Knowledge assessment of snake antivenom among healthcare practitioners involving educational intervention in northern Nigeria: a study protocol

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Abstract

Introduction

Snakebite envenoming (SBE) is an important occupational and public health hazard especially in sub-Saharan Africa. For optimum management of SBE, adequate knowledge of Snake antivenom (SAV) is very critical among the healthcare practioners in this region. Information related to the knowledge of SAV use in the management of SBE, as well as SAV logistics is scarce among the Health Care Professionals (HCPs) in Nigeria, particularly in the northern region. We therefore aimed to develop, validate and utilize a tool to assess the SAV knowlegde among HCPs in northern Nigeria. We also sought to implement and evaluate an intervention that could improve the SAV knowledge among the HCPs.

Methods

The proposed study will be conducted in three phases: Phase I will involve the development of the item-pool to be included in the tool, followed by a face, content validity and construct validity. The tool reliability, readability and difficulty index will be determined. Phase II will involve the utilization of the tool to assess baseline SAV knowledge among the HCPs followed by an educational intervention. Multiple Linear Regression analysis will be used to determine the factors associated with SAV knowledge among the HCPs. Lastly, Phase III which will be a repeat of Phase II to assess and evaluate the knowledge after the intervention.

Discussion

The study design and findings may guide future implementation and streamline the intervention of improving SAV knowledge in HCPs training and practice.

Keywords: Snake, healthcare professionals, knowledge, Nigeria, protocol, venom

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Lay Summary

Knowledge assessment and educational intervention of snake antivenom among healthcare practitioners in northern Nigeria: a study protocol

Snakebite envenoming (SBE) is an important occupational and public health hazard especially in sub-Saharan Africa. For optimum management of SBE, adequate knowledge of snake antivenom (SAV) is very critical among the healthcare practitioners. The baseline knowledge SAV dosage, mode of administration, availability, and logistics is very relevant among healthcare professionals, particularly those that are directly involved in its logistics.

It is paramount that SAV is handled and used appropriately. The efforts and advocacy for the availability for more SAV will be in vain if not handled appropriately before they are used. This study protocol aims to develop a tool, to assess SAV knowledge and effects of educational interventions among healthcare professionals (HCPs) in northern Nigeria. This protocol suggests conducting studies in three phases: (a) Development and validation of SAV knowledge assessment tool, (b) Baseline assessment of SAV knowledge assessment tool among HCPs, and (c) Development, implementation and evaluation of an educational intervention to improve SAV knowledge among HCPs in northern Nigeria.

Introduction

Snakebite envenoming (SBE) has been identified as an important occupational and public health hazard.[1] Every year, millions of people in low- and middle-income countries face death, disability and disadvantage from SBE without access to appropriate treatment.[2] The crisis has reached an alarming level in sub-Saharan Africa. In 2017, SBE was enlisted as one of the World Health Organization's high-priority (category A) neglected tropical diseases.[3]

Nigeria is reported to have one-fifth of all West African region snake bite cases, with 174 cases in every 100,000 hospital admissions. The burden associated with it, is on the increase in the northern part of Nigeria[4] because the region has the highest number of snakes; more than all other regions of the country put together.[5,6] Antivenom also known as snake antivenom (SAV) is the only standard antidotal treatment available for SBE and it has been in clinical use for over a century.[3] Although, high-quality SAV against the most medically important snakes does exist, some communities where snakebite incidence is common lack adequate storage facilities.[2,7]

Our literature review showed that there is generally poor knowledge of the snakebite crisis among healthcare professionals (HCPs) in Africa and Asia. This was demonstrated by a study conducted by Michael et al.[8] The study reported a low overall knowledge of venomous snakes, snakebite first aid, treatment and prevention among doctors in northern Nigeria. Similarly, another study in Asia reported a gap in baseline knowledge and treatment confidence among physicians in Hong Kong.[9] It was also reported that knowledge of snakebite management among physicians and nurses in Savannakhet Province of Laos, was not sufficient to ensure the professional care of snakebite patients in the province. There was also the lack of adequate knowledge in dosage and appropriate administration of SAV.[10] A study among medical students in Nepal reported their inadequate knowledge of first aid on snakebite.[11] The common source of their snakebite knowledge was school books, which often provide faulty knowledge.[11,12] Internee doctors were also found lacking in general knowledge of snakebite management in West Bengal.[13]

Despite the high incidence of snakebites and other healthcare burden associated with SBE in northern Nigeria, studies related to SAV knowledge are limited in Nigeria. To our knowledge, no study has reported assessment of SAV knowledge among a group of HCPs who are believed to be the custodians of the SAV in terms of procurement, distribution, storage, handling and administration in Nigeria, except the study conducted by Michael *et al*.,[8] which only assessed general knowledge of snakebite management among doctors. The knowledge of SAV and storage requirements among the targeted HCPs will provide an insight on whether SAVs are being handled appropriately or not. In addition, an intervention to improve the knowledge will assist in improving the knowledge, ensuring that adequate and right dose of quality and effective SAV has reached the end user.

Considering the sub-Sahara African climate and the possible logistics problems, lack of storage equipment, lack of constant electricity, high temperature and lack of technical capacity that may be encountered in rural areas where the snakebite crisis is predominant, adequate distribution, storage and usage of SAV can be a matter of great concern.[14] SAV is recommended to be stored at a temperature within the range that assures stability; this is particularly critical for

liquid formulations, which usually require storage at between 2 and 8°C. Therefore, deviations from this temperature range, due to interruptions in the cold chain during transportation or storage, are likely to result in product deterioration.[3]

HCPs in charge of the management of SBE, should have basic knowledge in the basic aspects of therapy as well as the nature and logistics requirements of SAV.[15] Data regarding the knowledge of SAV are limited in Nigeria. In addition, there is also paucity of intervention to improve the knowledge and skills of SAV among the relevant HCPs in Nigeria. Moreover, training was found to significantly improve knowledge of snakebite management among HCPs in Cameroon[16]

Rationale of the study

The knowledge of SAV dosage, mode of administration, availability, and logistics is very relevant among HCPs, particularly those that are directly involved in its logistics.[3] It is paramount that antivenom is handled and used appropriately. The efforts and advocacy for the availability for more SAV will be in vain if not handled appropriately before they are used. An important goal of the international toxicology community includes the promotion of research initiatives to improve epidemiological and clinical knowledge of envenoming and initiatives to improve training of HCPs on antivenom quality control[17]

Limitations of the protocol

1. There may be an inherent issue of recall bias in the determination post-intervention SAV knowledge assessment as participants may not be able to accurately recall what they have learnt during the intervention.
2. The study is limited with a lack of funding to employ only face-to-face methods of data collection from the participants as the most suitable methods for assessing and imparting SAV knowledge. Thus, a mixed-mode approach will be used (face-to-face and online). The online method has an inherent shortcoming of not allowing the opportunity for motivating participants using body language and detailed explanation about the scope of the study compared with that in face-to-face questionnaire surveys.

Aim of the study

This study aims to assess SAV knowledge, provide educational intervention and a follow-on evaluation of the impact of the intervention among HCPs in northern Nigeria.

Specific objectives

1. To develop and validate a questionnaire to assess SAV knowledge among HCPs in northern Nigeria.
2. To assess the baseline knowledge on SAV (knowledge of logistics, dosage, and mode of administration).
3. To identify gaps in knowledge on SAV, logistics, dosage, and mode of administration.
4. To determine the factors associated with SAV knowledge among HCPs in northern Nigeria.
5. To develop, implement and evaluate an educational intervention to improve SAV knowledge among HCPs in northern Nigeria.

Methodology

The study will be conducted in three phases:

1. Development and validation of SAV knowledge assessment tool
2. Baseline assessment of SAV knowledge assessment tool among HCPs
3. Development, implementation and evaluation of an educational intervention to improve SAV knowledge among HCPs in northern Nigeria

Phase I (questionnaire development and validation)

Phase I of the study will involve the development of the questionnaire from a review of available literature and discussion with research experts in the field. The items to be included in the questionnaire will measure a single construct (knowledge) with the seven domains (sociodemographic information of the respondents, SAV definition, dosage, mode of administration, availability, cost, and logistics). The questionnaire will consist of three sections containing questions related to the domains.

1. **Section A** will contain items related to sociodemographic characteristics, professional

qualification, and practice area in northern Nigeria.
2. **Section B** will contain items related to knowledge of SAV, dosage, mode of administration and source of the respondent knowledge.
3. **Section C** will contain items related to availability, cost, and knowledge of storage requirements and handling of the SAV.

The questionnaire will be in the form of self-administered, semi-structured and open- and closed-ended. Several detractors will be added to prevent guessing by participants. The items will also be in short sentences with commonly used words.

The questionnaire developed will be validated through:

Face validity: To ensure the questionnaire has made any sense and will measure SAV knowledge among the HCPs, the questionnaire will be presented to a panel of experts. The experts will consist of professionals with SAV research knowledge, and some selected target participants. The panel will be asked to comment on the questionnaire in terms of appropriateness to measure the SAV knowledge among the HCPs.
Content validity: To ensure each item in the questionnaire is relevant to measure the SAV knowledge among the HCPs. A panel of seven experts with experience in SAV will be asked to rate each item on the questionnaire based on a Likert scale (4, very relevant; 3, relevant; 2, irrelevant; 1, not relevant). The selection of each item in the questionnaire for inclusion in the final draft will be based on content validity score of >0.7. An item with a content validity score <0.7 will be dropped.
Construct validity: To ensure the questionnaire will measure the construct (SAV knowledge) among the HCPs and the ability to discriminate knowledge among people with different knowledge background, the construct validity will be determined by hypothesis testing of a pilot study of the questionnaire among a sample of the target participants (pharmacy technicians, nurses, pharmacists and physicians). It will be hypothesized that the SAV score will be higher among pharmacists, then physicians, pharmacy technicians and nurses.
Reliability: To ensure the questionnaire will reliably measure the SAV among the HCPs over time. A Cronbach' α coefficient of at least 0.7 to 0.9 will be regarded as acceptable.[18]
Readability: To ensure the majority of the respondents understand the items in the questionnaire will be assessed using Simple Measure of Gobbledygook (SMOG) score.
Difficulty index: Items that look ambiguous to the participants will be identified and reworded by taking the percentage of correct responses overall. Items below 50% will be reworded.

Phase II (baseline SAV knowledge assessment among HCPs)

Phase II will involve the utilization of the validated SAV questionnaire to assess SAV knowledge among HCPs and to determine the risk factors associated with SAV knowledge among SAVs,

Study design: The study will be in the form of a cross sectional study design. A mixed-mode survey will be employed (online and face-to-face survey)

Study settings: For the face-to-face survey, the study will be conducted at hospitals, primary healthcare facilities, government-owned medical stores and community pharmacies in the northern part of Nigeria; divided into North-West, North-East, and North-Central regions. Participants for the online survey will be recruited *via* Facebook and WhatsApp groups of professional associations. A participant consent statement will be explained on the introductory page of the questionnaire, clicking the next button or a signature will imply consent for online and face-to-face questionnaires, respectively.

Study population: The study will be conducted among pharmacy technicians, nurses, pharmacists, and physicians working in the selected hospitals, community pharmacies, government-owned drug stores and relevant drug distribution companies in northern Nigeria.

Sampling technique: Eligible participants will be selected for inclusion in the current study from the states in the three regions of the northern part of Nigeria based on purposive sampling.

Data collection

Online survey: The online survey will be conducted based on CHERRIES statement. The hyperlink to the questionnaire (Google form) will be shared to the eligible participants *via* social media groups/individual accounts (Facebook and WhatsApp) belonging to the participants.

Face-to-face survey: The self-administered hard copy of the questionnaire will be distributed to eligible participants at the appropriate study settings. The questionnaire will be administered by the investigators through the president or chairman of the professional association of the study setting where applicable. Some participants in this phase will be asked whether they will be interested in participating in Phase III (post educational intervention knowledge assessment). Interested participants will be approached for a repeat of the SAV knowledge assessment 2 weeks after implementation of the intervention.

All responses will be collected over an 8-week period.

Phase III (development, implementation and evaluation of an educational intervention)

Development of educational materials: Educational interventions in the form of printed and online educational materials will be developed based on the gap identified in the baseline study and a review of literature. The first draft of the educational materials will be presented to a panel of experts. The panel will consist of pharmacists with vast experience in clinical and logistic research and practice. The panel will be asked to review the items in the educational materials based on relevance, appropriateness for the study objectives and ease of understanding by the target participants. The educational material will be revised based on the feedback received from the panel. The educational materials will be in the form of a threefold SAV information leaflets and size A3 SAV information posters (electronic and hard copy). Items in the educational materials will be short and in simple sentences, less technical and with commonly used wording.

Development of Facebook SAV campaign: An online campaign will be conducted *via* Facebook advert. The online campaign will be in the form of a Google form consisting of four pages; the first page will be the participant's information sheet and consent statement, the second page will be SAV knowledge assessment questions, page 3 will consist of the educational materials and the last page will be the SAV knowledge assessment questions.

The developed materials will be pre-tested among 10 target participants. This is to ensure clarity, ease of understanding and relevance. The final draft will be assessed for ease of readability using SMOG index.

Implementation: The educational materials developed will be used to improve the SAV knowledge among some selected participants from the baseline SAV knowledge assessment study. The educational intervention will be conducted based on a mixed-mode approach:

1. Printed educational materials: the threefold flyer will be distributed to HCPs particularly some selected participants in Phase II (baseline SAV knowledge assessment) after completion of Phase I. The SAV information poster will be distributed at the study centre for placement at the notice boards. The flyer and the poster will contain a QR code that will allow the HCPs to scan and be directed to a page where detailed information about SAV will be assessed.
2. Electronic educational materials: the educational materials will be converted to a pdf and JPEG format for sharing with the participants *via* their individual and group's social media accounts such as Facebook, WhatsApp and Twitter.
3. Online Facebook educational campaign: the hyperlink to the campaign will be shared in the Facebook advert page. The Facebook advert page will be shared with the Facebook pages of potential participants. All access to the online campaign pages will be by a click on the advert. Thereafter, the participant will be directed to the page 1 where information about the study and consent will be accessed, the participants will be asked to answer the baseline SAV questions before and after reading the educational materials.

Evaluation: The impact of the educational intervention will be assessed using the following steps:

1. Online Facebook educational campaign: the SAV knowledge scores SAV assessment at baseline (page 1) and after reading the educational material will be compared and the statistical difference will be determined.
2. Printed educational materials: some participants who received the printed educational materials after participating in the baseline SAV knowledge assessment will be identified and selected based on purposive sampling. The participants will be administered with the same SAV knowledge assessment tool as in Phase I. The difference in the knowledge of the two knowledge scores will be determined and compared.

Sample size determination

The sample size (n) for the proposed study was calculated using two mean sample estimations with the aid of the OpenEpi version 3 software application. The estimate of the finite population, standard deviation of 10, and the mean difference between groups will be set at 2, with a power of 80% and a confidence interval of 95%. The sample size was found to be $n = 393$ with assumed 10% attrition rate.[19]

Data analysis

Data collected from the online survey will be exported into SPSS (IBM Corp., version 22.0. Armonk, NY, USA). Other information collected from the face-to-face survey will be analyzed using SPSS.

Phase I: Analysis of variance will be used to compare SAV knowledge score of the study group, and Cronbach's α to determine the internal consistency reliability. Readability index will be assessed using SMOG score and difficulty index will be assessed by taking the proportion of correct answers in the overall completed responses.

Phase II: Descriptive statistics will be used to determine the knowledge scores and multiple linear regression will be used to determine the factors associated with SAV knowledge.

Phase III: General linear modelling analysis will be used as appropriate to evaluate the impact of the educational interventions among the HCPs.

Throughout the study, we will increase awareness about the knowledge of SAV and its benefits to researchers, practitioners, policy makers, academic and professional bodies, funders, and journal editors through conference presentations, editorials, and peer-reviewed publications in academic and professional journals and *MRC Network*. We will also provide updates to stakeholders after each phase.

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Author contributions

We declare that this work was conducted by the authors named in this article and all liabilities relating to the content of this article will be borne by them. All authors have met the criteria for authorship of the YPS. Each authors' contribution to the protocol is stated in the following.

AAB conceived the original idea, developed the theory and co-wrote the protocol. JAI developed the methods for the second and third phase of the study intervention and co-wrote the protocol. IY and MM designed the analysis and sampling technique. AHM wrote the introduction. AI and WAS conducted the literature review. KAG and IB designed Phase I of the study and co-wrote the final protocol. GCM and SM edited and critically reviewed the protocol. BZAC gave the final approval and revision for intellectual content of the protocol.

Confidentiality and data storage

We will maintain the privacy of all accessible research data. The information obtained will be kept confidentially by the researchers and only the authorized researchers will know any identifying information. Sensitive information will be kept in a locked filing cabinet separate from the interview material and the interview material will be destroyed after data has been coded. Electronic data will be digitally stored on a password secured folder. All data will be destroyed or deleted after a period of 5 years' post-publication.

Conflict of interest statement

The authors declare that there is no conflict of interest.

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