Translation and validation of an epilepsy-screening questionnaire in three Nigerian languages

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Abstract

Objective: We describe the development, translation and validation of epilepsy-screening questionnaires in the three most popular Nigerian languages: Hausa, Igbo and Yoruba.

Methods: A 9-item epilepsy-screening questionnaire was developed by modifying previously validated English language questionnaires. Separate multilingual experts forward- and back-translated them to the three target languages. Translations were discussed with fieldworkers and community members for ethnolinguistic acceptability and comprehension. We used an unmatched affected-case versus unaffected-control design for the pilot study. Cases were people with epilepsy attending the tertiary hospitals where these languages are spoken. The controls were relatives of cases or people attending for other medical conditions. An affirmative response to any of the nine questions amounted to a positive screen for epilepsy.

Results: We recruited 153 (75 cases and 78 controls) people for the Hausa version, 106 (45 cases and 61 controls) for Igbo and 153 (66 cases and 87 controls) for the Yoruba. The sensitivity and specificity of the questionnaire were: Hausa (97.3% and 88.5%), Igbo (91.1% and 88.5%) and Yoruba (93.9% and 86.7%). The three versions reliably indicated epilepsy with positive predictive values of 85.9% (Hausa), 85.4% (Igbo) and 87.3% (Yoruba) and reliably excluded epilepsy with negative predictive values of 97.1% (Hausa), 93.1% (Igbo) and 95.1% (Yoruba). Positive likelihood ratios were all greater than one. **Conclusions:** Validated epilepsy screening questionnaires are now available for the three languages to be used for community-based epilepsy survey in Nigeria. The translation and validation process are discussed to facilitate usage and development for other languages in sub-Saharan Africa.

Keyword: Seizures, Screening tools, Sensitivity, Specificity, Predictive values, Likelihood ratios.

1.0 Introduction

Of the approximately 50 million people with active epilepsy worldwide [1], it is estimated that 5.4 million live in sub-Saharan Africa (SSA) [2]. The true burden in SSA is unknown and may be higher than projected, warranting more community-based studies to close this gap [3]. Despite the drawbacks like cost, logistics, intrusiveness and non-disclosure [4]; the traditional door-to-door (D2D) survey is still useful for collecting health-related data [5]. The D2D approach offers the prospect of an ethnographic complement by interacting with participants, understanding their cultures and discussing concerns that contributes to data quality [5].

The performance of epilepsy questionnaires depends on multiple factors, such as reference standards, definitions and selection bias. Sensitivity, specificity and predictive values should also be known, highlighting the need for prior validation [6]. A screening questionnaire should be in the respondents' native language and well-understood by them. Translation to native language should follow set guidelines [7, 8]. Questionnaires must take into account ethnolinguistic issues,[9] as meanings and perceptions vary between communities [7, 10]. Nigeria has about 400 diverse ethnic groups and languages [11], but over two-thirds of Nigerians speak at least one of three common languages of Hausa, Igbo and Yoruba (Figure 1) [12]. One small study validated a 3-item Igbo epilepsy-screening questionnaire [13], but it is unclear if previous questionnaires were in local languages [14-17]. The development and validation of a screening questionnaire in the three Nigerian languages would fill an unmet need for a standard screening tool for community-based epilepsy prevalence studies across Nigeria.

2.0 Methodology

2.1 Development of the epilepsy screening questionnaire

Component studies of a systematic review [6] on epilepsy screening questionnaires were scrutinized to develop our questionnaire [18, 19]. Co-authors from the three regions of

Nigeria (MMW, SAB and MBF, SCI, MK) rated and discussed the questions. A 9-item questionnaire (Table 1) was developed from the two most suitable studies. We planned to cover as many seizure types as possible. We rearranged items in the questionnaire so that the question probing whether the participant had epilepsy or took treatment was placed at the end. This was to make the questionnaire less intrusive as epilepsy is a sensitive issue in Nigeria [18].

2.2 Translation of the screening questionnaire to the local language

Bilingual experts familiar with prevailing sociocultural settings translated the questionnaire into Igbo, Hausa and Yoruba. Each was then back-translated to English by different sets of translators [8]. The 'general dialect' of the Hausa, Igbo and Yoruba languages understood by the majority of people in those regions of Nigeria, were used. Concurrently, the questionnaires were forward- and back-translated by the departments of Public Health and Language and Linguistics of the Universities in Abakiliki, Ile-Ife and Sokoto. These departments have experience in medical translations and community-based research. The two versions were assessed for correspondence and reviewed by local neurologists to deal with discrepancies and to develop a final draft. The back-translated versions were compared with the original English version for linguistic conformity. The research team and a group of community health workers at each site, met and discussed the native-language version for comprehensibility and socio-cultural acceptability, taking into account local dialects. Lay adult community members also reviewed the questionnaires.

Terms or words like loss of consciousness (Q2), paleness (Q2), twitching, jerking or shaking (Q1), trembling (Q5), lose contact (Q6), abnormal smell (Q6), stare into space (Q7), seizure and epilepsy (Q9) in different languages were deliberated in stake-holder meetings. Some of the terms lacked precise meanings, were ambiguous, had several nearly matching labels in local languages or could vary according to locally prevailing dialects. For example, the term "*fitan hankali*" in Hausa refers to loss of consciousness as well as loss of cognition and "*suma*" to brief loss of consciousness or awareness (thereby implying, syncope). Hence, we

used the term, "*dogon suma*" ("*dogon*" means "longer") to denote loss of consciousness in seizures.

The expression, "*bugun tsunsu*" meaning "shaking of the bird" was adopted to denote a seizure in Hausa. "*Farfadiya*", the common term for epilepsy or seizure disorder in Hausa was used instead in Q9. The Igbo term for seizure or convulsive episode irrespective of aetiology or recurrence is generally referred to as "*ihe odido*", while epilepsy specifically is referred to as "*oria ihe odido*" or "*akwukwu"*". The word "*akwukwu"* was preferred as it relates to recurrent unprovoked seizures and was used for Q9. In the Yoruba version, epilepsy was translated *"aisan giri"* meaning "convulsive or seizure disorder". Another term *"warapa",* also refers to convulsions in Yoruba but was avoided due to stigma associated with it.

The Yoruba and Igbo and less often Hausa languages entail the use of accents and diacritical signs, altering pronunciation and changing word meanings. These glyphs were added manually to the documents and the research assistants and enumerators were trained in using and recognizing them. The Hausa language uses grammatical gender; for example, "*ka*" means "you" for a male, "*ki*" means "you" for a female, these differences were used in various questions.

2.3 Pilot study to validate the screening questionnaire

Validation was performed using an unmatched affected-case versus unaffected-control study design. Diagnosis by a neurologist with epilepsy expertise was the gold standard for a case. The sample size for the pilot study was estimated using the standard error of sample estimates to demonstrate a sensitivity and specificity of 80% and a precision of 10%. The sample size for each language was established to be 61 cases and 61 controls.

Cases were recruited consecutively from the neurology clinics or while attending EEG recording at the Federal Neuropsychiatric Hospital, Kware and Usman Danfodio University Teaching Hospital, Sokoto for the Hausa version; Alex Ekwueme Federal University Teaching Hospital, Abakaliki for the Igbo version, and Obafemi Awolowo University Teaching Hospital Complex, Ile-Ife and the Wesley Guild Hospital, Ilesa for the Yoruba version (See the centers shown in Figure 1). The cases were people with active epilepsy, defined as two

or more unprovoked epileptic seizures separated by >24 hours within the last year [20]. Controls included unmatched non-affected healthy relatives or other people attending hospital with no known brain disorder. Cases and controls were matched for geographic location and ethnicity. Two trained lay health workers at each site read verbatim the questionnaires to the participants and recorded the responses. They were, however, not blinded to the diagnosis. Respondents with an affirmative response to any of the nine questions were deemed screen-positive.

The entire study (translation and validation) was conducted in the three regions between January 2017 and January 2018. The National Health and Research Ethics Committee (NHREC) in Nigeria and the respective hospitals approved the project. All participants provided written informed consent in local language.

2.4 Statistical analysis

Statistical analysis was performed using Stata version 15 (StataCorp. 2017. *Stata Statistical Software: Release 15*. College Station, TX: StataCorp LLC). A chi-squared test was used to compare categorical variables and the Mann-Whitney U test for continuous variables between the cases and the controls. The "*diagti*" command in Stata was used to calculate the sensitivity, specificity, negative predictive value and positive predictive value and their 95% confidence intervals (CI) of individual and combined set/s of items [21]. We used set criteria for the definitions and calculation of accuracy measures (sensitivity, specificity, PPV and NPV) [22-24]. Agreement level between different combinations of items and epilepsy diagnoses was established using the Altman's Kappa Benchmark Scale [25]. To provide a performance score of the questions and resolve the trade-off between sensitivities and specificities, the positive and negative likelihood ratios (LRs) were computed. The positive LR is the probability of a positive outcome having a positive screening divided by the probability of a negative outcome having a positive screening. The negative LR is the probability of a positive outcome with a negative screening divided by the probability of a negative outcome having a negative screening [26, 27].

3.0 Results

3.1 Translations

The final versions of the screening questionnaires in the three languages are shown in Supplement 1 (Igbo), Supplement 2 (Yoruba) and Supplement 3 (Hausa).

3.2 Pilot Study

Table 2 provides the demographic features of research participants. A total of 153 people (75 cases and 78 controls) were recruited for the Hausa questionnaire. Cases were older than controls (Mann Whitney U test: $z = 3.175$, $P = 0.0015$), but no significant gender difference ($\chi2$ (1) = 2.3248, $P = 0.127$). The Igbo questionnaire was administered to 45 cases and 61 controls with no significant age (Mann Whitney U test: $z = 1.184$, $P = 0.2363$) or gender differences ($\chi2$ (1) = 0.8536, $P = 0.356$). Lastly, 153 people (66 cases and 87 controls) were recruited for the Yoruba questionnaire, with no significant age (Mann Whitney U test: $z = 0.740$, $P = 0.4596$) or gender ($\chi2$ (1) = 0.6950, $P = 0.404$) differences between cases and controls. The majority of the controls (81%) were relatives of cases, while 19% of controls were attending for hypertension and respiratory complaints.

Two (2.7%) with confirmed epilepsy screened negative on all items, while 11 (14.1%) controls screened positive in Hausa. Only 4 cases (8.9%) screened negative compared to 54 (88.5%) among the controls in Igbo. Four (6.1%) cases had a negative screen compared to 9 (10.3%) controls who screened positive in Yoruba. Sensitivities, specificities, PPVs and NPVs of individual questions and combinations are shown in Table 3. For the Hausa version, each of questions Q1, Q2, Q7 and Q9 had a good sensitivity; while the combination of Q1 to Q9, Q1Q2Q5Q7Q9, Q1Q2Q5Q9 and Q1Q2Q5Q7 had the best sensitivity. The specificity was between 95% and 100% for all individual questions. For the Igbo version the Q1, Q2 and Q9 had good sensitivity, while the best sensitivity was for Q1 to Q9 and Q3Q4Q6Q8. The sensitivity for the individual questions was lower in the Yoruba version, with most questions having a sensitivity of 50% and below, apart from Q9 with 67%. The sensitivity, however, improved to above 90% when the questions where combined. Two people with essential tremor and one with Parkinson's disease screened positive among the controls.

Supplement 4 shows the positive and negative LRs. The Hausa version showed that, Q2, Q3, Q5, Q7 and Q9 had the highest positive LR indicating an increased probability of the particular screening performance. Q1, Q3, Q8, and Q9 were the highest for the Igbo version, while Q1, Q4, Q5, Q9 were the highest for the Yoruba version.

Table 4 illustrates the predictive ability of various questions and combinations compared to the combination with the best accuracy (the combination of Q1 to Q9). It shows that the best combinations with good predictive ability are combinations Q1Q2Q5Q7Q9, Q1Q2Q5Q9 and Q1Q2Q5Q7 for all the three languages. The individual questions do not have good predictive ability.

4.0 Discussion

We translated and piloted an epilepsy-screening questionnaire in three Nigerian languages which showed good sensitivity, specificity, PPV and NPV. We explored the differential sensitivities and specificities of individual and combinations of component items of questionnaire and the LRs calculated indicated that the questions had good albeit varied probability of predicting epilepsy. These instruments are simple and can easily be used by health workers in the community, suggesting a robust epilepsy-screening tool for resource-limited settings.

There were wide differences in the sensitivity; however, the variation in the specificity of individual and combined items was less. Besides, specificity measures were consistent between questions and languages. This means that a positive screen on the questionnaire was good for "ruling in" epilepsy. LRs also varied, suggesting that the screening capabilities of individual questions between languages are not diagnostically equivalent, as the positive and negative LRs of the same item often change the probability asymmetrically [26]. Some of the differences in the measures of accuracy between various languages may be due to differences in the population characteristics, the dynamics of the translation process, linguistic characteristics and methods of administration of the questionnaire between centers [28]. It may also be due to the differences in etiology, general literacy, awareness of epilepsy

and stigma between the three populations. Clinic-based validation studies are not usually influenced by stigma-related concealment as much as population-based studies [29]. The differences in the sensitivity of the individual component questions may likely be related to the frequency of the phenomena (e.g., tongue bite, incontinence, absence and myoclonic seizures; *cf* Qs 3, 4, 7 and 8) captured by them and also that myoclonic and absence seizures often go unnoticed by patients. The low sensitivity for absences and myoclonic seizures has been reported previously [18].

There are no studies in Nigeria using a similar screening tool to make comparison. The previous southwest Nigerian study, using the WHO three-question protocol, reported nearly similar sensitivity and specificity, but a lower PPV of 57% [14, 15]. While, a southeast Nigeria validation study using the same instrument translated into Igbo yielded sensitivity, specificity, PPV and NPV of 100%, 96%, 96% and 100% [13]. These almost perfect values may have been due to the small sample size and selection bias. The Ecuadorian study yielded a low PPV of 18.3% [18]. The Rochester study also had a low PPV of 23% [19]. Our study had a comparatively higher PPV, meaning that more people with epilepsy were likely to screen positive.

Regardless of the results, the advantage of a validation study is that the prevalence can be adjusted to the known sensitivity and specificity of the screening test [30]. This is important in sub-Saharan Africa (SSA) where more studies are needed to clarify epilepsy burden and to provide an accurate prevalence estimates. A recent study emphasized the need to have accurate estimates for neurological disorders in SSA. A Bayesian latent-class model was used to obtain verification bias-adjusted validity estimates for the screening questionnaire in a community-based epilepsy study [31]. This analytical framework reduced errors in estimating prevalence in the absence of a gold standard test and observed that unadjusted prevalence estimates were consistently lower than adjusted estimates.

We found that the nine questions together had the best sensitivity. The combination of 4 or 5 questions could, however, be used with an acceptable predictive ability to save time and logistics. From a public health perspective, short concise questionnaires are preferred for

evaluation of large populations in the shortest possible time. It would, however, risk missing some people with non-convulsive seizures. Even though the tool includes items to screen non-convulsive seizures, it generally has a bias to recruiting people with convulsive seizures when used in the community [32]. One advantage of our tool is that it addresses multiple seizure types, unlike other available questionnaires which address convulsive epilepsy alone. Another advantage is the computation of LRs for the three languages. This is important as sensitivity and specificity alone may not provide sufficient information on the probability for ruling-in or ruling-out epilepsy. Due to this inherent trade-off, LRs are more appropriate to compare individual components [27].

One limitation of the study is that it is clinic-based rather than community-based. This might result in selection bias as questions are administered to people with a formal diagnosis and more likely to have severe epilepsy. The generalizability of the results will be limited by these selection criteria. This could lead to an underestimation of epilepsy in community-based studies as less severe cases may be missed. A community-based study would have been better as data is obtained in a less biased setting and provide a more accurate sensitivity, but this would significantly increase logistic and costs as larger sample sizes would be needed [18]. Another potential problem with clinic-based studies is the 'spectrum effect', in which the performance of a test may vary in different settings as each setting may have varied case-load. The predictive ability of a tool when used in a general population may, therefore differ from the study sample in which it was first developed [33]. Participants in a validation study should be as similar to the population in which the test is intended to be used. We included "abnormal smell" suggesting an olfactory aura, but excluded epigastric aura which is common in clinical practice. This may have potentially impacted the sensitivity of the questionnaire.

Another limitation was the lack of information on epilepsy severity. This is important as any test only applied to the more severe cases is more likely to have a high sensitivity, whereas any test applied to perfectly healthy controls is more likely to have a high specificity [34]. This lack of information limited our understanding as to why some cases screened negative.

This could have been due to an inability to comprehend the questionnaire by respondents or a failure of the questionnaire to capture certain seizure types. The use of proxies or caregiver questionnaire was an option we considered. This could be a future study to see if using proxy questionnaires can improve reliability since it is difficult to get affirmative answers to some questions, as subjects may not be aware of all symptoms

5.0 Conclusion

The screening tool represents a valid instrument with an acceptable level of sensitivity and specificity that can easily be used by trained health workers in community-based surveys to screen for people with epilepsy. It can be translated to different SSA languages by following the translation and validation process here described and so be of help in establishing the burden of epilepsy in such settings.

Table 1: The 9-item epilepsy screening questions

	Questions	Yes	No
Q1	Have you ever had attacks of twitching, jerking or shaking of the arms or legs, which you could not control?		
Q2	Have you ever lost consciousness, or fallen and become pale?		
Q3	Have you ever had attacks in which you fall and bite your tongue?		
Q4	Have you ever had attacks in which you fall and lose control of your bladder?		
Q5	Have you ever had brief attacks of shaking or trembling in one arm or leg or face?		
Q6	Have you ever had attacks in which you lose contact with your surroundings and experience abnormal smells?		
Q7	Did you when you were a small child, daydream or stare into space more than other children?		

Q8 Shortly after waking up, either in the morning or after a nap have you ever noticed uncontrolled jerking or clumsiness, such as dropping things or things suddenly "flying" from your hands?

Q9 Have you ever been told that you have or have had epilepsy or epileptic fits, or have taken medication for seizures/epilepsy?

The questions (Q) will be answered as 'No' or 'Yes' with a tick (✓**).**

Table 2: Summary of subjects recruited for the validation study

	Epilepsy Status	Gender (female)	Mean ± SD (years)	Median (years)	IQR (years)	Range (years)
Sokoto (Hausa)	Total (N=153)	81 (53%)	28.1 ± 8.9	26	21 – 32	15 – 60
	Cases (n=75)	35 (47%)	30.6 ± 9.9	29	22 – 39	15 – 59
	Control (n=78)	46 (59%)	25.6 ± 7.1	24	20 – 28	18 – 60
Ebonyi (Igbo)	Total (N=106)	51 (48%)	28.7 ± 10.5	26	23 – 29	11 – 76
	Cases (n=45)	24 (53%)	32.1 ± 14.7	28	21 – 43	11 – 76
	Control (n=61)	27 (44%)	26.1 ± 4.7	25	24 – 27	19 – 47
Osun (Yoruba)	Total (N=153)	87 (57%)	27.5 ± 9.4	25	21 – 30	15 – 61
	Cases (n=66)	35 (53%)	30.0 ± 13.0	26	19 – 35	15 – 61
	Control (n=87)	52 (60%)	25.6 ± 4.6	25	22 – 29	18 – 35

SD – Standard deviation; IQR – Interquartile range

Table 3: Validation results of the epilepsy-screening questionnaire in three languages

		Hausa	Igbo	Yoruba
Positive to any Q1-Q9*	Sensitivity	97.3	91.1	93.9
	Specificity	85.9	88.5	89.7
	PPV	86.9	85.4	87.3
	NPV	97.1	93.1	95.1
Question 1	Sensitivity	78.7	60.0	50.0
	Specificity	94.9	96.7	98.9
	PPV	93.7	93.1	97.1
	NPV	82.2	76.6	72.3
Question 2	Sensitivity	78.7	64.4	50.0
	Specificity	97.4	93.4	97.7
	PPV	96.7	87.9	94.3
	NPV	82.6	78.1	72.0
Question 3	Sensitivity	54.7	46.7	43.9
	Specificity	98.7	98.4	97.7
	PPV	97.6	95.5	93.6
	NPV	69.6	71.4	69.7
Question 4	Sensitivity	38.7	42.2	50.0
	Specificity	96.2	95.1	98.9
	PPV	90.3	86.4	97.1
	NPV	62.0	69.1	72.3
Question 5	Sensitivity	76.0	57.8	50.0
	Specificity	97.4	95.1	98.9
	PPV	96.6	89.7	97.1
	NPV	80.9	75.3	72.3

Question 6	Sensitivity	29.3	57.8	51.5
	Specificity	96.2	95.1	96.6
	PPV	88.0	89.7	91.9
	NPV	59.6	75.3	72.4
Question 7	Sensitivity	60.0	51.1	24.2
	Specificity	97.4	95.1	95.4
	PPV	95.7	88.5	80.0
	NPV	71.7	72.5	62.4
Question 8	Sensitivity	42.7	53.3	37.9
	Specificity	94.9	98.4	97.7
	PPV	88.9	96.0	92.6
	NPV	63.3	74.1	67.5
Question 9	Sensitivity	73.3	60.0	66.7
	Specificity	97.4	98.4	98.9
	PPV	96.5	96.4	97.8
	NPV	79.2	76.9	79.6
Combination 1:	Sensitivity	97.3	84.4	86.4
Q1,Q2,Q5,Q7,Q9	Specificity	87.2	88.5	92.0
	PPV	88.0	84.4	89.1
	NPV	97.1	88.5	89.9
Combination 2:	Sensitivity	94.7	80.0	84.9
Q1,Q2,	Specificity	88.2	90.2	97.7
Q5,Q9	PPV	88.8	85.7	96.6
	NPV	94.4	85.9	89.5
Combination 3:	Sensitivity	96.0	80.0	80.3
Q1,Q2,Q5,Q7	Specificity	88.5	86.9	93.1
	PPV	88.9	81.8	89.8

	NPV	95.8	85.5	86.2
Combination 4:	Sensitivity	70.7	73.3	84.9
Q3,Q4,Q6,Q8	Specificity	89.7	91.8	93.1
	PPV	86.9	86.8	90.3
	NPV	76.1	82.4	89.0

PPV – positive predictive value; NPV – negative predictive value; Q – Question; *all the values had appreciable narrow confidence intervals.

Table 4: Predictive ability of various questions and combinations

	Kappa (κ)		
	HAUSA	**IGBO**	**YORUBA**
Q1Q2Q5Q7Q9	0.93	0.90	0.91
Q1Q2Q5Q7	0.91	0.88	0.84
Q1Q2Q5Q9	0.90	0.85	0.83
Q3Q4Q6Q8	0.68	0.77	0.88
Q1	0.68	0.59	0.50
Q2	0.68	0.67	0.51
Q3	0.45	0.48	0.45
Q4	0.36	0.44	0.50
Q5	0.68	0.63	0.50
Q6	0.28	0.59	0.54
Q7	0.53	0.56	0.30
Q8	0.40	0.54	0.40
Q9	0.66	0.57	0.65

Combination of all questions Q1 to Q9 has the best measures of accuracy and was considered as the gold standard. Interpretation of Kappa statistics in terms of the strength of agreement or predictive ability: poor <0.20; fair = 0.21-0.40; moderate = 0.41-0.60; good = 0.61-0.80; very good = 0.81-1.00

Conflict of Interest:

MMW, SAB and MBF, SCI, MK, EvD, YWN, ASW and GS have no conflicts to declare. JWS has received research grants from UCB and GW Pharmaceuticals and personal fees from Arvelle, UCB and Zogenix outside the submitted work.

We confirm that we have read the position of the Journal regarding ethical publication and declare that this manuscript is consistent with those guidelines.

Author Contributions:

MMW, GS and JWS conceived and designed the study. MMW, SAB MBF, SCI, MK and YWN acquired the data. MMW did the statistical analysis. MMW drafted the manuscript with critical input from EvD, ASW, YWN, GS and JWS. All authors approved the final version. JWS is the guarantor.

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Supplement 1: Igbo version of the epilepsy screening questionnaires

ID number:_____ Serial number:_____ Date:_ _ / _ _ / _ _ _ _		
Name of Investigator: _____		
Horo Aziza [✓]	*Mba*	*Ee*
1. inwetula oria ukwu na aka ima jijiji nke na inweghi ike ijide onwe gi?		
2. Onwutula mgbe imataghi onwe gi, da na ala ihu agbaruo gi?		
3. Onwetula mgbe inweturula oria nke mere gi ida na ala tabisie ire gi?		
4. Onwetula mgbe inweturula oria nke mere gi ida na ala baa onwe gi mamiri?		

5. Onwetula mgbe inweturula oria neme otu aka gi, otu ukwu gi ma obu ihu gi ima jijiji nwa obere oge?		
6. Onwetula mgbe inweturula oria nke mere gi amatazigi gburugburu ebe ino ma nuwazie isi ojoo?		
7. Onwere mgbe obula na mgbe idi ntakiri ina eche oke echiche ma obu na ele anya puru iche karia umu ntakiri ndi uzo?		
8. Ngwa-ngwa itetara na ura na ututu ma obu na ehihe, onwetula mgbe ichoputara na ahu na ama gi jijiji ma obu ihe idanarigi na aka na amaghi ama?		
9. Onwere mgbe obula agwaturula gi na inwere oria akwukwu ma obu ihe yiri ya, ma obu inutu ogwu akwukwu ma obu nke yiri ya?		

Supplement 2: Yoruba version of the epilepsy screening questionnaires

ID number:_____ Serial number:_____ Date:_ _ / _ _ / _ _ _ _		
Name of Investigator: _____		
Jowo dahun awon Ibeere wonyi: ✓	Beeko	Beeni*
1. Nję o ti fi igba kan ni aisan ese tabi owo to ngbon-riri ti e kole dekun re?		
2. Nję o ti daku tabi subu lule ti o si funfun ni'gba kan ri?		
3. Nję o fi igbakan ni ikolu ti o mu o subu lulę ti o si ge ahon rę ję?		
4. Nję o ti fi igbakan ni ikolu ti o mu o subu, ti o si to sara laimo?		
5. Nję o ti fi igbakan ni ikolu ranpę to mu o maagbon-pipi l'apa kan, l'ęsę kan tabi l'oju?		
6. Nje o ti fi igbakan ni ikolu ti o mu ma mo ibi ti o wa tabi ti o mu o n gbo oorun abami?		

7. Nję, nigba ewe, o ti fi igbakan ma n **lá álà ọ̀sán gan** tabi ma wo bọọn?		
8. Nję o ti se akiyesi ri pe nigbati o ji lati oju orun, yala ni aaro ni abi ni osan, o wa ni airorun tabi ti ara rẹ ngbon-riri to bẹẹ ti nkan jabo tabi fo danu lowo rẹ?		
9. Nję won so fun o ri pe o ni aisan giri tabi o fi igbakan lo oogun giri ri?		

Supplement 3: Hausa version of the epilepsy screening questionnaires

ID number:_____ Serial number:_____ Date:_ _ / _ _ / _ _ _ _		
Name of Investigator: _____		
Zabi daya ✓	Babu	a
1. Ka/Kin taba samun jijjigan ko motsin hannuwa ko kafafuwa da bashi da ikon dainawa da kanshi?		
2. Ka/Kin taba fadi ko ka/kin yi dogon suma kuma sai jiki yayi fari fat?		
3. Ka/Kin taba fadi ka/kin cije harshen ka/ki?		
4. Ka/Kin taba shiga wani yanayi na faduwa da sakar fistari ba tare da tsanin ka/ki ba?		
5. Ka/Kin taba samun jijjigan bangaren jiki kaman hannu, kafa ko fuska?		
6. Ka/Kin taba fita daga cikin hayyacin ka/ki, sannan ka/kin ji wani wari/kamshi?		
7. Shin, a lokacin da kake/kike yaranta ka/kin taba shiga yanayin da za ka/ki yi shuru ka/ki kalli wuri guda fiye da sauran yara?		

8. Jim kadan bayan tashi daga barci, ko da safe ko bayan wani ɗan rurumi ka/kin taba lura ka/ki na yawan yar da abun da kake/kike rike da shi ba tare da niyan yar da shi ba?		
9. An taba gaya ma ka/ki cewa kana/kina da bugun tsunsu ko ka/kin taba shan maganin cutar farfadiya?		

Supplement 4: Likelihood ratios of various questions and combinations

	Positive likelihood ratios (LR+)			**Negative likelihood ratios (LR–)**		
	Hausa	**Igbo**	**Yoruba**	**Hausa**	**Igbo**	**Yoruba**
Positive to any Q1 to Q9	6.90	7.90	9.10	0.03	0.10	0.07
Question 1	15.40	18.20	45.50	0.22	0.41	0.51
Question 2	30.30	9.80	21.70	0.002	0.38	0.51
Question 3	42.10	29.20	19.10	0.46	0.54	0.57
Question 4	10.20	8.60	45.50	0.64	0.61	0.51
Question 5	29.20	11.80	45.50	0.25	0.44	0.51
Question 6	7.70	11.80	15.10	0.73	0.44	0.50

Question 7	23.10	10.40	5.20	0.41	0.51	0.79
Question 8	8.40	33.30	1.70	0.60	0.47	0.64
Question 9	28.20	37.50	60.60	0.27	0.41	0.34
Combination 1 : Q1,Q2,Q5,Q7,Q9	7.60	7.30	10.80	0.03	0.18	0.15
Combination 2: Q1,Q2,Q5,Q9	8.00	8.20	36.90	0.06	0.22	0.16
Combination 3: Q1,Q2,Q5,Q7	8.00	6.10	11.60	0.13	0.23	0.21
Combination 4: Q3,Q4, Q6,Q8	6.90	8.90	12.30	0.33	0.29	0.16

$$\boldsymbol{LR}+ = \frac{Sensitivity}{1 - Specificity}$$

$$\boldsymbol{LR}- = \frac{1 - Sensitivity}{Specificity}$$

LR+ *of 1 to 2 signifies minimal probability. A larger positive magnitude indicates that a screening question is more accurate at predicting epilepsy.* ***LR-*** *range from 0 to 1. Values nearer to zero have a stronger likelihood that a person with a negative screen has a higher probability of not having epilepsy. [27]*