaan perkembangan yang dialami oleh remaja ID adalah:* (The characteristics of developmental disabilities experienced by ID adolescents are:)					
K17	*sukar menguruskan diri sendiri* (difficult to manage ownself)	-1.60 (0.25)	2.50 (0.91)	0.93	39.69 (9)	**<0.001**
K18	*sukar memulakan perbualan* (difficult to start a conversation)	-1.97 (0.39)	1.76 (0.60)	0.87	19.65 (9)	**0.012**
K19	*mengalami kesukaran dalam proses pembelajaran* (experiencing difficulties in the learning process)	-2.36 (0.48)	1.97 (0.73)	0.89	13.27 (9)	0.103
K20	*kurang tumpuan untuk tempoh yang lama* (lack of concentration for long periods of time)	-2.04 (0.37)	2.01 (0.69)	0.89	55.08 (9)	**<0.001**
K21	*boleh bertindak agresif* (can act aggressively)	-1.36 (0.22)	2.19 (0.71)	0.91	53.58 (9)	**<0.001**
K23	*sukar untuk menyatakan keperluan dan kehendak mereka* (difficult to express their needs and wants)	-2.01 (0.37)	2.20 (0.82)	0.91	28.68 (9)	**<0.001**
	BAHAGIAN D: MASALAH TINGKAH LAKU BERISIKO (PART D: HIGH-RISK BEHAVIOUR PROBLEMS)					
	Remaja ID berisiko untuk: (Adolescents with ID are at risk for:)					
K24	*dipengaruhi oleh rakan sebaya* (influenced by peers)	-0.63 (0.12)	1.93 (0.35)	0.89	25.91 (14)	**0.001**
K25	*dimanipulasi oleh orang di sekeliling mereka* (manipulated by the people around them)	-1.69 (0.22)	2.63 (0.70)	0.94	20.20 (14)	**0.010**
K26	*terpengaruh dengan tabiat merokok dan vape* (influenced by smoking and vaping habits)	-0.57 (0.08)	**6.68 (2.74)**	0.99	8.65 (14)	0.373

CONTINUE

Table II: Result of the IRT analysis in the knowledge section in validation study (n = 222). (CONT.)

	Items	b (SE)	a (SE)	λ	χ2 (df)	P values
	BAHAGIAN D: MASALAH TINGKAH LAKU BERISIKO (PART D: HIGH-RISK BEHAVIOUR PROBLEMS)					
K28	*terpengaruh dengan ketagihan pornografi* (influenced by pornography addiction)	-0.33 (0.10)	**6.66 (1.78)**	0.99	8.45 (14)	0.391
K29	*menjadi mangsa jenayah siber* (become a victim of cybercrime)	-0.88 (0.14)	1.91 (0.36)	0.89	24.65 (14)	**0.002**
K30	*menjadi mangsa buli* (be a victim of bullying)	-2.28 (0.43)	1.48 (0.40)	0.83	30.09 (14)	**<0.001**
K31	*melakukan keganasan* (commit violence)	-1.04 (0.20)	1.27 (0.26)	0.79	15.10 (14)	0.057
	BAHAGIAN E: MASALAH KESIHATAN BERKAITAN PEMAKANAN (PART E: NUTRITION RELATED HEALTH PROBLEMS)					
	Remaja ID berisiko mempunyai masalah kesihatan berkaitan pemakanan seperti: (Adolescents with ID are at risk of having nutrition-related health problems such as:)					
K32	*berat badan berlebihan* dan obesity (overweight and obesity)	-1.62 (0.31)	1.51 (0.45)	0.83	35.31 (14)	**<0.001**
K34	*kurang zat pemakanan* (micronutrient deficiency)	-1.10 (0.21)	1.62 (0.46)	0.85	41.29 (14)	**<0.001**
K35	*memilih makanan* (picky eating)	-1.54 (0.35)	1.19 (0.36)	0.77	43.05 (14)	**<0.001**
K36	*amalan pemakanan yang tidak sihat* (unhealthy eating habits)	-1.29 (0.20)	**2.92 (1.28)**	0.95	24.01 (14)	**0.002**
	***Faktor penyebab** masalah berat badan berlebihan dalam kalangan remaja ID adalah:* (Factors causing overweight and obesity problems among ID adolescents are:)					
K37	*kurang peluang beraktiviti fizikal* (less opportunity for physical activity)	-3.36 (1.47)	0.80 (0.41)	0.62	54.21 (14)	**<0.001**
K38	*gaya hidup yang tidak aktif* (sedentary lifestyle)	-2.93 (0.91)	1.59 (0.78)	0.85	15.32 (14)	0.053
K39	*kurang pendedahan tentang amalan pemakanan yang sihat* (lack of exposure to healthy eating practices)	-3.85 (1.90)	0.72 (0.41)	0.58	15.68 (14)	**0.047**
	BAHAGIAN F: MASALAH KESIHATAN SEKSUAL DAN REPRODUKTIF (PART F: SEXUAL AND REPRODUCTIVE HEALTH PROBLEMS)					
	Remaja ID berisiko mempunyai masalah seksual dan reproduktif seperti: (Adolescents with ID are at risk of having sexual and reproductive problems such as:)					
K40	*didera secara seksual* (sexual abuse)	-0.78 (2.75)	**18.66 (527.82)**	0.99	3.47 (5)	0.901
K41	*dieksplotasi secara seksual* (sexual exploitation)	-1.07 (0.15)	**3.63 (1.01)**	0.96	67.93 (5)	**<0.001**
K43	*melakukan sentuhan yang tidak sepatutnya kepada orang lain di tempat awam* (touching others inappropriately in a public place)	-0.86 (0.17)	1.59 (0.38)	0.85	108.54 (5)	**<0.001**
K44	*mengandung dalam usia remaja bagi remaja* perempuan (teenage pregnancy for girls)	-1.66 (0.31)	1.46 (0.37)	0.83	38.80 (5)	**<0.001**
	Dalam aspek kesihatan seksual dan reproduktif, remaja ID: (In terms of sexual and reproductive health, ID adolescents:)					
K46	*sukar memahami batas dalam pergaulan* (difficult to understand boundaries in socializing)	-2.18 (0.50)	1.16 (0.34)	0.76	14.37 (5)	0.073

Modified parallel analysis supported unidimensionality, RMSEA = 0.01-0.14, M2 = 3.33-72.63, TLI = 0.57-1.01, CFI = 0.71-1.00, b difficulty, a discrimination, df degree of freedom, IRT item response theory, SE standard error, χ2chi-square, λ standardized loading, Items with P values < 0.05 in the assessment of the item fit and items with discrimination over 2.5 are highlighted in bold.

The EFA analysis for the attitude section is shown in Table III. The KMO index was 0.90, and Bartlett's test achieved a significance level well below the 0.001 threshold, affirming the suitability of EFA. Despite parallel analysis indicating a five-factor model, a three-factor solution was determined to be optimal, as evidenced by the scree plot analysis recommended by Pett et al. (28). Subsequent rotation of these factors employed the Promax method, an oblique alternative to the varimax rotation, as supported by Thompson (27). Item with low factor loading (<0.3) and low communalities (<0.25) were sequentially eliminated. Factor loadings exceeded the 0.3 criterion for all items within the attitude domain, except for A7, A31, A37, A39, and A40, which were consequently excluded. Communalities for each item were also considered, leading to the removal of items A1, A4, A8, A24, A29, A32, A33, and A34 due to their low communalities, falling below 0.25. Factor loadings (FLs) ranged from 0.350 to 0.904. The Cronbach's alpha values for the cognitive, affective, and behavioural domains were 0.877, 0.900, and 0.956 respectively. These values demonstrate good reliabilities for the domains in the scale. At this stage, the three-factor model comprised a total of 39 items: cognitive attitude (items A2, A3, A5, A6, A9, A10, A11, A12, A13, A14, A15 and A16), affective attitude (items A18, A19, A20, A21, A22 and A23) and behaviour attitude (items A17, A25, A26, A27, A28, A30, A35, A36, A38, A41, A42, A43, A44, A45, A46, A47, A48, A49, A50, A51 and A52).

Table III: Results of the EFA of attitude section

Factors		Items	Factor loading (λ)	Communalities (h^2)	Reliability (Cronbach's alpha-a)
Cognitive	A2	*Remaja ID perlu diberi masa tambahan untuk membantu perawatan yang optimum* (ID adolescents need to be given extra time to achieve an optimal care)	0.757	0.427	0.877
	A3	*Cara perawatan yang berbeza adalah perlu untuk mengurus tingkah laku remaja ID* (A different treatment approach is necessary to manage ID adolescents' behaviour)	0.541	0.268	
	A5	*Penglibatan remaja ID dalam membuat keputusan membantu kualiti penjagaan kesihatan mereka* (Involvement of ID adolescents in decision-making helps the quality of their healthcare)	0.456	0.259	
	A6	*Sokongan penjaga dapat meningkatkan kualiti penjagaan kesihatan remaja ID* (Caregivers support can improve the quality of healthcare for adolescents with ID)	0.575	0.421	
	A9	*Kehadiran penjaga remaja ID dapat membantu komunikasi semasa perawatan* (The presence of ID adolescents' caregivers can help communication during treatment)	0.476	0.319	
	A10	*Masalah komunikasi remaja ID menghalang penyampaian perkhidmatan yang berkesan* (ID adolescents' communication problems hinder effective service delivery)	0.430	0.285	
	A11	*Gambar atau video dapat membantu dalam menyampaikan pendidikan kesihatan kepada remaja ID* (Photos or videos can help in conveying health education to ID adolescents)	0.382	0.282	
	A12	*Pendidikan kesihatan untuk remaja ID perlu menggunakan bahasa yang mudah difahami* (Health education for ID adolescents needs to use easy-to-understand language)	0.754	0.602	
	A13	*Bahan pendidikan kesihatan untuk remaja ID perlu mengambilkira tahap kefahaman mereka* (Health education materials for ID adolescents need to take into account their level of understanding)	0.725	0.611	
	A14	*Remaja ID tidak selesa menunggu lama di ruangan menunggu* (ID adolescents are not comfortable waiting in the waiting area for a long time)	0.551	0.345	
	A15	*Remaja ID tidak selesa bersesak-sesak di ruangan menunggu* (ID adolescents are uncomfortable in the crowded waiting area)	0.565	0.331	
	A16	*Petugas kesihatan memerlukan latihan berkenaan pengurusan kesihatan remaja ID* (Healthcare providers need training on ID adolescent health management)	0.743	0.509	
Affective	A18	*Saya akan berasa marah jika remaja ID menyentuh barang -barang/peralatan yang ada di klinik semasa perawatan* (I will feel angry if the ID adolescents touch the items/equipment in the clinic during treatment)	0.744	0.576	0.900
	A19	*Saya akan berasa kecewa jika remaja ID tidak mampu memberikan sejarah kesihatan yang dialaminya* (I will be disappointed if the ID adolescents are unable to provide a medical history)	0.636	0.458	
	A20	*Saya akan berasa tidak selesa apabila remaja ID mengganggu saya semasa proses perawatan* (I will feel uncomfortable when the ID adolescents interrupt me during the treatment process)	0.817	0.630	
	A21	*Saya akan berasa kecewa apabila nasihat yang diberikan kepada remaja ID tidak dipatuhi* (I will be disappointed when the advice given to ID adolescents is not followed)	0.830	0.643	
	A22	*Saya akan berasa penat untuk mengulangi arahan yang sama kepada remaja ID* (I will get tired of repeating the same instructions to ID adolescents)	0.839	0.716	
	A23	*Saya akan berasa tidak mahu untuk meneruskan pemeriksaan kesihatan jika remaja ID tidak boleh memberi kerjasama* (I will feel reluctant to proceed with the health check/medical examination if the ID adolescents cannot cooperate)	0.837	0.700	
Behaviour	A17	*Saya akan sentiasa cuba bersabar dengan tingkah laku remaja ID semasa perawatan* (I will always try to be patient with the behaviour of ID adolescents during treatment)	0.453	0.429	0.956
	A25	*Saya memerlukan latihan berkenaan pengurusan kesihatan remaja ID* (I need training on ID adolescent health management)	0.429	0.259	
	A26	*Saya akan lebih prihatin jika melibatkan perawatan remaja ID* (I will be more concerned if it involves the treatment of ID adolescents)	0.574	0.520	
	A27	*Saya akan berusaha untuk mengatasi rasa sukar dalam melakukan pemeriksaan kesihatan ke atas remaja ID yang agresif* (I will try to overcome the difficulty in doing health check up/medical examination on aggressive ID adolescents)	0.526	0.316	
	A28	*Saya memerlukan kemahiran untuk lebih yakin dalam menguruskan tingkah laku remaja ID semasa perawatan* (I need skills to be more confident in managing the behaviour of ID adolescents during treatment)	0.469	0.254	
	A30	*Saya akan berasa kagum melihat penjaga remaja ID menguruskan anak-anak mereka* (I will be amazed to see the caregivers of ID adolescents manage their children)	0.376	0.375	
	A35	*Saya akan meluangkan masa yang lebih dalam perawatan remaja ID* (I will spend more time when treating ID adolescents)	0.560	0.493	

CONTINUE

Table III: Results of the EFA of attitude section. (CONT.)

Factors		Items	Factor loading (λ)	Communalities (h^2)	Reliability (Cronbach's alpha-a)
Behaviour	A36	*Saya akan memberi perhatian yang lebih dalam perawatan remaja ID* (I will pay more attention when treating ID adolescents)	0.563	0.555	
	A38	*Saya akan memberi peluang kepada remaja ID untuk menyatakan pendapat terhadap perawatan yang diberi* (I will give ID adolescents the opportunity to express their opinion on the care given)	0.350	0.320	
	A41	*Saya akan berusaha menggunakan bahasa yang mudah apabila berkomunikasi dengan remaja ID semasa perawatan* (I will try to use simple language when communicating with ID adolescents during treatment)	0.982	0.799	
	A42	*Saya akan cuba memberi arahan yang ringkas kepada remaja ID semasa perawatan* (I will try to give simple instructions to ID adolescents during treatment)	0.806	0.537	
	A43	*Saya akan mengulangi percakapan jika remaja ID tidak mampu memahami saya* (I will repeat the conversation if the ID adolescents are unable to understand me)	0.850	0.766	
	A44	*Saya akan sentiasa memberi kata-kata semangat kepada remaja ID* (I will always give words of encouragement to ID adolescents)	0.904	0.770	
	A45	*Saya akan sentiasa memberi kata-kata semangat kepada penjaga remaja ID* (I will always give words of encouragement to ID adolescents' caregivers)	0.876	0.750	
	A46	*Saya akan cuba membina perhubungan (rapport) sebelum meneruskan rawatan agar remaja ID lebih selesa* (I will try to build a relationship (rapport) before continuing the treatment so that the ID adolescents are more comfortable)	0.796	0.674	
	A47	*Saya akan selalu memuji remaja ID jika mereka melakukan sesuatu yang betul* (I will always praise ID adolescents if they do something right)	0.733	0.698	
	A48	*Saya tidak akan ketawakan remaja ID jika mereka melakukan kesilapan* (I will not laugh at ID adolescents if they make mistakes)	0.718	0.485	
	A49	*Saya akan bertenang ketika menghadapi remaja ID yang bersikap agresif* (I will stay calm when dealing with aggressive ID adolescents)	0.820	0.500	
	A50	*Saya akan mendahulukan rawatan kepada remaja ID jika didapati mereka bertindak agresif di ruangan menunggu* (I will prioritize treatment for ID adolescents if they are found to be aggressive in the waiting area)	0.803	0.684	
	A51	*Saya akan berusaha membuat pemeriksaan kesihatan yang menyeluruh terhadap remaja ID* (I will try to do a comprehensive health check up/medical examination on ID adolescents)	0.786	0.559	
	A52	*Saya akan berusaha memperbaiki komunikasi saya dengan remaja ID* (I will try to improve my communication with ID adolescents)	0.774	0.740	

EFA exploratory factor analysis, λ factor loading, h2 communalities, a Cronbach's alpha

The Confirmatory Factor Analysis (CFA) was performed on a three-factor model populated with well-performing items. Given the non-normal distribution of the data (evidenced by a kurtosis > 5, $p < 0.05$); hence, a robust maximum likelihood (MLR) the CFA utilised a robust maximum likelihood estimation (MLR) method. The initial CFA model (Model 1) indicated suboptimal fit across the 39 items (χ^2 [df = 699] = 1860, $p < 0.001$; CFIrobust = 0.79; TLIrobust = 0.77; RMSEArobust = 0.10; SRMR = 0.07). Decisions on item removal during the CFA were based on statistical indicators such as high modification indices, low factor loadings, poor item-total correlations, and high standardized residuals. Items contributing to the highest model misfit were prioritised for removal, ensuring the retained items enhanced the overall model fit. In an attempt to refine the model, items such as A10, which had factor loadings below 0.5, were removed. However, this modification did not yield an adequate fit, necessitating further analysis of the model. Items exhibiting standardized residuals exceeded 2.58 were closely evaluated, leading to the removal of items A15, A35, A38, A30, A27, A25, A5, and A49 due to their presentation in the model were impacting the model's fit. To further improve the fit indices, the analysis focused on items within the same factor that presented high modification indices, particularly those with an MI exceeding 3.84. Consequently, this analysis resulted in the elimination of items A23 and A51 from the model.

The measurement of the final model demonstrated a good fit, as evidenced by the following metrics (χ^2 [df = 347] = 639.34, $p < 0.001$; CFIrobust = 0.92; TLIrobust = 0.91; RMSEArobust = 0.07; SRMR = 0.06). Inter-factor correlations were maintained below 0.85, with the cognitive and affective factors correlating at r = 0.12, cognitive and behavioural factors at r = 0.68, and affective and behavioural factors at r = 0.37. Factor loadings (FLs) of the final model ranged from 0.494 to 0.895. The composite reliability for the cognitive, affective, and behavioural attitude factors were acceptable as demonstrated by Raykov's rho values of 0.871, 0.888, and 0.954, respectively, which are detailed in Table IV.

Table IV: Results of the CFA of attitude section

Factors		Items	Factor loading (λ)	Reliability (Raykov's rho, b)
Cognitive	A2	*Remaja ID perlu diberi masa tambahan untuk membantu perawatan yang optimum* (ID adolescents need to be given extra time to achieve an optimal care)	0.638	0.871
	A3	*Cara perawatan yang berbeza adalah perlu untuk mengurus tingkah laku remaja ID* (A different treatment approach is necessary to manage ID adolescents' behaviour)	0.605	
	A6	*Sokongan penjaga dapat meningkatkan kualiti penjagaan kesihatan remaja ID* (Caregivers support can improve the quality of healthcare for adolescents with ID)	0.723	
	A9	*Kehadiran penjaga remaja ID dapat membantu komunikasi semasa perawatan* (The presence of ID adolescents' caregivers can help communication during treatment)	0.738	
	A11	*Gambar atau video dapat membantu dalam menyampaikan pendidikan kesihatan kepada remaja ID* (Photos or videos can help in conveying health education to ID adolescents)	0.659	
	A12	*Pendidikan kesihatan untuk remaja ID perlu menggunakan bahasa yang mudah difahami* (Health education for ID adolescents needs to use easy-to-understand language)	0.752	
	A13	*Bahan pendidikan kesihatan untuk remaja ID perlu mengambilkira tahap kefahaman mereka* (Health education materials for ID adolescents need to take into account their level of understanding)	0.76	
	A14	*Remaja ID tidak selesa menunggu lama di ruangan menunggu* (ID adolescents are not comfortable waiting in the waiting area for a long time)	0.499	
	A16	*Petugas kesihatan memerlukan latihan berkenaan pengurusan kesihatan remaja ID* (Healthcare providers need training on ID adolescent health management)	0.664	
Affective	A18	*Saya akan berasa marah jika remaja ID menyentuh barang -barang/peralatan yang ada di klinik semasa perawatan* (I will feel angry if the ID adolescents touch the items/equipment in the clinic during treatment)	0.673	0.888
	A19	*Saya akan berasa kecewa jika remaja ID tidak mampu memberikan sejarah kesihatan yang dialaminya* (I will be disappointed if the ID adolescents are unable to provide a medical history)	0.819	
	A20	*Saya akan berasa tidak selesa apabila remaja ID mengganggu saya semasa proses perawatan* (I will feel uncomfortable when the ID adolescents interrupt me during the treatment process)	0.788	
	A21	*Saya akan berasa kecewa apabila nasihat yang diberikan kepada remaja ID tidak dipatuhi* (I will be disappointed when the advice given to ID adolescents is not followed)	0.83	
	A22	*Saya akan berasa penat untuk mengulangi arahan yang sama kepada remaja ID* (I will get tired of repeating the same instructions to ID adolescents)	0.767	
Behaviour	A17	*Saya akan sentiasa cuba bersabar dengan tingkah laku remaja ID semasa perawatan* (I will always try to be patient with the behaviour of ID adolescents during treatment)	0.494	0.954
	A26	*Saya akan lebih prihatin jika melibatkan perawatan remaja ID* (I will be more concerned if it involves the treatment of ID adolescents)	0.762	
	A28	*Saya memerlukan kemahiran untuk lebih yakin dalam menguruskan tingkah laku remaja ID semasa perawatan* (I need skills to be more confident in managing the behaviour of ID adolescents during treatment)	0.647	
	A36	*Saya akan memberi perhatian yang lebih dalam perawatan remaja ID* (I will pay more attention when treating ID adolescents)	0.768	
	A41	*Saya akan berusaha menggunakan bahasa yang mudah apabila berkomunikasi dengan remaja ID semasa perawatan* (I will try to use simple language when communicating with ID adolescents during treatment)	0.877	
	A42	*Saya akan cuba memberi arahan yang ringkas kepada remaja ID semasa perawatan* (I will try to give simple instructions to ID adolescents during treatment)	0.864	
	A43	*Saya akan mengulangi percakapan jika remaja ID tidak mampu memahami saya* (I will repeat the conversation if the ID adolescents are unable to understand me)	0.895	
	A44	*Saya akan sentiasa memberi kata-kata semangat kepada remaja ID* (I will always give words of encouragement to ID adolescents)	0.847	
	A45	*Saya akan sentiasa memberi kata-kata semangat kepada penjaga remaja ID* (I will always give words of encouragement to ID adolescents' caregivers)	0.883	
	A46	*Saya akan cuba membina perhubungan (rapport) sebelum meneruskan rawatan agar remaja ID lebih selesa* (I will try to build a relationship (rapport) before continuing the treatment so that the ID adolescents are more comfortable)	0.87	
	A47	*Saya akan selalu memuji remaja ID jika mereka melakukan sesuatu yang betul* (I will always praise ID adolescents if they do something right)	0.768	
	A48	*Saya tidak akan ketawakan remaja ID jika mereka melakukan kesilapan* (I will not laugh at ID adolescents if they make mistakes)	0.746	
	A50	*Saya akan mendahulukan rawatan kepada remaja ID jika didapati mereka bertindak agresif di ruangan menunggu* (I will prioritize treatment for ID adolescents if they are found to be aggressive in the waiting area)	0.669	
	A52	*Saya akan berusaha memperbaiki komunikasi saya dengan remaja ID* (I will try to improve my communication with ID adolescents)	0.811	

CFA confirmatory factor analysis, λ factor loading, b Raykov's rho

DISCUSSION

The objective of this study was to develop and validate a new questionnaire designed to measure primary healthcare providers' knowledge of health issues in adolescents with intellectual disabilities and their attitudes towards the accessibility of primary healthcare services for adolescents with intellectual disabilities. The research began with the development of the questionnaire, followed by an evaluation of its validity and reliability. To the best of the author's knowledge, this is the first study that develops and validates a new Malay-language questionnaire for assessing knowledge regarding intellectually disabled adolescents' health issues and attitude on their accessibility to primary healthcare services. This KA-IDA questionnaire was tailor-made to suit the needs and context of primary healthcare providers.

Overall, the knowledge section exhibited acceptable psychometric properties as shown by the difficulty and discriminatory parameters of the items. The analysis carried out in the attitude section yielded a well-fitting three-factor model, demonstrating acceptable reliability. The findings from the content and face validity assessments suggested that participants were able to understand and interpret the items well, affirming that the items effectively represented the intended constructs. To ensure that the content of the questionnaire accurately represents the construct being measured, it was necessary to remove certain items (32, 33). Therefore, at this level, there were ten items in the knowledge were excluded and nine items from attitude were removed. This was done to improvise the psychometric properties of the remaining items.

In the knowledge section, the Item Response Theory (IRT) analysis revealed that all of the difficulty values for the items were within the acceptable range for the difficulty parameter. The discrimination values for most of the items were within the permissible range, except for items K4, K9, K26, K28, K36, K40, and K41, which exceeded the cutoff value of 2.5. These items, however, were maintained due to their usefulness in assessing knowledge regarding various important elements of adolescents with intellectual disabilities' health issues similar to a study conducted by Ngah et al. (32). Item K40 had a discrimination value of 18.66, above the 2.5 cut off value. Extremely high discrimination values indicated that an item effectively distinguishes between respondents with varying levels of knowledge. However, such items might be excessively difficult or overly specific, presenting challenges for the intended audience and potentially skewing results. This item was kept because the chi-square goodness-of-fit test showed it fitted the model and its difficulty levels were acceptable. On the other hand, most items had chi-square goodness-of-fit less than 0.05, indicating poor model fitted. In this research, the chi-square test's sensitivity to high sample sizes might be the cause. The problem might be due to the well-documented sensitivity of the chi-square test to large sample sizes (34). This study evaluated each domain separately, with fewer than ten items per domain, indicating a large sample size was used. Therefore, these items were retained in the model. However, retaining items with poor model fit might indicate that these items did not adequately capture the construct being measured, leading to potential inaccuracies in assessing respondents' knowledge. Poor model fit could also affect the overall reliability and validity of the questionnaire, potentially diminishing the quality of the data collected. Furthermore, in terms of the model's fitness, some of the fit indices such as RMSEA, TLI and CFI might be deemed unsatisfactory, but this model was still considered acceptable similar to the study conducted by Hill et al. (35). This was primarily due to the fact that the difficulty and discrimination levels of the majority of items fall within acceptable ranges and the inclusion of these items in the model was also based on expert recommendations. Based on the results, the IRT model was discovered to be unidimensional, describing the connections between all items through the representation of one factor in each domain (33). The Cronbach's alpha values for the domains in the knowledge segment fell within the interval of 0.56 and 0.8, indicating the questionnaire's reliability in accordance with a prior study's criterion that a value of 0.5 was considered acceptable (36).

The outcomes of the EFA supported the reliability and construct validity of the attitude component. The analysis yielded a tripartite model of attitude encompassing cognitive, affective, and behavioural dimensions as initially hypothesised. Out of the 52 items in the attitude domain, 39 items were preserved, each demonstrating a factor loading exceeding 0.3, which signifies a robust link between the items and their respective underlying factors (33, 37, 38). The attitude domain's reliability was further affirmed by a satisfactory Cronbach's alpha value surpassing 0.65, confirming the internal consistency of the scale (24).

The CFA results led to modifications in the attitude model to enhance its fit. Due to the data's deviation from multivariate normality, the MLR method was the chosen fit for the CFA model to address the non-normality issue (39). In the improved model, a total of 28 items were preserved, with the cognitive section including nine items, the affective section containing five items, and the behavioural section containing 14 items. These items were decided based on improved Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) values when comparing initial and revised models. The decrease in AIC and BIC values, coupled with a significant χ^2 value, suggested a well-fitting model (40). Factor loadings for the items were between 0.494 and 0.895, which is within the acceptable range, as values above 0.3 are considered satisfactory (25). The fit

indices for the attitude component of the questionnaire including RMSEA, CFI, TLI, and SRMR were all within the acceptable limits, aligning with findings from previous research (31, 32, 41). The reliability across the domains was confirmed by Raykov's rho values of 0.871, 0.888, and 0.954, indicative of good reliability (42).

Strength and limitations

The strength of our study is a validated questionnaire that adequately captures health concerns and access to primary care for adolescents with intellectual disability. This tool is critical for assessing and improving healthcare services for this special population. Furthermore, the questionnaire may assist primary healthcare providers of different job categories and level in identifying the intellectually disabled adolescents' health needs and primary care issues. Apart from primary healthcare services, this questionnaire may also be used at other level of healthcare services such as in secondary or tertiary care. It may also be used to influence policy changes that will result in more inclusive healthcare facilities for people with intellectual disabilities.

The scope of this study is limited, as the survey was restricted to primary healthcare providers within Kelantan, potentially overlooking the perspectives of providers in other regions. To enhance the generalizability of the KA-IDA questionnaire, future research should involve a broader and more diverse sample of healthcare providers from various geographic locations and healthcare settings. Additionally, while this study focused on assessing knowledge and attitudes, future research should expand the questionnaire to evaluate actual practices to provide a more comprehensive view of healthcare delivery. The predominantly female sample may also affect the generalizability of the results; therefore, future studies should aim for a more balanced representation of gender and other demographic variables. However, since this is a validation study, the primary focus is on assessing the reliability and validity of the instrument rather than ensuring its broad applicability across different demographics. Finally, subsequent research should address any issues with item and model fit identified in this study and explore the practical impact of the questionnaire on healthcare practices and policy to assess its effectiveness in real-world settings.

CONCLUSION

A new Malay-validated KA-IDA questionnaire was designed and validated among Kelantan primary healthcare providers in this study. The questionnaire consists of three sections and a total of 80 items. These items are further categorised into 14 general information items, 38 knowledge items, and 28 attitude items. Six domains were subdivided under knowledge, while three components were subdivided under attitude. Based on IRT, EFA, and CFA, the knowledge and attitude sections were psychometrically valid. The KA-IDA questionnaire provides several practical applications for enhancing healthcare for adolescents with intellectual disabilities. It serves as a standardised tool to assess healthcare providers' knowledge and attitudes, helping to pinpoint strengths and areas needing improvement in service delivery. Developed with expert input, the questionnaire ensures relevance and validity, offering reliable data to inform policy refinement and improve service quality. Additionally, it enables researchers to explore factors influencing provider attitudes and their impact on health outcomes, facilitating comparability across studies and advancing evidence in this critical area of healthcare.

ACKNOWLEDGEMENT

I would like to extend my heartfelt appreciation to my supervisor and co-supervisors, Associate Professor Dr Azriani Ab Rahman, Dr Anis Kausar Ghazali, Associate Professor Dr Surianti Sukeri, Dr Mohd Zulkifli Abdul Rahim, and Dr Noran Hashim for their steadfast guidance, continuous encouragement, and invaluable support throughout the course of this research project.

REFERENCES

1. Patel DR, Cabral MD, Ho A, Merrick J. A clinical primer on intellectual disability. Translational pediatrics. 2020;9(Suppl 1):S23-s35. doi: 10.21037/tp.2020.02.02.
2. Liao P, Vajdic C, Trollor J, Reppermund S. Prevalence and incidence of physical health conditions in people with intellectual disability – a systematic review. PLOS ONE. 2021;16(8):e0256294. doi: 10.1371/journal.pone.0256294.
3. Olusanya BO, Wright SM, Nair MKC, Boo NY, Halpern R, Kuper H, et al. Global burden of childhood epilepsy, intellectual disability, and sensory impairments. Pediatrics. 2020;146(1). doi: 10.1542/peds.2019-2623.
4. SWD. Statistics Report 2021. 2021 ed. Putrajaya: Department of Social Welfare; 2022.
5. APA. Diagnostic and statistical manual of mental disorders : DSM-5. vol Accessed from https://nla.gov.au/nla.cat-vn6261708. Arlington, VA: American Psychiatric Association; 2013.
6. Jansen DE, Krol B, Groothoff JW, Post D. People with intellectual disability and their health problems: a review of comparative studies. Journal of Intellectual Disability Research. 2004;48(2):93-102. doi: 10.1111/j.1365-2788.2004.00483.x.
7. Straetmans JM, van Schrojenstein Lantman-de Valk HM, Schellevis FG, Dinant GJ. Health problems of people with intellectual disabilities: the impact for general practice. British Journal of General Practice. 2007;57(534):64-6.
8. Sappok T, Diefenbacher A, Winterholler M. The Medical Care of People With Intellectual Disability. Deutsches Ärzteblatt International. 2019;116(48):809-16. doi: 10.3238/

arztebl.2019.0809.
9. Reddihough D, Leonard H, Jacoby P, Kim R, Epstein A, Murphy N, et al. Comorbidities and quality of life in children with intellectual disability. Child: care, health and development. 2021;47(5):654-66. doi: 10.1111/cch.12873.
10. Boardman L, Bernal J, Hollins S. Communicating with people with intellectual disabilities: a guide for general psychiatrists. Advances in Psychiatric Treatment. 2018;20(1):27-36. doi: 10.1192/apt.bp.110.008664.
11. Shady K, Phillips S, Newman S. Barriers and facilitators to healthcare access in adults with intellectual and developmental disorders and communication difficulties: An integrative review. Review Journal of Autism and Developmental Disorders. 2022. doi: 10.1007/s40489-022-00324-8.
12. Mohd FN, Said AH, Ahmad MS, Ridzwan AN, Muhammad AI, Mat Naji AS. Exploring the barriers and expectations towards health care services among parents/caretakers of people with intellectual disability in Kuantan, Malaysia: A qualitative study. Journal of International Society of Preventive and Community Dentistry. 2023;13(6):477-84. doi: 10.4103/jispcd.JISPCD_89_23.
13. Lam WY, Gunukula SK, McGuigan D, Isaiah N, Symons AB, Akl EA. Validated instruments used to measure attitudes of healthcare students and professionals towards patients with physical disability: a systematic review. J Neuroeng Rehabil. 2010;7:55. doi: 10.1186/1743-0003-7-55.
14. Morin D, Crocker AG, Beaulieu-Bergeron R, Caron J. Validation of the attitudes toward intellectual disability: ATTID questionnaire. Journal of intellectual disability research : JIDR. 2013;57(3):268-78. doi: 10.1111/j.1365-2788.2012.01559.x.
15. Saldana J. Thinking qualitatively: Methods of mind. SAGE publications; 2014.
16. Edelen MO, Reeve BB. Applying item response theory (IRT) modeling to questionnaire development, evaluation, and refinement. Quality of life research : an international journal of quality of life aspects of treatment, care and rehabilitation. 2007;16 Suppl 1:5-18. doi: 10.1007/s11136-007-9198-0.
17. Jackson DL. Sample size and number of parameter estimates in maximum likelihood confirmatory factor analysis: A Monte Carlo investigation. Structural Equation Modeling. 2001;8(2):205-23. doi: 10.1207/S15328007SEM0802_3.
18. IBM Corp S. Statistics for windows, version 26.0. Armonk, NY: IBM Corp. 2019.
19. Core RT. Team. R: a language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical. Computing. 2008.
20. Team R. RStudio: integrated development for R. (No Title). 2015.
21. De Ayala R. Item response theory and Rasch modeling. The reviewer's guide to quantitative methods in the social sciences. 2018:145-63.
22. Baker FB. The basics of item response theory. ERIC; 2001.
23. Hair JF, Black WC, Babin BJ, Anderson RE, Tatham RL. Multivariate data analysis 6th Edition. Pearson Prentice Hall. New Jersey. humans: Critique and reformulation; 2006.
24. DeVellis RF, Thorpe CT. Scale development: Theory and applications. Sage publications; 2021.
25. Hair JF. Multivariate data analysis. Marketing and Professional Sales; 2009.
26. Costello AB, Osborne J. Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. Practical assessment, research, and evaluation. 2005;10(1):7. doi: https://doi.org/10.7275/jyj1-4868.
27. Thompson B. Exploratory and confirmatory factor analysis: Understanding concepts and applications. vol 000. Washington, DC: Sage Publications; 2004.
28. Pett MA, Lackey NR, Sullivan JJ. Making sense of factor analysis: The use of factor analysis for instrument development in health care research. Sage; 2003.
29. Floyd FJ, Widaman KF. Factor analysis in the development and refinement of clinical assessment instruments. Psychological assessment. 1995;7(3):286. doi: 10.1037/1040-3590.7.3.286.
30. Munder T, Wilmers F, Leonhart R, Linster HW, Barth J. Working Alliance Inventory-Short Revised (WAI-SR): psychometric properties in outpatients and inpatients. Clinical Psychology & Psychotherapy. 2010;17(3):231-9. doi: https://doi.org/10.1002/cpp.658.
31. Baistaman J, Awang Z, Afthanorhan A, Rahim MMA. Developing and validating the measurement model for financial literacy construct using confirmatory factor analysis. Humanities & Social Sciences Reviews. 2020;8(2). doi: 10.18510/hssr.2020.8247.
32. Ngah H, Mohd Hairon S, Hamzah NA, Noordin S, Shafei MN. Development and validation of knowledge, attitude, and practice questionnaire: Toward safe working in confined spaces. International journal of environmental research and public health. 2022;19(3):1242. doi: 10.3390/ijerph19031242.
33. Goni MD, Naing NN, Hasan H, Wan-Arfah N, Deris ZZ, Arifin WN, et al. Development and validation of knowledge, attitude and practice questionnaire for prevention of respiratory tract infections among Malaysian Hajj pilgrims. BMC Public Health. 2020;20(1):189. doi: 10.1186/s12889-020-8269-9.
34. Thompson B. Research news and comment: AERA editorial policies regarding statistical significance testing: three suggested reforms.

Educational Researcher. 1996;25(2):26-30. doi: 10.3102/0013189X025002026.
35. Hill CD, Edwards MC, Thissen D, Langer MM, Wirth RJ, Burwinkle TM, et al. Practical issues in the application of item response theory: a demonstration using items from the pediatric quality of life inventory (PedsQL) 4.0 generic core scales. Medical Care. 2007;45(5):S39-S47. doi: 10.1097/01.mlr.0000259879.05499.eb.
36. Morera OF, Stokes SM. Coefficient α as a measure of test score reliability: Review of 3 popular misconceptions. American journal of public health. 2016;106(3):458-61. doi: 10.2105/ajph.2015.302993.
37. Pituch K, Stevens J. Applied multivariate statistics for the social sciences: Analyses with SAS and IBM's SPSS, sixth edition. 2015.
38. Sovey S, Osman K, Mohd-Matore ME. Exploratory and confirmatory factor analysis for disposition levels of computational thinking instrument among secondary school students. European Journal of Educational Research. 2022;11(2):639-52. doi: 10.12973/eu-jer.11.2.639.
39. Rosseel Y: Lavaan: Latent Variable Analysis. Retrieved from https://CRAN.R-project.org/package=lavaan (2018). Accessed.
40. Brown TA. Confirmatory factor analysis for applied research. Guilford publications; 2015.
41. Zahiruddin WM, Arifin WN, Mohd-Nazri S, Sukeri S, Zawaha I, Bakar RA, et al. Development and validation of a new knowledge, attitude, belief and practice questionnaire on leptospirosis in Malaysia. BMC Public Health. 2018;18:1-12. doi: 10.1186/s12889-018-5234-y.
42. Raykov T. Estimation of congeneric scale reliability using covariance structure analysis with nonlinear constraints. British Journal of Mathematical and Statistical Psychology. 2001;54(2):315-23. doi: 10.1348/000711001159582.