Validity and Reliability of a Hausa Language Questionnaire Assessing Information, Motivation and Behavioural Skills for Malaria Prevention during Pregnancy

CURRENT STATUS: ACCEPTED

AHMED DAHRI BALAMI
Universiti Putra Malaysia

Corresponding Author
ORCiD: https://orcid.org/0000-0001-7370-4955

Salmiah Muhammad Said
Universiti Putra Malaysia

Nor Afiah Muhammad Zulkefli
Universiti Putra Malaysia

Bachok Norsa’adah
Universiti Sains Malaysia - Kampus Kesihatan

Bala Muhammad Audu
University of Maiduguri

DOI: 10.21203/rs.2.11270/v2

SUBJECT AREAS
Maternal & Fetal Medicine

KEYWORDS
Questionnaire, Hausa, malaria in pregnancy, information-motivation-behavioural skills, validation
Abstract

**Background:** Many studies on malaria knowledge, attitude and practice among pregnant women have been conducted in Hausa speaking communities in Nigeria. Despite this, no standard and uniform instrument for assessing this important public health problem has been developed in the Hausa language, even though it is widely spoken. The aim of this study was to develop and validate a questionnaire in Hausa language assessing information, motivation, and behavioural skills for malaria prevention during pregnancy.

**Methods:** The questionnaire was first developed in English language, and then assessed for its contents by a team of experts. It was then forwardly translated to Hausa, and backwardly translated again to English by independent language experts. These two English versions were then compared by a Public Health expert, following which the questionnaire was administered to 190 Hausa speaking antenatal care attendees. Exploratory factor analysis was performed on the data collected. Sixty three out of the 190 respondents were invited after two weeks to answer the same questionnaire, following which reliability tests were performed.

**Results:** The questionnaire showed good internal consistency, with Cronbach’s alpha values of 0.859, 0.890 and 0.773 for information, motivation and behavioural skills constructs respectively. The motivation and behavioural skills constructs were able to delineate their items into three and two sub-sections respectively. The factor loadings for the two constructs ranged from 0.610 to 0.965. As for test retest reliability, the Krippendorff’s alpha values for the items of the motivation section ranged from 0.941 to 0.996; that for behavioural skills ranged from 0.810 to 0.953, while for frequency of ITN use, it was 0.988. The Cohen’s kappa values for the information section ranged from 0.689-0.974, except the item for ‘fever’ (zazzabi) which was 0.382, and was as such reworded to a simpler terminology ‘hotness of the body’ (zafin jiki).

**Conclusions:** The Hausa language IMB questionnaire on malaria in pregnancy demonstrated good validity, and a high level of reliability. It is as such recommended for use among Hausa speaking communities to ensure uniformity and objectivity.
Malaria remains a public health problem in Nigeria, as it contributed the largest percent of cases (27%) to its global incidence in the year 2016 [1]. Malaria had also been reported to account for 11% of maternal mortality [2]. Despite the World Health Organization’s recommendations (WHO) for pregnant women in sub-Saharan Africa to always sleep under an insecticide-treated net (ITN) and take at least two doses of intermittent preventive treatment during their pregnancy (IPTp) [3], the level of compliance to these preventive measures has been very low among pregnant women in Nigeria [4]. Many studies have been conducted on knowledge, attitude and practice of pregnant women towards malaria, ITN, and IPTp, in Hausa speaking communities [5-11]. Hausa language is widely spoken not only in Nigeria, but also in many other African countries like Niger Republic, Ghana and Sudan, with an estimated 50 to 60 million people who understand the language to various degrees [12]. There exists the need to develop a valid uniform assessment tool in this widely spoken language, to enable uniform assessment by researchers, and facilitate the efficient monitoring of progress of public health interventions in that regard. Developing the instrument based on a health theory is likely to allow for a more thorough and systematic assessment of the health behaviour in question. The Protection Motivation Theory, while laying much emphasis on motivation, fails to identify other environmental and cognitive factors that can affect attitude change [13]. The information-motivation-behavioural skills (IMB) theory was first developed to explain HIV preventive behaviours among college students [14]. This theory comprises of three components which are information about the health behaviours, motivation to carry out such behaviours, and the requisite skills for performing such behaviours [14]. The aim of this study was to develop and validate a questionnaire in Hausa language assessing information, motivation, and behavioural skills for malaria prevention during pregnancy.

Methods

**Questionnaire development**

The questionnaire comprises of four sections which are the information, motivation, behavioural skills and behaviour sections. For the information section, its items were adapted from the knowledge sections of some previous studies [6,11,15]. Items of the motivation and behavioural skills sections
were developed from modifications of the relevant sections of the IMB questionnaire on diabetes mellitus self-care by Osborn et al. [16]. The questionnaire was first developed in English language, after which it was translated through the process of translation and adaptation of instruments outlined by the WHO [17].

It was at first forwardly translated to Hausa language by a senior University academic staff of the Hausa Language Department. This translation was then assessed by a native Hausa Public Health specialist, and then backwardly translated into English by a different translator of the same qualification. The two English versions (original and back-translated) were then compared by another Public Health specialist. This was followed by questionnaire testing

**Questionnaire structure**

**Section A**

This section had a total of 45 questions assessing the different domains of knowledge on malaria in pregnancy, which were: transmission, symptoms, complications, and prevention of malaria during pregnancy. There were three options for each question: ‘Yes’, ‘No’, and ‘I don’t know’. The total maximum obtainable information score was 45 points, while the minimum obtainable score was zero (0) points.

**Section B**

This section assessed participants’ level of motivation for sleeping under an ITN and taking IPTp. It had a total of 12 items, and comprised of two sub-sections (one on personal motivation, and the other on social motivation). The first four items on personal motivation asked of the participants’ perception of the level of goodness or otherwise of practicing those malaria preventive measures. These questions had response options on a five-point Likert scale thus: ‘very bad’, ‘somewhat bad’, ‘neither bad nor good’, ‘somewhat good’ and ‘very good’, which were scored 1, 2, 3, 4, and 5 points respectively. The next four questions on personal motivation assessed participants’ perception of the level of pleasantness or otherwise of practicing these preventive measures. These also had response options on a five-point Likert scale thus: ‘very unpleasant’, ‘somewhat unpleasant’, ‘neither unpleasant nor pleasant’, ‘somewhat pleasant’ and ‘very pleasant’, which were scored 1, 2, 3, 4, and
5 points respectively.
There were four questions on social motivation, which assessed how truly or not, their significant others thought they should comply with those malaria preventive measures. This section had response options on a six-point Likert scale thus: ‘very untrue’, ‘mostly untrue’, ‘untrue’, ‘true’, ‘mostly true’, and ‘very true’, which were scored 1, 2, 3, 4, 5, and 6 respectively. The total maximum obtainable motivation score was 64 points, while the minimum obtainable score was 12 points.

**Section C**

This section assessed participants’ levels of behavioural skills. It had a total of seven items and two sub-sections. The first sub-section had three items which assessed how hard or easy it was to comply with ITN and IPTp. Responses to this section were on a four-point Likert scale, thus: ‘very hard’, ‘hard’, ‘easy’, and ‘very easy’, which were scored 1, 2, 3, and 4 respectively. The second sub-section which assessed the level of effectiveness with which the participants could execute certain tasks relating to ITN use, had four items. This section had responses on a four-point Likert scale too, thus: ‘very ineffectively’, ‘ineffectively’, ‘effectively’ and ‘very effectively’, which were scored 1, 2, 3, and 4 respectively. The total maximum obtainable behavioural skills score was 28 points, while the minimum obtainable score was 7 points.

**Section D**

This section assessed their frequency of ITN use during pregnancy, that is, the number of days in a week in which they slept under an ITN. Frequency of ITN use was categorized as: Never, Seldom (once to twice weekly), Sometimes (thrice to 4 times a week), Often (5-6 times a week) and Almost always. These categories were scored as: 1, 2, 3, 4 and 5 respectively. This section also asked whether or not they had received any IPT, and the number of doses they had received.

**Ethics approval and consent to participate**

Ethical approval was obtained to carry out the research, from the Ethics Committee for Research Involving Human Subjects of the Universiti Putra Malaysia (UPM) (UPM/TNCPI/RMC/1.4.18.2 (JKEUPM)). Permission was also obtained from the Ethics Committee of the State Specialist Hospital, Maiduguri (SSH/GEN/64/Vol.1). All the respondents were first taken through the respondent’s information sheet
in Hausa language, after which informed verbal consent was obtained from them. This was due to the low literacy rates in the study location [18], and it had been approved by the JKEUPM.

**Questionnaire testing**

This was done in stages thus: content validity by experts, face validity by 20 pregnant women, test of construct validity by on different pregnant women, and finally test of reliability by 63 out of the 190 initial respondents.

**Content validity**

Content validity was assessed using an expert group [19] who went through the questionnaire to ensure that the wordings of its items were clear, and that they represent their content domain. The assessment team comprised of three Public Health specialists and an Obstetrics and Gynaecology specialist.

**Face validity**

Twenty antenatal care attendees were conveniently selected from a secondary-level health centre in Maiduguri, north-eastern Nigeria, to assess the questionnaire. The criteria for selection was to be a fluent Hausa speaker, and also be at their first antenatal visit for their index pregnancy. The questionnaires were administered to them by interviewers, following which they were asked to assess each section of the questionnaire, based on order of its questions, language clarity, and whether the questions under each construct appropriately measured the respective constructs. Order of questions was scored as Good order, Average order, or Poor order; language clarity was scored as Clear, Average or Confusing; while appropriateness of construct measurement was scored as Good, Average, or Poor.

**Construct validity and reliability**

A further cross-sectional study was conducted at the same antenatal clinic, a week after the face-validity study. A hundred and ninety respondents were conveniently selected using the same criteria as for face validity. They were similarly made to complete the questionnaire, and the data obtained was then analysed in IBM SPSS version 22. Internal consistency was measured using the Cronbach’s alpha. The motivation and behavioural skills constructs of the questionnaire were subjected to an
exploratory factor analysis (EFA) to determine how properly the items of each of their respective sub-sections correctly fitted. The assumptions for conducting an EFA had been met, as the data for these two constructs were collected on an interval scale, and there were also positive correlations between all the items. Items with factor loadings less than 0.3 were suppressed, and for the rotation, the oblique method (promax) was chosen due to some high correlations among some items.

Two weeks after the first questionnaire administration, it was re-administered to 63, out of the 190 respondents. These 63 respondents were randomly selected from the complete list of the initial 190 respondents using the random function in Microsoft Excel 2013. The Cohen’s kappa was measured to determine the reliability between the answers at first and second administration, for items of the information section, since the responses were in a nominal form. For the motivation, behavioural skills and frequency of ITN use sections, the Krippendorff’s alpha were measured to determine reliability.

Results
The results of face validity by the 20 respondents are presented in Table 1. For the information section, 85% rated the order of its questions as good, 95% rated its language clarity as clear, while 75% rated its appropriateness for its construct as good. For the motivation section, 75% rated the order of its questions as good, while 80% rated its language clarity as clear, and its appropriateness for its construct as good. For behavioural skills, 80% rated the order of its questions as good, 85% rated its language clarity as clear, while 80% rated its appropriateness for its construct as good. All other ratings given were average, with none of the ratings given as poor.

For the subsequent questionnaire evaluation, the ages of the 190 respondents ranged from 17 to 45 years, with mean (SD) of 25.4 (5.5) years. Most of them were married in a monogamous setting (75.3%), around a third had some form of employment (32.1%), while 84.2% were multigravidae (Table 2).

The Cronbach’s alpha results for these sections ranged from 0.773 to 0.889 as presented in Table 3. For motivation, enough items were predicted by each factor, as evidenced by Kaiser-Meyer-Olkin (KMO) of 0.840. The variables were correlated enough, as evidenced by a significant Bartlett’s test of Sphericity (<0.001). Rotation sum of square factor loadings indicated that 69% of the total variance
was being explained by the three significant factors. For behavioural skills, enough items were also predicted by each factor, as evidenced by KMO of 0.785. The Bartlett’s test of Sphericity was also significant (<0.001). Rotation sum of square factor loadings indicate that 60% of the total variance was being explained by the two significant factors.

The initial factor loadings for the factor analysis of motivation are presented in Table 4. The motivation construct was able to delineate its items into three main categories, however Mot7 and Mot8 were not able to gauge level of pleasantness, but rather had high factor loadings for level of goodness. Mot1 also had moderate factor loading for level of pleasantness. Since both level of goodness and level of pleasantness were measuring personal motivation, the two items (Mot7 and Mot8) were dropped, since items with the same wordings appeared in the ‘level of goodness section’ (Mot3 and Mot4). The final factor loadings after the two items were dropped is presented in Table 5.

There was still some moderate cross loading for Mot1, although this was a little less than the values in the initial analysis when Mot7 and Mot8 were included. The behavioural skills construct was able to delineate its items into two main categories with no significant cross loading of items (Table 6).

Table 7 presents the socio-demographic characteristics of the retest sample (N=63) and the remaining sample (N=127). Both groups were similar on all factors except employment status, for which the remaining sample had a higher proportion of unemployed persons compared to the retest group ($\chi^2=3.939, df=1, p=0.049$).

The Cohen’s kappa reliability test for ‘Info6’ was 0.382, while those of the other items of the information section ranged from 0.689 to 0.974 as shown in Table 8. The Krippendorff’s alpha values for the items of the motivation section ranged from 0.941 to 0.996, while that for the behavioural skills section ranged from 0.810 to 0.953 (Table 9). For frequency of ITN use, it was 0.988.

**Discussion**

The results of the face validity assessment suggests that the questionnaire was comprehensible and acceptable. It also had an acceptable internal consistency, as all the Cronbach’s alpha values were within the acceptable range of 0.70 to 0.95 [20]. It also demonstrated a good reliability, with all the items of the information section having a Cohen’s kappa of greater 0.60 [21], except for one item,
which was fever (zazzabi). However, fever being a cardinal feature of malaria, was still retained in the questionnaire, due to its relevance, but re-worded to a simpler terminology, ‘hotness of the body’ (zafin jiki). The Krippendorff’s alpha values for motivation, behavioural skills and ITN use were all above 0.8, and as such, acceptable [22]. Considering that Mot7 and Mot8 did not have even moderate loadings for level of pleasantness, it was reasonable to expunge them since the category for which they had high loadings (level of goodness) had items with not only similar wordings, but also higher factor loadings (Table 10).

Among the limitations of this study was the inadequate sample size to allow for a confirmatory factor analysis, and should be considered in future studies.

Conclusion
The Hausa language IMB questionnaire on malaria in pregnancy demonstrated good validity, and a high level of reliability. It is as such recommended for use among Hausa speaking communities to ensure uniformity and objectivity. It could also be translated, validated, and adapted in other malaria endemic regions. Further reliability tests like the item-response theory models should be performed to determine item difficulty and item discrimination.

Declarations

Ethics approval and consent to participate
Ethical approval was obtained to carry out the research, from the Ethics Committee for Research Involving Human Subjects of the Universiti Putra Malaysia (UPM) (UPM/TNCPI/RMC/1.4.18.2 (JKEUPM)). Permission was also obtained from the Ethics Committee of the State Specialist Hospital, Maiduguri (SSH/GEN/64/Vol.1). All the respondents were first taken through the respondent’s information sheet in Hausa language, after which informed verbal consent was obtained from them. This was due to the low literacy rates in the study location, and it had been approved by the JKEUPM.

Consent to publish
Not Applicable.

Availability of data and materials
The data set, questionnaire, and consent forms for this study are available as supplementary
material. To maintain respondents’ anonymity, only two indirect identifiers were retained (age and employment status).

**Competing interests**

The authors declare that they have no competing interests.

**Funding**

No external funding was received for this study.

**Authors’ contributions**

AB and SS conceived the study. AB, SS, NZ, BN and BA participated in the study design and manuscript review. AB and SS did the data analysis and manuscript writing. All authors read and approved the final manuscript.

**Acknowledgements**

The authors acknowledge and wish to express their appreciation to the women who participated in this study. They also thank the enumerators and all ante-natal care staff of the State Specialist Hospital, Maiduguri, for their tremendous support.

**Abbreviations**

EFA – exploratory factor analysis

ITN – insecticide-treated net

IPTp – intermittent preventive treatment in pregnancy

IMB – information-motivation-behavioural skills

KMO – Kaiser-Meyer-Olkin

WHO – World Health Organization

**References**

1. WHO: *World malaria report 2016*. World Health Organization; 2017

2. FMOH: *Strategic Plan 2009-2013:A Road Map for Malaria Control in Nigeria*. Federal Ministry of Health; 2008

3. WHO: *A strategic framework for malaria prevention and control during pregnancy in the African region*. World Health Organization; National Population Commission
4. NPC: Nigeria Demographic and Health Survey 2013. National Population Commission; 2014.

5. Iliyasu Z, Gajida AU, Galadanci HS, Abubakar IS, Baba AS, Jibo AM, Aliyu MH. Adherence to intermittent preventive treatment for malaria in pregnancy in urban Kano, northern Nigeria. Path & Glob Heal. 2012;106:323–9.

6. Akaba GO, Otubu JAM, Agida ET, Onafowokan O. Knowledge and Utilization of Malaria Preventive Measures among Pregnant Women at a Tertiary Hospital in Nigeria’s Federal Capital Territory. Niger J Clin Pract. 2013;16:201–6.

7. Bawa JA, Auta T, Liadi S. Prevalence of malaria: knowledge, attitude and cultural practices of pregnant women in Katsina. Eur Sci J. 2014;10:148-167.

8. Ibrahim SM, Umar NI, Garba NA, Isa B, Usman HA, Bako BG. Utilization of insecticide treated nets among pregnant women attending antenatal clinic in a suburban referral hospital, North-East Nigeria. Br J Med Med Res. 2014;4:2343–51.

9. Singh R, Musa J, Singh S, Ebere UV. Knowledge, attitude and practices on malaria among the rural communities in Aliero, northern Nigeria. J Family Med Prim Care 2014;3:39–44.

10. Teryila KR, Haruna HK, Kasamu D, Dathini H. Knowledge and practice of plasmodiasis prevention among pregnant women in Maiduguri, Borno State. West Afr J Nurs. 2014;25:52.

11. Kallamu H, Abdul Rahman H, Hayati KS, Ismaila UG. Association between Knowledge, Attitude and Preventive Practices on Malaria among Pregnant Women with and Without Malaria Attending Ante-Natal Care in Zamfara State, Nigeria. Int J Public Heal Clin Sci. 2015;2:68–78.

12. ECOWAS — SWAC/OECD: The Atlas on Regional Integration. atlas-westafrica.org. Accessed 07 Jul 2018.
13. Munro S, Lewin S, Swart T, Volmink J. A review of health behaviour theories: How useful are these for developing interventions to promote long-term medication adherence for TB and HIV/AIDS? BMC Pub Heal. 2007;7:1-16.

14. Fisher J. Fisher W. Changing AIDS risk behavior. Psych Bull. 1992;111:455-474.

15. Adebayo AM, Akinyemi OO, Cadmus EO. Knowledge of malaria prevention among pregnant women and female caregivers of under-five children in rural southwest Nigeria. Peer J. 2015;3:e792.

16. Osborn CY, Amico KR, Fisher WA, Egede LE, Fisher JD. An Information-Motivation-Behavioral Skills Analysis of Diet and Exercise Behavior in Puerto Ricans with Diabetes. J Health Psychol. 2010;15:1201-1213.

17. WHO: Process of translation and adaptation of instruments. http://www.who.int/substance_abuse/research_tools/translation/en/. Accessed 24 Jul 2016.

18. The national literacy survey. Abuja: National Bureau of Statistics; 2010.

19. Saw SM, Ng TP. The design and assessment of questionnaires in clinical research. Sing. Med J 2001;42:131-135.

20. Tavakol M, Dennick R. Making sense of Cronbach’s alpha. Int J Med Educ. 2011;2:53-55.

21. McHugh ML. Interrater reliability: the kappa statistic. Biochemia Medica: Biochemia Medica 2012;22:276-282.

22. Krippendorff, K. Content analysis: an introduction to its methodology. California: Sage Publications; 2005.

Tables
Table 1 Face validity results (N=20)
### KNOWLEDGE

| Order of questions | Freq. (%) |
|--------------------|-----------|
| Good order         | 17        |
| Average            | 3         |
| Poor order         | 0         |
| Total              | 20        |

| Language clarity   | Freq. (%) |
|--------------------|-----------|
| Clear              | 19        |
| Average            | 1         |
| Confusing          | 0         |
| Total              | 20        |

| Appropriately measures level of knowledge | Freq. (%) |
|------------------------------------------|-----------|
| Good                                     | 15        |
| Average                                  | 5         |
| Poor                                     | 0         |
| Total                                    | 20        |

### MOTIVATION

| Order of questions | Freq. (%) |
|--------------------|-----------|
| Good order         | 15        |
| Average            | 5         |
| Poor order         | 0         |
| Total              | 20        |

| Language clarity   | Freq. (%) |
|--------------------|-----------|
| Clear              | 16        |
| Average            | 4         |
| Confusing          | 0         |
| Total              | 20        |

| Appropriately measures level of motivation | Freq. (%) |
|--------------------------------------------|-----------|
| Good                                       | 16        |
| Average                                    | 4         |
| Poor                                       | 0         |
| Total                                      | 20        |

### BEHAVIOURAL SKILLS

| Order of questions | Freq. (%) |
|--------------------|-----------|
| Good order         | 16        |
| Average            | 4         |
| Poor order         | 0         |
| Total              | 20        |

| Language clarity   | Freq. (%) |
|--------------------|-----------|
| Clear              | 17        |
| Average            | 3         |
| Confusing          | 0         |
| Total              | 20        |

| Appropriately measures level of behavioural skills | Freq. (%) |
|----------------------------------------------------|-----------|
| Good                                               | 16        |
| Average                                           | 4         |
| Poor                                              | 0         |
| Total                                             | 20        |

Table 2 Respondents' characteristics (N=190)
| Factor                  | Frequency (n) | Percentage (%) |
|------------------------|---------------|----------------|
| Age                    |               |                |
| <20 years              | 25            | 13.2           |
| ≥20 years              | 165           | 86.8           |
| Total                  | 190           | 100.0          |
| Ethnicity              |               |                |
| Kanuri                 | 60            | 31.6           |
| Hausa                  | 46            | 24.2           |
| Babur                  | 19            | 10.0           |
| Shuwa                  | 16            | 8.4            |
| Marghi                 | 12            | 6.3            |
| Fulani                 | 14            | 7.4            |
| Others                 | 23            | 12.1           |
| Total                  | 190           | 100.0          |
| Family type            |               |                |
| Monogamy               | 143           | 75.3           |
| Polygamy               | 47            | 24.7           |
| Total                  | 190           | 100.0          |
| Education              |               |                |
| None                   | 74            | 38.9           |
| Primary                | 32            | 16.8           |
| Secondary              | 61            | 32.1           |
| Tertiary               | 23            | 12.1           |
| Total                  | 190           | 100.0          |
| Occupation status      |               |                |
| Employed               | 61            | 32.1           |
| Not employed           | 129           | 67.9           |
| Total                  | 190           | 100.0          |
| Type of residence      |               |                |
| Permanent resident     | 155           | 81.6           |
| Internally displaced   | 35            | 18.4           |
| Total                  | 190           | 100.0          |
| Gravidity              |               |                |
| Primigravida           | 30            | 15.8           |
| Multigravida           | 91            | 47.9           |
| Grandmultigravida      | 69            | 36.3           |
| Total                  |               |                |

Table 3 Summary of Cronbach’s alpha results (N=190)

| Section                              | No. of items | Cronbach’s alpha |
|--------------------------------------|--------------|------------------|
| Knowledge                            | 46           | 0.859            |
| Motivation I (Question 1 to 8)       | 8            | 0.872            |
| Motivation II (Question 9 to 12)     | 4            | 0.889            |
| Behavioural skills                   | 7            | 0.773            |

Table 4 Factor loadings based on factor analysis for the motivation construct (all items retained)
| Item summary | Subscale |
|--------------|----------|
|              | G o o d n e s s | T r u e n e s s |
|              |           |                |

| **a.** | *Don Allah a gaya mana yaya kyaun ko rashin kyaun wadannan game da lafiyarki* |
|--------|--------------------------------------------------------------------------------|
| Mot1   | Rinka kwana a cikin gidan sauro mai feshin magani                                |
| Mot2   | Rinka kwana akai-akai fiye da da a cikin gidan sauro mai feshin magani             |
| Mot3   | Rinka shan maganin kariya daga cutar malarinya da aka ba ni yayin goyon ciki       |
| Mot4   | Rinka shan dukkan magungunan kariya daga cutar malariya da aka bani ko da ina jin lafiyata kalau |
|        | Goodness | True ness |
|        | 0.542    | 0.370     |
|        | 0.595    | 0.370     |
|        | 0.889    |           |
|        | 0.912    |           |

| **b.** | *Don Allah a gaya mana yaya dadì ko rashin dadìn wadannan halayen a gareki* |
|--------|--------------------------------------------------------------------------------|
| Mot5   | Rinka kwana a cikin gidan sauro mai feshin magani                                |
| Mot6   | Rinka kwana akai-akai fiye da da a cikin gidan sauro mai feshin magani             |
| Mot7   | Rinka shan maganin kariya daga cutar malarinya da aka ba ni yayin goyon ciki       |
| Mot8   | Rinka shan dukkan magungunan kariya daga cutar malariya da aka bani ko da ina jin lafiyata kalau |
|        | Goodness | True ness |
|        | 0.441    | 0.397     |
|        | 0.569    |           |

| **c.** | *Mutanen da ke da muhimman ci a gare ni suna tsammanin yakamata in...* |
|--------|--------------------------------------------------------------------------------|
| Mot9   | Rinka kwana a cikin gidan sauro mai feshin magani                                |
| Mot10  | Rinka kwana akai-akai fiye da da a cikin gidan sauro mai feshin magani             |
| Mot11  | Rinka shan maganin kariya daga cutar malarinya da aka ba ni yayin goyon ciki       |
| Mot12  | Rinka shan maganin kariya daga cutar malariya da aka bani ko da ina jin lafiyata kalau |
|        | Goodness | True ness |
|        | 0.760    |           |
|        | 0.821    |           |
|        | 0.953    |           |
|        | 0.870    |           |

Table 5 Factor loadings based on factor analysis for the motivation construct (two items deleted)
#### Table 6: Factor loadings based on factor analysis for the behavioural skills construct

| Item summary                                                                 | Goodness of Fit | Pleasantness |
|------------------------------------------------------------------------------|-----------------|--------------|
| **Subscale**                                                                 |                 |              |
| Gocolness                                                                    |                 |              |
| Truelessness                                                                  |                 |              |
| Pleasantness                                                                  |                 |              |
| **Mot1** Rinka kwana a cikin gidan sauro mai feshin magani                   | 0.640           | 0.354        |
| **Mot2** Rinka kwana akai-akai fiye da da a cikin gidan sauro mai feshin magani | 0.651           |              |
| **Mot3** Rinka shan maganin kariya daga cutar malariya da aka ba ni yayin goyon ciki | 0.897           |              |
| **Mot4** Rinka shan dukkan magungunan kariya daga cutar malariya da aka bani ko da ina jin lafiyata kalau | 0.878           |              |
| **Mot5** Rinka kwana a cikin gidan sauro mai feshin magani                   |                 | 0.904        |
| **Mot6** Rinka kwana akai-akai fiye da da a cikin gidan sauro mai feshin magani |                 | 0.936        |
| **Mot9** Rinka kwana a cikin gidan sauro mai feshin magani                   | 0.734           |              |
| **Mot10** Rinka kwana akai-akai fiye da da a cikin gidan sauro mai feshin magani | 0.794           |              |
| **Mot11** Rinka shan maganin kariya daga cutar malariya da aka ba ni yayin goyon ciki | 0.965           |              |
| **Mot12** Rinka shan maganin kariya daga cutar malariya da aka bani ko da ina jin lafiyata kalau | 0.880           |              |

**Don Allah a gaya mana yaya kyaun ko rashin kyaun wadannan game da lafiyarki**

**Don Allah a gaya mana yaya dafi ko rashin dafin wadannan halayen a gareki**

**Mutanen da ke da muhimanci a gare ni suna tsammanin yakamata in...**

*Table 6: Factor loadings based on factor analysis for the behavioural skills construct*
Table 7 Comparison of socio-demographic characteristics of test and re-test samples

| Variables          | Group | Test sample | Retest sample | $\chi^2$ | df | p       |
|--------------------|-------|-------------|---------------|---------|----|---------|
|                    |       | Freq. (%)   | Freq. (%)     |         |    |         |
|                    |       | n = 127     | n = 63        |         |    |         |
| Age group          |       |             |               |         |    |         |
| Less than 20       |       | 14 (11.0)   | 9 (14.3)      | 0.421   | 1  | 0.516   |
| 20 years and above |       | 113 (89.0)  | 54 (85.7)     |         |    |         |
| Ethnicity          |       |             |               |         |    |         |
| Kanuri             |       | 41 (32.3)   | 20 (31.7)     | 2.707   | 6  | 0.845   |
| Tribe      | Count | Percentage |
|------------|-------|------------|
| Hausa      | 30    | (23.6)     |
| Babur      | 13    | (10.2)     |
| Shuwa      | 10    | (7.9)      |
| Marghi     | 9     | (7.1)      |
| Fulani     | 9     | (7.1)      |
| Others     | 15    | (11.8)     |

| Family type | Count | Percentage |
|-------------|-------|------------|
| Monogamy    | 93    | (73.2)     |
| Polygamy    | 34    | (26.8)     |

| Type of residence | Count | Percentage |
|-------------------|-------|------------|
| Permanent resident| 102   | (80.3)     |
| IDP               | 25    | (19.7)     |

| Education level | Count | Percentage |
|-----------------|-------|------------|
| None            | 52    | (40.9)     |
| Primary         | 20    | (15.7)     |
| Secondary       | 38    | (29.9)     |
| Tertiary        | 17    | (13.4)     |

| Occupational status | Count | Percentage |
|---------------------|-------|------------|
| Not employed        | 92    | (72.4)     |
| Employed            | 35    | (27.6)     |

| Type of residence | Count | Percentage |
|-------------------|-------|------------|
| Permanent resident| 102   | (80.3)     |
| IDP               | 25    | (19.7)     |

| Gravidity          | Count | Percentage |
|--------------------|-------|------------|
| Primigravida       | 18    | (14.2)     |
| Multigravida       | 63    | (49.6)     |
| Grandmultigravida  | 46    | (36.2)     |

Table 8 Summary of test retest results for knowledge

| SNo | Item                          | Cohen’s k coefficient |
|-----|-------------------------------|-----------------------|
| Info1 | *Ta yaya ake kamuwa da malar*ya?* | (no variance)          |
| Info2 | Cizon sauro                  | 0.803                 |
|      | Jikewa da ruwan sama         |                       |
| Info |  |  |
|------|-----------------|-----------------|
| Info3 | Sauyin yanayi | 0.858 |
| Info4 | Cin wasu irin abinci | 0.974 |
| Info5 | Aikin wahala a rana | 0.817 |

**Mene ne alamun cutar malariya?**

| Info6 | Zazzabi later reworded to **Zafin jiki** | 0.382 |
| Info7 | Karkarwa | 0.705 |
| Info8 | Ciwon kai | 0.821 |

- Ciwon gaɓobi

| Info9 |  |  |
|-------|-----------------|-----------------|
| Info10 | Rashin son cin abinci | 0.826 |
| Info11 | Jin bani da lafiya | 0.850 |

- Dacin baki

| Info12 |  |  |
|--------|-----------------|-----------------|
| Info13 | Jin amai | 0.689 |
| Info14 | Yin amai | 0.858 |

- Jin kamar lafiya ta kalau

| Info15 |  |  |
|--------|-----------------|-----------------|
| Info16 |  |  |

- Shin sauron da ke yaɗa cutar malariya na iya cizo da rana?

| Info17 |  |  |
|--------|-----------------|-----------------|
| Info18 | Shin cutar malariya na iya cutar da mai goyon ciki? | 0.859 |

- Shin cutar malariya na iya cutar da ɗan tayin ciki?

**Wace irin illa malariya kan iya jawowa lokacin goyon ciki?**

| Info19 |  |  |
|--------|-----------------|-----------------|
| Info20 | Tana iya sa mace mai ciki ta rasa isasshen jinni | 0.875 |
| Info21 | Yìn bari | 0.850 |

| Info22 | Haihuwa ba lokacin da ya dace ba | 0.900 |

- Haddasa haihuwar da/'ya mai karancin nauyi

| Info23 |  |  |
|--------|-----------------|-----------------|
| Info24 | Mutuwar uwa | 0.839 |

- Mutuwar ɗan tayi

| Info25 |  |  |
|--------|-----------------|-----------------|
| Info26 | Kina da masaniyar gidan sauron da ke dauke da feshin maganin sauro? | 0.945 |

*Me ake yi da gidan sauron da ke dauke da feshin maganin sauro?*

| Info27 | Kawar da sauro | 0.710 |
| Info28 | Kawar da beraye | 0.834 |
|-------|----------------|-------|
| Info29 | Gidan sauro mai feshin magani ya fi wanda ba feshin magani | 0.868 |
| Info30 | Feshin maganin gidan sauron kan iya zamowa hadari gare ni muddin na kwanta a cikinsa | 0.778 |

| Info31 | Bayan tsawon wane lokaci ya kamata a wanke gidan sauro mai feshin magani? | 0.897 |
|--------|-------------------------------------------------|-------|
| Info32 | Bayan wata 1 | 0.890 |
| Info33 | Bayan wata 3 | 0.903 |
| Info34 | Bayan wata 6 | 0.820 |

| Info35 | Da me ya kamata a wani gidan sauro mai feshin maganin sauro? | 0.890 |
|--------|---------------------------------------------------------------|-------|
| Info36 | Ruwa da sabulu | 0.890 |
| Info37 | Ruwa da omo | 0.818 |

| Info38 | A ina ya kamata a shanya gidan sauro mai feshin maganin sauro? | 0.844 |
|--------|---------------------------------------------------------------|-------|
| Info39 | A inuwa | 0.844 |
| Info40 | A rana | 0.885 |
| Info41 | Kina da masaniya akan maganin da ake bayarwa na kariya lokacin goyon ciki? | 0.913 |

| Info42 | Wane irin magani ake bayarwa don kariya daga cutar malarinya lokacin goyon ciki? | 0.927 |
|--------|-----------------------------------------------------------------|-------|
| Info43 | Chloroquine | 0.927 |
| Info44 | Fansidar | 0.921 |

| Info45 | Nawa ne adadin kwayoyin maganin kariya daga cutar malarinya da ake bayarwa kowane lokaci ga mai goyon ciki | 0.923 |
|--------|-----------------------------------------------------------------|-------|
| Info46 | Kwaya 2 | 0.923 |
| Info47 | Kwaya 3 | 0.925 |
| Info48 | Kwaya 4 | 0.925 |
| Info49 | Maganin da ake ba wa masu goyon ciki don kariya daga cutar malarinya zai | 0.925 |
| Info50 | iya zama mai illa akan cikin da nake goyo | 0.915 |
| Info51 | Ana iya shan maganin kariya daga cutar malarinya ba tare da an ci abinci ba? | 0.915 |
| Item   | Krippendorff’s alpha | Item   | Krippendorff’s alpha |
|--------|-----------------------|--------|-----------------------|
| Mot1   | 0.981                 | BSkills1 | 0.896                |
| Mot2   | 0.965                 | BSkills2 | 0.886                |
| Mot3   | 0.946                 | BSkills3 | 0.947                |
| Mot4   | 0.964                 | BSkills4 | 0.890                |
| Mot5   | 0.996                 | BSkills5 | 0.953                |
| Mot6   | 0.981                 | BSkills6 | 0.810                |
| Mot9   | 0.972                 | BSkills7 | 0.915                |
| Mot10  | 0.942                 |        |                       |
| Mot11  | 0.953                 |        |                       |
| Mot12  | 0.941                 |        |                       |

**Supplementary Files**

This is a list of supplementary files associated with this preprint. Click to download.

- BMC Med Res Questnnaire Eng & Hausa.docx
- BMC PH Questn Data set Test reTest.xlsx
- BMC PH Questn Data setTest.xlsx