ORIGINAL ARTICLE

Knowledge, Attitude and Practice on the Provision of Long-acting Reversible Contraception Among Primary Healthcare Workers in Malaysia: Questionnaire Development and Validation

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ABSTRACT

Introduction: Long-acting reversible contraception (LARC) is a pivotal strategy in mitigating unintended pregnancies. However, its utilisation in Malaysia remains low. Healthcare workers significantly influence clients' adoption of LARC but existing questionnaires were not adequately validated. This study aimed to develop and validate a new questionnaire to measure the knowledge, attitude and practice of LARC provision among local primary healthcare workers. **Materials and methods:** The questionnaire development involved a comprehensive literature review, discussion with healthcare workers and consultations with experts. Validation procedures included content validity, cognitive interviews and psychometric evaluation of internal structure. The knowledge section was analysed using a two-parameter logistic item response theory (2-PL IRT) analysis. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted to assess both attitude and practice sections. A total of 444 healthcare workers involved in the study were randomly selected from health clinics throughout Kelantan, Malaysia. **Results:** Following IRT analysis, 15 items in the knowledge section displayed satisfactory difficulty and discrimination values. The construct validity analyses of the attitude section revealed 13 items that loaded onto three factors: 'client-related', 'method-related resources', and 'method-related limitations'. In the practice section, the construct validity analyses revealed nine items that loaded onto two factors: counselling and clinical evaluation. The final model exhibited acceptable model fitness, with all items having good factor loading (>0.32) and all factors having acceptable composite reliability (Raykov's rho>0.60). **Conclusion:** The questionnaire was shown to have acceptable psychometric properties and reliability, making it a robust instrument.
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INTRODUCTION

Long-acting reversible contraception (LARC) is a contraceptive method which is highly effective at preventing unintended pregnancy, lasts for several years and does not rely on compliance once inserted (1). The World Health Organization has also acknowledged the safety of LARC, affirming its suitability for various groups of clients including adolescents, women over 40 years old, nulliparous women, post-abortion women and lactating women (2). Globally, there are two types of LARCs: implants and intrauterine contraceptive devices (IUCD). The LARC Guidelines for Malaysia similarly acknowledge only these two types as LARC (3). However, only 3.4% of Malaysian women of reproductive age use LARC, and the prevalence has fluctuated below 5% for the past four decades (4). It is significantly lower as compared to contraceptive pills (14.9%); which is the most popular modern contraceptive method in Malaysia.

LARC uptake relies heavily on healthcare workers (HCWs) because every LARC insertion or removal requires a clinician visit. LARC cannot be purchased online or over the counter. HCWs are the primary source of contraceptive information compared to friends, family, sexual education or media (5). However, a qualitative study in the United States revealed that some HCWs admitted to having outdated and lack of knowledge about LARC (6). Through counselling, HCWs can provide accurate information about LARC and help clients make informed decisions about their contraception. Their attitude towards LARC is crucial since they have the power to decide who is eligible for LARC insertion (7). Nevertheless, HCWs often create unnecessary barriers to contraceptive choice,

either based on client-specific characteristics or the contraceptive method itself (8).

Numerous questionnaires are available to evaluate the knowledge, attitude and practice (KAP) of HCWs regarding LARC provision. However, there is a lack of information concerning the validity and reliability of these questionnaires. A valid questionnaire has the ability to accurately measure the underlying outcome of interest (9). Evidence supporting the validity of an instrument can be gathered from five sources which are a) content: the degree to of the instrument completely represents the construct, b) response process: the relationship between the construct and the prospective respondents' thought process, c) internal structure: the reliability and factor structure, d) relation to other variables: correlation with scores from different instrument and e) consequences: significance of the measurement scores (10). In addition to validation, reliability is also crucial in questionnaire evaluation, referring to the instrument's ability to produce results consistently (9).

A study has assessed the KAP regarding IUCD among HCWs working in private and government health facilities in Malaysia (11). However, the questionnaire was modified based on a questionnaire by Chakraborty et al. (12); which only had content validity by experts. No face validity or psychometric analysis was conducted. Additionally, a limitation of the questionnaire was it did not assess the KAP of implants, another important LARC method. Moreover, the study was limited to doctors only, neglecting the important role of nurses as the initial point of contact for many clients seeking family planning services.

Therefore, there is a pressing need for a locally suitable instrument that is both valid and reliable. The validated questionnaire can facilitate the planning of a more effective intervention to improve KAP among HCWs. The purpose of this study is to develop and validate a new questionnaire assessing the KAP on the provision of LARC among primary HCWs.

MATERIALS AND METHODS

A systematic process is required to design, develop and validate a questionnaire to obtain high-quality data and results (13). The process of questionnaire development and validation involved the following steps: setting a clear aim, identifying constructs, developing items, conducting content validation, performing cognitive interviews, pre-testing, and evaluating the psychometric properties of the internal structure (13). The first three steps emphasize the development of the questionnaire, whereas the last four steps focus on questionnaire validation.

1. Set a clear aim

It is pivotal to have a well-defined purpose and goal for developing a questionnaire (13). In this study, the questionnaire is designed to objectively measure the level of KAP on LARC provision among primary HCWs in Kelantan, a state located in the northeastern region of Malaysia. Subsequently, the findings from the study using the new questionnaire can help to plan for a more effective intervention.

2. Identification of construct

The construct denotes the concept, domain or variable being measured (14). A thorough literature review was conducted, encompassing both qualitative and quantitative research, along with an examination of existing questionnaires to identify potential items and scales. The literature search incorporated both qualitative and quantitative research, using the terms "long-acting reversible contraception", "healthcare worker", "questionnaire", and "KAP". The team members also referred to several local and international guidelines to ensure the accuracy of the items. Inputs were obtained from our research team, which included two specialists in Public Health and Biostatistics, along with two additional experts in Family Medicine and Obstetrics and Gynaecology.

Additionally, discussions were conducted with three doctors and five nurses from three different clinics to gain insights into their experiences and views on LARC provision. The discussion explored commonly used terms for LARC, baseline knowledge, procedural flow from LARC ordering to insertion, and challenges encountered in LARC provision. Then the construct was refined by integrating researchers' ideas, expert opinions, literature findings and perspectives from prospective participants. It was decided that the knowledge section covers general information regarding LARC including mechanism of actions, length of duration, safety, insertion time, effectiveness, side effects and complications. Whereas, the attitude section covers 'client-related' and 'method-related' attitudes. The "client-related" attitudes refer to restrictions on specific clients based on factors such as medical conditions, age, parity, or marital status. The "method-related" attitudes, on the other hand, reflect preferences or aversions towards LARC based on the method itself. The practice section covers counselling, clinical evaluation and insertion of LARC. Clinical evaluation refers to how HCWs assess the client before, during or after LARC insertion.

3. Item development

Subsequently, we developed items to cover the construct adequately in a language that the participants could easily understand (15). Furthermore, it should adhere to the current best practices in survey design to reduce

ambiguity and to get the best response (16). The items were developed by the aforementioned research team and experts. Serial meetings were conducted until all experts agreed on the first draft of the questionnaire.

4. Content validation

Six experts, comprising a Public Health Medicine Specialist, a Biostatistician who is also a Public Health Specialist, two Family Medicine Specialists and two Obstetrics and Gynaecology Specialists were appointed to evaluate the content of the questionnaire. They were not involved in the initial item development stage to prevent bias. The purpose was to assess the representativeness of all the items to cover the construct, the relevance of the items to the construct and the clarity of items (15).

The experts provided scores for each item using a 4-point Likert scale of item relevancy and representativeness (14). The score was used to calculate the item-level CVI (I-CVI) and scale-level CVI based on the average method (S-CVI/Ave). The acceptable I-CVI values by six experts should be at least 0.83 (17). Besides, the experts were encouraged to provide written comments to improve the items' relevance, format, design or clarity.

5. Cognitive interview

A cognitive interview was conducted among ten HCWs (three doctors and seven nurses) from a health clinic to ensure participants' understanding of the questionnaire items and response anchors. Both think-aloud technique and verbal probing method were used to perform cognitive interviews (15). The think-aloud technique involved participants verbalising thoughts while answering, and retrospective probing involved participants answering a series of questions at the end of each section to improve the questionnaire (15). These questions include interpretation, paraphrasing, recalling answers and suggestions to improve clarity. Participants assessed the comprehensiveness and clarity of each item by assigning scores through a face validation form. The acceptable cut-off score of the face validity index (FVI) with ten raters was at least 0.83 (18), while the cut-off for S-FVI (Ave) should be more than 0.90 (19). Feedback from the HCWs was discussed within the research team and modifications were made based on their suggestions.

6. Pre-testing

Questionnaire pre-testing was performed to identify any potential shortfalls in the questionnaire, evaluate the administration process and prepare for data entry before conducting subsequent larger study (13). Thirty doctors and nurses were recruited using convenience sampling method to participate in the pre-testing.

7. Psychometric validation of the internal structure and reliability

The knowledge section was analysed using item response theory (IRT), while the attitude and practice sections were analysed using factor analysis. Factor analysis helps to explore (exploratory factor analysis, EFA) and confirm (confirmatory factor analysis, CFA) the presence of underlying hypothesised constructs which are measured by items (13).

A cross-sectional study was conducted from December 2022 to June 2023. Edelen and Reeve (20) stated that a sample size of 200 or less is adequate for IRT analysis. On the other hand, the sample size required for EFA should be at least 200 (21). Similarly, Kline (22) recommended a minimum sample size of 200 for CFA. After considering a 10% non-response rate, the sample size required for EFA, IRT and CFA was 222 participants. Thus, a total of 444 HCWs were involved at this stage, comprising 222 HCWs for the EFA and IRT, and another group of 222 HCWs for the CFA.

The inclusion criteria necessitated participants to be either doctors or nurses, with a minimum of one year of experience in the Maternal and Child Health (MCH) service at the current healthcare facility and understand the Malay Language.

For the EFA and IRT, a list of all eligible doctors and nurses from the randomly selected 12 health clinics in Kota Bharu district was gathered. Then, the number of required doctors and nurses for each clinic was determined by the stratified proportionate sampling formula. Subsequently, at the clinic level, participants were selected using simple random sampling based on the list given. A similar sampling approach was applied for the CFA, involving randomly selected 12 health clinics from the purposively chosen districts of Pasir Mas and Machang. Participants were approached and briefed regarding the study details. Written informed consent was obtained from those who agreed to participate. Participants were given ample time to complete the questionnaire, which took about 20 minutes to complete. Data analysis for the knowledge section was conducted using a two-parameter logistic item response theory (2-PL IRT) model, which determines item difficulty and discrimination levels. The 2-PL IRT requires a binary response. The correct responses were coded as one, whereas incorrect or "don't know" responses were coded as zero. The analysis was conducted using R software version 4.2.0. An acceptable range of difficulty between -3 to +3 and discrimination between 0.35 to 2.5 was used as the cut-off value (23). Item fit was assessed using a chi-squared goodness-of-fit test per item with a p-value > 0.05 indicating a good item fit and unidimensionality was determined using modified parallel analysis.

The EFA was conducted using SPSS software version 26. A Kaiser-Meyer-Olkin (KMO) measure of sample adequacy of 0.60 was deemed acceptable (24). Bartlett's test of sphericity with a p-value <0.05 was used to

determine the data appropriateness (24). The number of constructs was decided based on visual inspection of the scree plot and parallel analysis. Factor loadings of more than 0.32 and communalities of more than 0.2 were considered acceptable (25). The principal axis factoring extraction method, with oblimin rotation was applied. A Cronbach's alpha of more than 0.6 signifies an acceptable internal consistency (26).

Regarding the CFA, data analysis was conducted using SPSS AMOS software version 24. Model fitness was evaluated based on three categories: absolute fit, incremental fit and parsimonious fit. Absolute fit consists of root mean square error of approximation (RMSEA) and goodness of fit index (GFI); incremental fit consists of comparative fit index (CFI) and Tucker-Lewis Index (TLI); and parsimonious fit consists of Chi-square/degree of freedom (χ^2/df).

The values of model fit indices are as follows RMSEA <0.08, GFI >0.90, CFI >0.90, TLI >0.90, and χ^2/df <5.0 (13). Additionally, it has been recommended to utilize at least one fitness index from each category to attain model fitness (27). Composite reliability, as indicated by Raykov's rho, is considered desirable when exceeding a value of 0.6 (28).

Ethical Clearance

Ethical approval for the study was granted by the Medical Research & Ethics Committee (MREC), Ministry of Health Malaysia (NMRR ID-22-01463-WYY (IIR)) and the Human Research Ethics Committee of Universiti Sains Malaysia (USM/JEPeM/22060427). Prior to data collection, written informed consent was obtained from each respondent.

RESULTS

1. Item development

The items were developed by the aforementioned team members. The questionnaire was designed for self-administration and developed in the Malay language. At this stage, a draft questionnaire was formulated, consisting of 70 items distributed across three sections: knowledge (27 items), attitude (28 items), and practice (15 items). The knowledge section encompasses general knowledge and side effects of LARC. The attitude section includes domains of 'client-related' and 'method-related' attitude towards LARC provision. The practice section focuses on counselling, clinical evaluation, and LARC insertion. Notably, two items on LARC insertion are applicable only to doctors. Response options in the knowledge section are "true," "false," and "don't know." The attitude section employs a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), while the practice section uses a scale from 1 (never) to 5 (always).

2. Content validation

The item content validity index (I-CVI) and scale-level CVI based on the average method (S-CVI/Ave) were calculated. In the knowledge section, no item was removed. Two items were removed from each attitude (A8 and A17) and practice section (P5 and P10) because their I-CVI values were below the threshold of 0.83. In this study, the S-CVI/Ave values of the knowledge, attitude and practice sections were 0.96, 0.94 and 0.91 respectively. These values exceed the suggested cutoff of more than 0.90 (19), indicating excellent relevance to the overall questionnaire. The experts also provided written comments on certain items, suggesting that they be simplified or rephrased. The research team carefully evaluated the experts' comments and then the necessary adjustments were made without major correction.

3. Cognitive interview

Ten participants including three doctors and seven nurses were selected from a health clinic in Kota Bharu district, Kelantan. Both think-aloud technique and verbal probing method were used to perform cognitive interviews. Participants agreed that simple annotation for the term LARC on each page facilitated them to grasp the word. They found that putting a few English medical terms alongside the Malay terms such as "pelvic inflammatory disease" or "nulliparous" enhanced their understanding. Additionally, participants proposed enhancing item clarity by bolding key terms. For instance, they recommended emphasizing words like "are having" and "with a history" in items A3, A4 and A5 to capture participants' attention. Participants recommended changing the sentence structure of item K23 to ensure the consistent placement of the term "IUCD" at the beginning of each item. This change is intended to improve readability and create a smooth flow throughout the questionnaire. Participants also suggested word substitutions, proposing changes such as replacing "I feel scared" with "I feel worried" in item A25, as they perceived the former term to be exaggerated.

Participants evaluated item comprehensiveness and clarity, and all items in the three sections met face validity criteria with I-FVI values > 0.83 (16). The S-FVI/Ave were excellent with 0.99, 1.00 and 1.00 for the knowledge, attitude and practice sections, respectively.

4. Pretesting

The questionnaire underwent pre-testing with 30 participants from a health clinic in Kota Bharu district. The participants' mean (SD) age was 41.17 (7.63) years old. All participants were Malay, predominantly female (93.3%), married (96.7%) and nurses (50.0%). All participants found the font size and type to be acceptable, and the questionnaire to be well-structured. Moreover, 86.7% of participants expressed that the instructions and items were easy to comprehend.

Despite half of the participants finding it lengthy, the mean (SD) of completion time was only 20.53 (8.89) minutes.

5. Psychometric validation of the internal structure and reliability

Characteristics of the participants

A total of 444 participants responded to this study, where 222 participants completed the questionnaire for EFA and IRT, and another 222 participants for CFA. Table I presents the characteristics of the participants. Overall, the participants were predominantly female (92.7%), Malay (98.4%), married (89.2%) and worked as nurses (61.9%), with a mean (SD) age of 40.19 (6.65) years old. The mean (SD) experience working as HCWs and in MCH services was 15.25 (6.93) and 10.23 (6.91) years, respectively.

Table I: Characteristics of the participants (n=444)

Characteristics	n (%)		
	Overall (n=444)	EFA and IRT (n=222)	CFA (n=222)
Age (years)*	40.19 (6.65)	39.61 (6.53)	40.77 (6.73)
Sex			
Male	32 (7.2)	17 (7.7)	15 (6.8)
Female	412 (92.7)	205 (92.3)	207 (93.2)
Ethnicity			
Malay	437 (98.4)	217 (97.7)	220 (99.1)
Non-Malay	7 (1.6)	5 (2.3)	2 (0.9)
Marital status			
Married	396 (89.2)	198 (89.2)	198 (89.2)
Non-married	48 (10.8)	24 (10.8)	24 (10.8)
Education			
Certificate	128 (28.8)	60 (27.0)	68 (30.6)
Diploma	134 (30.2)	59 (26.6)	75 (33.8)
Degree and higher	182 (41.0)	103 (46.4)	79 (35.6)
Provider type			
Nurse	275 (61.9)	131 (59.0)	144 (64.9)
Doctor	169 (38.1)	91 (41.0)	78 (35.1)
Income (RM)*	4808.40 (1853.06)	4946.67 (1916.21)	4670.14 (1781.27)
Years working as HCW*	15.25 (6.93)	14.73 (6.65)	15.76 (7.17)
Years working in MCH*	10.23 (6.91)	9.41 (6.38)	11.04 (7.33)
Number of clients*	17.06 (8.42)	19.30 (9.28)	14.82 (6.78)
Formal LARC training			
No	261 (58.8)	143 (64.4)	118 (53.2)
Yes	183 (41.2)	79 (35.6)	104 (46.8)
Personal/partner's use of LARC			
No	360 (81.1)	179 (80.6)	181 (81.5)
Yes	84 (18.9)	43 (19.4)	41 (18.5)
Clinic with FMS			
No	219 (49.3)	105 (47.3)	114 (51.4)
Yes	225 (50.7)	117 (52.7)	108 (48.6)
Awareness of LARC insertion service			
No	75 (16.9)	60 (27.0)	15 (6.8)
Yes	369 (83.1)	162 (73.0)	207 (93.2)

** Mean (SD)*

IRT analysis for knowledge section

The 27-item knowledge section was assessed using 2-PL IRT. Items K1, K4 and K14 were removed due to a very low difficulty index, while K3 was removed due to a very high difficulty index. Eight items (K11, K13, K15, K18, K20, K24, K25, K27) with negative discrimination index were also removed since they were unable to discriminate between high scorers and low scorers. The final model consisted of 15 items, as presented in Table II.

Table II: IRT analysis of the knowledge section (n=222)

Items in the final model	Correct response n (%)	Difficulty b (SE)	Discrimination α (SE)	X^2 (df=16)	P-value
K2: Implant makes cervical mucus thicker	162 (73.0)	-3.72 (2.62)	0.27 (0.19)	27.36	0.453
K5: Implant is effective in preventing pregnancy for up to 5 years*	91 (41.0)	1.34 (0.96)	0.28 (0.18)	26.02	**0.003**
K6: Implant releases a low dose of the progestin hormone	167 (75.2)	-2.03 (0.71)	0.59 (0.21)	21.82	0.547
K7: Implant can be inserted regardless of the menstrual cycle time, provided that the client is not pregnant	195 (87.8)	-2.71 (0.82)	0.81 (0.29)	30.79	0.087
K8: Fertility returns immediately after the removal of Implant	181 (81.5)	-3.14 (1.36)	0.50 (0.23)	18.39	0.396
K9: Implant can cause the client to have no period (amenorrhoea)	180 (81.1)	-2.11 (0.63)	0.77 (0.26)	44.15	0.406
K10: Implant can cause irregular menstrual cycles	198 (89.2)	-3.34 (1.33)	0.68 (0.31)	29.23	**0.001**
K12: Implant is safe for use by the client who is breastfeeding	211 (95.0)	-8.26 (8.57)	0.37 (0.39)	15.49	0.061
K16: IUCD can be inserted when the client is not menstruating	114 (51.4)	-0.14 (0.36)	0.39 (0.18)	23.51	0.428

CONTINUE

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

Items in the final model	Correct response n (%)	Difficulty b (SE)	Discrimination α (SE)	X^2 (df=16)	P-value
K17: IUCD can be inserted within 24 hours after delivery	58 (26.1)	3.18 (1.84)	0.34 (0.20)	15.77	**0.001**
K19: Fertility returns immediately after the removal of IUCD	195 (87.8)	-3.67 (1.62)	0.57 (0.27)	25.47	**0.012**
K21: IUCD can cause heavier menstrual bleeding than usual	155 (69.8)	-0.58 (0.09)	4.85 (2.30)	17.41	**<0.001**
K22: IUCD can cause prolonged menstrual bleeding	151 (68.0)	-0.56 (0.11)	2.76 (0.67)	22.33	**<0.001**
K23: IUCD can cause cramping pain during the early phase of insertion	118 (53.2)	-0.13 (0.13)	1.40 (0.30)	44.79	0.538
K26: The effectiveness of LARC in preventing pregnancy is over 99	186 (83.8)	-5.45 (4.04)	0.31 (0.23)	6.02	0.089

**Negative statement; IRT item response theory; SE standard error; X^2 chi-square; df degree of freedom*

The difficulty indices for most items were within or close to the acceptable range of -3 and +3, ranging from -3.72 to 3.18, except for items K12 (-8.26) and K26 (-5.45). Following expert recommendations, these two items were retained for their essential content. In terms of discrimination, most of the items were within the acceptable range of 0.35 to 2.5. Items K2, K5, K17 and K22, closely approaching the cut-off value of the discrimination index with the range of 0.27 to 2.76, were retained due to their significant content. However, item K21 exceeded the discrimination index cut-off by a substantial margin at 4.85, yet it was also retained based on the experts' recommendation. The item goodness-of-fit demonstrated that six items did not fit well, indicated by p-values <0.05, highlighted in bold. However, all these items were retained based on expert advice due to their significance to the study.

The Item Characteristics Curve (ICC) revealed the relationship between ability level and the probability of answering correctly (graph not shown). At an ability level of -6, over 50% of participants could correctly answer items K12, aligning with its low difficulty index. Moreover, a steeper slope in the ability level is observed when the discrimination value is high, making the slopes most pronounced for items K21 and K22. The total amount of information yielded by the items was 80.1% between -3 to +3 range of ability. The unidimensionality was proven by modified parallel analysis with a p-value of 0.137. In terms of internal consistency reliability, the Cronbach's alpha was acceptable at 0.620.

EFA and CFA analysis for attitude section

Exploratory and confirmatory factor analyses (EFA and CFA) were performed to evaluate the validity and reliability of the attitude and practice sections. The results for the EFA and CFA of the attitude section are presented in Table III.

Table III: EFA analysis of the attitude section (n=222)

Factor	Item	Factor loading	Communalities	Cronbach's alpha
Client-related	A3: I think IUCD is suitable for clients who are having sexually transmitted diseases*	0.633	0.496	0.724
	A4: I think IUCD is suitable for clients with a history of pelvic inflammatory disease	0.569	0.404	
	A5: I think IUCD is suitable for clients with a history of ectopic pregnancy	0.483	0.246	
	A6: I think LARC is suitable for adolescents less than 20 years old	0.394	0.152	
Method-related resources	A7: I think LARC is suitable for nulliparous clients	0.713	0.475	0.712
	A10: I think LARC is suitable for unmarried clients	0.599	0.356	
	A11: I think many doctors have the skill to insert Implant	0.704	0.513	
	A14: I think many doctors have the skill to insert IUCD	0.793	0.636	
	A15: I think the IUCD supply in this clinic is sufficient	0.392	0.207	
	A18: I think the LARC training is sufficient	0.595	0.392	
	A19: I think the LARC insertion procedure is easy	0.412	0.187	
Method-related limitations	A22: I think LARC counselling takes a long time*	0.597	0.402	0.666
	A24: I think LARC can cause severe side effects*	0.610	0.387	
	A25: I feel worried about being blamed if a complication occurs after LARC insertion*	0.728	0.506	
	A28: I will not recommend LARC to clients because it is expensive*	0.427	0.213	

**Negative statement, EFA exploratory factor analysis*

In the EFA, 26 items were analysed. While univariate skew and kurtosis values were not extreme, Mardia's multivariate kurtosis was significant (p<0.001), indicating a non-normal distribution. Therefore, the extraction technique of principal axis factoring was applied. The KMO value of 0.664 and significant Bartlett's test of sphericity (p<0.001) indicated that the

data was adequate for conducting EFA.

The parallel analysis and scree plot inspection revealed a three-factor model. Eleven items (A1, A2, A9, A12, A13, A16, A20, A21, A23, A26 and A27) were removed during the analysis due to low factor loadings and communalities. The final 15-item EFA model demonstrated acceptable factor loadings ranging from 0.392 to 0.793 (Table III). Items A6 and A19 were retained since their communality values were only marginally below the cut-off of <0.2. Furthermore, the Cronbach's alpha for all the factors demonstrated acceptable internal consistency reliability, ranging from 0.666 to 0.724. The three factors were designated as 'client-related', 'method-related resources', and 'method-related limitations'.

In CFA analysis, bootstrap maximum likelihood (ML) was applied due to multivariate non-normal distribution. However, the initial CFA model demonstrated poor fit (RMSEA = 0.095; GFI = 0.859; TLI = 0.727; CFI = 0.774; χ^2/df = 2.998). Model revision was conducted by removing items A6 and A12 with low factor loading (<0.32). Despite this measure, the model fit remained unsatisfactory. Hence, the model was further revised by correlating the error of items A7 and A10 which showed a high Modification Index of 40. This step significantly improved the model's fitness (RMSEA = 0.067; GFI = 0.922; TLI = 0.888; CFI = 0.912; χ^2/df = 1.984).

The factor loadings for all items ranged from 0.363 to 0.819 are depicted in Table IV. The composite reliability was acceptable, as indicated by Raykov's rho values for factors 'client-related', 'method-related resources' and 'method-related limitations' were 0.728, 0.726 and 0.690, respectively. As evidence of discriminant validity, the correlation between the factors was as follows: 'Client-related'↔'Method-related limitations' (r= 0.146); 'Client-related↔'Method-related resources' (r= 0.083); and 'Method-related limitations'↔'Method-related resources' (r=0.331).

Table IV: CFA analysis of the attitude section through convergent validity

Factor	Item	Factor loading	Raykov's rhO
Client-related	A3	0.779	0.728
	A4	0.776	
	A5	0.549	
	A7	0.430	
	A10	0.376	
Method-related resources	A11	0.819	0.726
	A14	0.776	
	A18	0.523	
	A19	0.363	
Method-related limitations	A22	0.669	0.690
	A24	0.654	
	A25	0.644	
	A28	0.412	

CFA confirmatory factor analysis

EFA and CFA analysis for the practice section

Eleven items were subjected to EFA in the practice section. Items P14 and P15 were excluded from the EFA analysis since these items are only applicable to doctors, which were analysed descriptively. Although univariate skew and kurtosis values were not extreme, Mardia's multivariate kurtosis indicated non-normality (p<0.001). Therefore, the principal axis factoring was used. The data was appropriate for EFA since the KMO value was acceptable at 0.713 and Barlett's test of sphericity was significant with p<0.001.

The parallel analysis and scree plot suggested a one-factor model; thus, all items were grouped in a single factor. After removing items P9 and P13 due to low factor loadings, the remaining items in the model displayed good factor loadings ranging from 0.414 to 0.783 (Table V). The identified factor was then labelled as 'counselling and clinical evaluation'. These items demonstrated good internal consistency reliability with Cronbach's alpha of 0.840.

Table V: EFA and reliability analysis of the practice section (n=222)

Factor	Item	Factor loading	Communalities	Cronbach's alpha
Counselling and clinical evaluation	P1: I provide counselling regarding IUCD to clients	0.783	0.690	0.840
	P2: I provide counselling regarding Implant to clients	0.571	0.598	
	P3: I explain the advantages of LARC during counselling	0.739	0.670	
	P4: I use visual aids (for example, flipcharts or pictures) while providing counselling regarding LARC	0.515	0.330	
	P6: I explain LARC to clients who are planning to use other contraception	0.717	0.642	
	P7: I recommend IUCD to clients	0.684	0.628	
	P8: I recommend Implant to clients	0.624	0.568	
	P11: I assess sexually transmitted disease risk before IUCD insertion	0.479	0.299	
	P12: I check blood pressure readings before Implant insertion	0.414	0.255	

EFA exploratory factor analysis

Since the data for CFA for the practice section was non-normally distributed, bootstrap maximum likelihood was applied. Initially, CFA was conducted based on the one-factor model as in the EFA. The primary model showed

a poor data fit for all nine items (RMSEA = 0.172; GFI = 0.848; TLI = 0.703; CFI = 0.777; χ^2/df = 7.524). Despite having various model revision by eliminating items and adding covariance among the items' residuals, the model fit was not fulfilled.

Hence, the nine items were divided into a two-factor model: 'counselling' and 'clinical evaluation'. The fit indices of this model were slightly improved, yet still did not fulfil the acceptable range (RMSEA = 0.163; GFI = 0.868; TLI = 0.734; CFI = 0.808; χ^2/df = 6.857). Consequently, three correlated error terms (P1↔P7, P2↔P8 and P7↔P8) were added based on the modification index, resulting in the final model. The revision improved the final model which showed acceptable model fitness, with at least one index adhering to the fitness criteria in each category (RMSEA = 0.105; GFI = 0.918; TLI = 0.864; CFI = 0.913; χ^2/df = 3.996).

The factor loading in the final CFA model ranged between 0.393 and 0.899 (Table VI). The composite reliability for the 'counselling' and 'clinical evaluation' factors was considered acceptable, with Raykov's rho values of 0.825 and 0.642, respectively. The correlation coefficient for these two factors was r=0.614. Upon completing the psychometric validation process, the finalised questionnaire was titled "Knowledge, Attitude and Practice on Provision of Long-Acting Reversible Contraception (KAPP-LARC)".

Table VI: CFA analysis of the practice section through convergent validity

Factor	Item	Factor loading	Raykov's rho
Counselling	P1	0.728	0.825
	P2	0.781	
	P3	0.899	
	P4	0.492	
	P6	0.616	
	P7	0.466	
	P8	0.393	
Clinical evaluation	P11	0.761	0.642
	P12	0.611	

CFA confirmatory factor analysis

DISCUSSION

To the best of the authors' knowledge, this is the first study to develop and validate a questionnaire related to KAP on LARC provision among HCWs, using a meticulous and rigorous process. This study presents a new, valid, reliable and culturally appropriate questionnaire in the Malay language.

The questionnaire development entails a comprehensive combination of literature review, reference to the latest guidelines, expert advice and discussion with HCWs at the ground level. Besides, the excellent CVI and FVI provided by content and face validity greatly help to objectively determine the accuracy and representativeness of all the items (14). In addition to the quantitative assessment, the qualitative evaluation, facilitated through cognitive interviews and written comments provided by the experts, offered valuable input to improve design, wording and accuracy. Their inputs ensure that the items are relevant to the local culture. The positive responses garnered during pre-testing regarding questionnaire comprehensibility and structure were indicative of the successful implementation of suggestions from content validity and cognitive interviews.

In the knowledge section, items with negative discrimination were problematic because participants with high scores were prone to answer these items incorrectly and vice versa (29). Consequently, the decision to remove such items was warranted. Besides, it was proposed that the negative discrimination index is associated with very difficult content (30). For instance, item K24, addressing the potential of IUCD to reduce the risk of cervical cancer (31), represents a relatively new finding which is not widely known among HCWs. Besides, items with conflicting answers contributed to the negative discrimination index. Despite the World Health Organisation stating that IUCD does not interfere with sex (2), its impact on sexual activity is subjective and varies among users (item K18). Additionally, it can be attributed to poor item design such as double-barrelled items or confusing words (15). For example, in item K15, the statement "IUCD can prevent pregnancy for three to five years" introduced confusion due to the variability in the duration, which depends on the IUCD types.

The items retained in the final model in the knowledge section demonstrated satisfactory difficulty and discrimination indices. Items with extreme parameters such as K1, K3, K4 and K14 were removed. Low-quality items with extreme parameter values were removed to harmonise the remaining items in the questionnaire (26). The remaining items in the final model comprehensively covered content related to general knowledge of LARC, highlighting the advantages of LARC over other methods, such as its length of efficacy, effectiveness, safety during breastfeeding and rapid fertility return. This information is important in guiding HCWs when counselling clients regarding LARC (29). Furthermore, the final model included items addressing the potential side effects of LARC. Accurately mentioning these side effects was associated with a higher continuation rate and better client satisfaction (32).

In the attitude section, the EFA revealed a three-factor model ('client-related', 'method-related resources', and 'method-related limitations'), deviating from the initially proposed two-factor model ('client-related' and

'method-related'). However, this deviation is valid as the 'method-related' factor splits into two, maintaining the underlying theory by Solo and Festin (8) The subsequent CFA of the attitude section confirms the legitimacy of this structure. In summary, the content of the attitude sections covers the HCW's attitude regarding the suitability of LARC for certain clients, the availability of resources and limitations for LARC provisions.

In the practice section, the CFA of the initial one-factor model showed poor model fitness despite the various attempted revisions. Consequently, the model was transformed into a two-factor model, yielding acceptable goodness-of-fit values. During this revision, the two-factor model was disaggregated into 'counselling' and 'clinical evaluation' from the once-combined one-factor model 'counselling and clinical evaluation'. This adjustment aligns with the recommendation by Hoyle (33), suggesting that if the initial model fails to produce satisfactory fit indices during CFA, researchers should revise it to establish a defensible account of the data. This shift in analysis, moving from hypothesis testing to hypothesis generation and model revision, proves highly informative when the evaluation of the initial model lacks support.

In terms of reliability, Cronbach's alpha for the knowledge section in IRT, and all factors in the attitude and practice sections during EFA, surpassed the 0.60 threshold (26), indicating acceptable internal consistency. In CFA, all factors in both attitude and practice sections displayed good composite reliability as indicated by Raykov's rho with values exceeding 0.60 (28). This implies that the questionnaire is reliable, capable of consistently producing similar results (9).

The initial draft of the questionnaire had 70 items as researchers decided to develop more items than initially needed, as some items would inevitably be deleted or revised during the validation process (34). Half of the participants during the pre-testing phase criticised that there were too many items in the questionnaire. Nonetheless, the items were reduced to 39 items in the final version. The shorter version of the questionnaire is expected to be more user-friendly and prevent participants from becoming bored or demotivated (35). This is important, considering the questionnaire is designed to be used by HCWs who are busy with limited time available for completion.

The questionnaire will help to explore the common misunderstandings, needs or issues about LARC provision. Furthermore, the level of KAP scores among HCWs will inform the policymakers regarding the magnitude of the problem with LARC provision. If the KAP scores are low, intervention or a new policy is warranted to improve family planning services. The intervention can focus on a certain area which needs attention based on the study findings.

Besides, this study provides a new validated questionnaire to assess KAP among HCWs in Malaysian settings. In the future, the questionnaire can be used by other researchers to further explore LARC provision. It can also help to objectively measure the effectiveness of LARC intervention programmes by conducting pre- and post-intervention surveys. Such assessment can determine whether the intervention is performing following expectations and then improvement can be made if necessary.

Several limitations should be addressed in this study. Firstly, the study sample was homogenous in terms of ethnicity. Each ethnic group has diverse cultures which can possibly affect LARC provision, including language, core beliefs and religion. However, this questionnaire can be used by any doctors and nurses who understand the Malay language, as it is the national language of Malaysia. Secondly, the study was conducted in the northeastern region of Malaysia, where the majority of HCWs are Malay Muslims, who may have different cultures and beliefs from other regions in the country. As a result, the responses, particularly in the attitude section of the questionnaire, might have been influenced by the specific cultural and religious beliefs of the participants. Nonetheless, HCWs often migrate from one state to another throughout their careers. Therefore, it is likely that they had been exposed to diverse cultures.

CONCLUSION

In this study, a new validated questionnaire was developed to assess the KAP of LARC provision among primary HCWs in Kelantan. The questionnaire, developed in the Malay language, comprised three sections and 39 items (15 items on knowledge, 13 items on attitudes, and 11 items on practices). The questionnaire demonstrated acceptable psychometric properties and reliability which can be used as an instrument to evaluate KAP on LARC provision among HCWs in primary care.

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