

Development and Content Validation of a Competency-Based Training Package for Traditional Bone Setters in Ondo State, Nigeria

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Abstract

Background

Traditional bone setters (TBSs) remain the first point of care for many fracture patients in Nigeria due to affordability, accessibility, and cultural acceptability. However, the absence of standardized, competency-based education contributes to inappropriate fracture management and preventable complications. The development of an evidence-based training package is essential to improve practice and support collaboration between traditional and orthodox healthcare systems. This study aimed to develop and establish the content validity of an intervention training package for TBSs in Ondo State, Nigeria.

Methods

A methodological study was conducted as the first phase of a larger intervention study. The 8-module training package was developed from literature review, findings from a needs assessment of 30 TBSs, WHO guidelines on trauma and infection prevention, and principles of Social Cognitive Theory and Adult Learning Theory. Content validity was established through review by 10 experts using the Content Validity Index method.

Results

The final package comprised 8 competency-based modules. The Item-level Content Validity Index (I-CVI) ranged from 0.80 to 1.00. The overall Scale-level Content Validity Index Average (S-CVI/Ave) was 0.92.

Conclusion

The intervention training package demonstrated excellent content validity and provides an evidence-based educational resource for improving TBS knowledge and practice. The validated package can support the design of future training programmes and the integration of TBSs into community-based musculoskeletal care in Nigeria and similar low-resource settings.

1. Introduction

Musculoskeletal injuries constitute one of the leading causes of disability worldwide, particularly in low- and middle-income countries where road traffic accidents, occupational injuries and falls continue to increase. The World Health Organization estimates that millions of people sustain fractures annually, with many requiring immediate immobilization, wound care and appropriate referral to specialist orthopaedic services. In many developing countries, however, access to modern orthopaedic care remains limited because of shortages of specialists, inadequate healthcare infrastructure, financial barriers and geographical inaccessibility. Consequently, many injured patients seek treatment from

Traditional Bone Setters (TBSs), who provide community-based fracture care using indigenous knowledge passed through generations^{5,16,31,36,37,39}.

Traditional Bone Setting has remained an important component of healthcare delivery throughout sub-Saharan Africa and is deeply embedded in cultural beliefs and community practices. In Nigeria, traditional bone setters frequently manage fractures, dislocations, sprains and other musculoskeletal injuries using manual manipulation, herbal preparations and locally fabricated splints³. Their services are particularly valued because they are readily accessible, relatively inexpensive and culturally acceptable to many communities. Previous studies have shown that between one-third and four-fifths of fracture patients initially present to Traditional Bone Setters before seeking orthodox medical treatment, especially in rural areas^{2,3,8,12,25,31,35,38,40,42}.

Despite their widespread patronage, Traditional Bone Setters rarely receive formal education in anatomy, through family inheritance and apprenticeship, with little opportunity for standardized professional training. This traditional mode of knowledge transfer has preserved valuable indigenous practices but has also perpetuated misconceptions regarding fracture care and delayed referral of complicated cases. As a result, patients managed exclusively by Traditional Bone Setters frequently experience avoidable complications such as compartment syndrome, wound infection, malunion, non-union, chronic pain, joint stiffness, gangrene and limb amputation. These complications contribute substantially to disability, prolonged hospitalization, increased healthcare costs and reduced quality of life^{1,4,15,17–24,26–30,32–34}.

Evidence increasingly suggests that improving the competencies of informal healthcare providers through structured educational interventions can significantly enhance patient safety and clinical outcomes. Rather than discouraging Traditional Bone Setting, many researchers and policymakers now advocate collaboration between traditional practitioners and formal healthcare systems through competency-based education, supportive supervision and clearly defined referral pathways. The World Health Organization has similarly emphasized the importance of strengthening traditional medicine through education, regulation and quality assurance to improve healthcare delivery in resource-constrained settings^{2,9,13,14,30,35,38,40,42}.

The development of educational interventions intended for healthcare providers requires rigorous methodological procedures to ensure that learning materials are accurate, relevant, culturally appropriate and understandable by the intended audience. Content validation represents one of the most important stages in educational resource development because it establishes whether instructional materials adequately represent the concepts they intend to teach. Expert review using the Content Validity Index (CVI) has become one of the most widely accepted methods for evaluating educational and clinical instruments. The Item-level Content Validity Index (I-CVI) evaluates agreement among experts for individual learning components, while the Scale-level Content Validity Index (S-CVI) provides an overall measure of content adequacy^{6,11,14}.

The present study formed part of a larger doctoral research project that aimed to develop, validate and evaluate an intervention training package for Traditional Bone Setters in Ondo State, Nigeria. Initial qualitative findings from the project identified important educational gaps related to fracture assessment, infection prevention, safe immobilization, recognition of complications and timely referral. These findings informed the development of a structured training package grounded in adult learning principles and Social Cognitive Theory⁷. The present paper specifically reports the systematic development process and content validation of this intervention package before its implementation among Traditional Bone Setters^{7,10}.

Establishing the content validity of the intervention package provides evidence that the educational materials adequately reflect current best practices in fracture management while remaining culturally appropriate for Traditional Bone Setters. The validated package may serve as a practical educational resource for future training programmes, policy implementation and collaborative healthcare initiatives aimed at reducing fracture-related complications in Nigeria and other low-resource settings^{5,13,36,37,41–43}.

2. Methodology

2.1 Study Design

This study employed a methodological research design to develop and establish the content validity of an intervention training package for Traditional Bone Setters (TBSs) in Ondo State, Nigeria. The methodological design was considered appropriate because the study focused on the systematic development, refinement, and validation of an educational intervention before implementation. The study constituted the first phase of a larger quasi-experimental research that evaluated the effectiveness of the intervention package in improving TBS knowledge, practice, and reducing fracture-related complications^{6,11}.

The intervention package was developed using evidence obtained from an extensive review of scientific literature, findings from a needs assessment conducted among Traditional Bone Setters, recommendations from international trauma care guidelines, and expert opinions from specialists in orthopaedics, nursing, public health, and medical education^{5,13,36,37,39,41,43}.

2.2 Study Setting

The study was conducted in Ondo State, South-West Nigeria, between January and June 2026. Ondo State has a large number of Traditional Bone Setters who provide fracture management services in both rural and urban communities. The state has numerous government-owned and private hospitals, including specialist orthopaedic centres, making it suitable for collaboration between traditional and orthodox healthcare providers^{3,8,12,25,31,38,40,42}.

Traditional Bone Setters in Ondo State commonly acquire their skills through apprenticeship and family inheritance without standardized educational programmes. Previous findings from the larger study showed substantial variations in fracture management practices, infection prevention measures, wound care, documentation, and referral practices among practitioners. These identified gaps informed the development of the intervention package ^{2,3,8,12,16,25,31,35}.

3. Literature Review

A comprehensive review of published literature was undertaken to identify evidence-based practices in fracture management, infection prevention, adult education, trauma care, patient safety, and previous educational interventions for informal healthcare providers. Electronic databases including PubMed, Scopus, Web of Science, Google Scholar, and African Journals Online (AJOL) were searched. ^{5,13,23,36,37,39,41–43}.

Key documents consulted included

WHO Traditional Medicine Strategy; WHO Guidelines for Essential Trauma Care; WHO Infection Prevention and Control Guidelines; Nigerian Orthopaedic Association recommendations; and Previous studies on Traditional Bone Setters in Africa ^{5,13,41–43}.

The review identified several deficiencies associated with traditional fracture management, including: inadequate anatomical knowledge; poor aseptic techniques; inappropriate splint application; delayed referral of complicated fractures; poor documentation; and lack of collaboration with hospitals ^{1,4,15,17–24,26–34,36,37}.

These findings provided the scientific foundation for the training modules ^{1,4,15,17–24,26–34}.

Stage Two: Needs Assessment

A needs assessment involving 30 Traditional Bone Setters was conducted across selected Local Government Areas in Ondo State before developing the intervention package ^{2,3,8,9,12,16,25,31,35}.

Data were collected using: structured questionnaires; observation checklists; and key informant interviews.

The assessment explored participants': demographic characteristics; educational background; years of practice; methods of fracture management; knowledge of infection prevention; referral practices; and perceived training needs.

The needs assessment demonstrated that although most practitioners possessed considerable practical experience, important knowledge gaps existed regarding: fracture classification; recognition of

neurovascular compromise; compartment syndrome; infection prevention; wound care; documentation; and emergency referral^{1,4,12,15,17–24,26–34}.

These findings guided the selection of topics included in the intervention package.

Stage Three: Development of Training Modules

Based on findings from the literature review and needs assessment, an eight-module competency-based intervention package was developed^{2,9,14,30,35}.

Each module contained: clearly defined learning objectives; lesson content; practical demonstrations; illustrations; facilitator notes; group discussion activities; practical exercises; and evaluation questions.^{10,14,28,30}

The intervention package emphasized adult learning principles by encouraging participant interaction, demonstration, problem-solving, practical exercises, and experience sharing^{10,28,30}.

The eight modules included:

Module 1: Basic Musculoskeletal Anatomy

Topics included: bones and joints; muscles; ligaments; blood supply; nerves; and principles of bone healing^{36,37}.

Module 2: Types of Fractures

Topics included: closed fractures; open fractures; displaced fractures; comminuted fractures; greenstick fractures; dislocations; and fracture assessment^{36,37}.

Module 3: Principles of Fracture Immobilization

Topics included: principles of reduction; safe splint application; positioning; circulation assessment; and prevention of pressure injury^{5,36,37}.

Module 4: Infection Prevention and Control

This module emphasized: hand hygiene; aseptic techniques; wound cleansing; dressing procedures; instrument decontamination; environmental sanitation; and personal protective equipment^{13,41,43}.

Module 5: Recognition of Complications

Participants were taught early identification of: compartment syndrome; infection; gangrene; vascular injury; nerve injury; delayed union; non-union; and malunion^{1,4,15,17–24,26–34}.

Module 6: Criteria for Referral

This module identified situations requiring urgent referral, including: open fractures; uncontrolled bleeding; severe deformity; neurovascular compromise; suspected spinal injuries; and multiple trauma; fractures in children requiring specialist care^{5,36,37,39,41,43}.

Module 7: Communication with Hospitals

Topics included: referral communication; patient counselling; interdisciplinary collaboration; documentation during referral; and follow-up communication^{5,39}.

Module 8: Record Keeping and Follow-up

Participants were trained on: patient registration; treatment records; follow-up visits; complication monitoring; referral documentation; and confidentiality³⁹.

3.1 Theoretical Framework

The intervention package was guided by Bandura's Social Cognitive Theory, which emphasizes learning through observation, modelling, reinforcement, self-efficacy, and behavioural change⁷.

Adult Learning Theory (Knowles' Andragogy) also informed the educational strategy by recognizing that adult learners possess prior experience, require practical learning opportunities, and benefit from problem-centred instructional method¹⁰.

3.2 Content Validation

The preliminary training package underwent expert validation to establish its relevance, clarity, comprehensiveness, and suitability for Traditional Bone Setters.

A purposive sample of ten experts participated.

The panel consisted of: four Consultant Orthopaedic Surgeons; three Public Health Physicians; and three senior Traditional Bone Setter trainers with extensive experience in TBS education and community-based trauma care.

Each expert independently reviewed every module.

Evaluation was performed using a structured validation instrument adapted from^{6,11}.

Experts rated each item on two domains: relevance; and clarity.

A four-point Likert scale was used:

1 = Not relevant/Not clear

2 = Somewhat relevant/Somewhat clear

3 = Quite relevant/Quite clear

4 = Highly relevant/Highly clear

Experts were encouraged to provide qualitative comments regarding wording, sequence of topics, cultural appropriateness, illustrations, and overall presentation.

Recommendations received from validators were incorporated before producing the final version of the intervention package.

3.3 Data Analysis

Descriptive statistics were computed using IBM SPSS version 27.

Means and standard deviations summarized expert ratings.

Content validity was assessed using the Content Validity Index (CVI) ^{6,11}.

The Item-level Content Validity Index (I-CVI) was calculated as the proportion of experts assigning ratings of either 3 or 4 to each module.

The formula used was:

$$\text{I-CVI} = \text{Number of experts rating an item as 3 or 4} \div \text{Total number of experts}$$

The Scale-level Content Validity Index using the Average approach (S-CVI/Ave) was obtained by averaging the I-CVI values across all modules.

Following recommendations by ^{6,11}.

$\text{I-CVI} \geq 0.78$ indicated acceptable agreement ^{6,11}.

$\text{S-CVI/Ave} \geq 0.90$ indicated excellent overall content validity ^{6,11}.

Figure 1 – Flowchart showing development process from literature review to final validated package

3.4 Ethical Considerations

Ethical approval

was obtained from the Ondo State Health Research Ethics Committee (OSHREC) with approval number OSHREC/08/05/2025/987 and the Afe Babalola University Teaching Hospital Research Ethics Committee with approval number AMSH/REC/26/62/033.

Written informed consent was obtained from all participants before participation. Confidentiality, anonymity, voluntary participation, and the right to withdraw from the study at any stage without penalty

were assured. The study adhered to the ethical principles outlined in the Declaration of Helsinki for research involving human participants.

4. Result

4.1 Characteristics of experts

All 10 experts completed validation. 40% were orthopaedic surgeons, 30% public health physicians, and 30% senior TBS trainers.

4.2 Content validity of the training package as presented in Table 1

The 8-module package achieved an S-CVI/Ave of 0.92. I-CVI ranged from 0.80 for "Record Keeping and Follow-up" to 1.00 for "Types of Fractures", "Infection Prevention and Control", and "Criteria for Referral"^{6,11}.

The high scores for infection prevention and referral modules align with evidence that these are key areas contributing to complications in traditional fracture care^{1,4,15,17,18,24,26–29,32–34}.

Table 1
Expert Ratings of the Intervention Training Package (n = 10)

Module	I-CVI	Mean Relevance ± SD	Mean Clarity ± SD
Basic Musculoskeletal Anatomy	0.90	3.8 ± 0.4	3.7 ± 0.5
Types of Fractures	1.00	3.9 ± 0.3	3.9 ± 0.3
Principles of Fracture Immobilization	0.90	3.8 ± 0.4	3.6 ± 0.5
Infection Prevention and Control	1.00	4.0 ± 0.0	3.9 ± 0.3
Recognition of Complications	0.90	3.8 ± 0.4	3.7 ± 0.5
Criteria for Referral	1.00	3.9 ± 0.3	4.0 ± 0.0
Communication with Hospitals	0.90	3.7 ± 0.5	3.6 ± 0.5
Record Keeping and Follow-up	0.80	3.5 ± 0.5	3.4 ± 0.5
Scale-level	Content	Validity Index	(S-CVI/Ave) = 0.92

All modules exceeded the minimum acceptable I-CVI threshold of 0.78.

Experts recommended simplifying technical terms in the record keeping module and adding pictorial examples. These were incorporated into the final package.

4.3 Discussion

This study developed and established the content validity of an intervention training package designed specifically for Traditional Bone Setters (TBSs) in Ondo State, Nigeria. The findings demonstrated that the package possesses excellent content validity, with an overall Scale-level Content Validity Index (S-CVI/Ave) of 0.92, exceeding the recommended benchmark of 0.90 for newly developed educational instruments. The high level of agreement among the multidisciplinary expert panel indicates that the intervention package is relevant, comprehensive, clear, and appropriate for improving the knowledge and clinical practices of Traditional Bone Setters^{6,11,14}.

The development process adopted in this study followed internationally accepted procedures for educational intervention design, incorporating evidence from an extensive literature review, findings from a local needs assessment, recommendations from the World Health Organization (WHO), and expert review. This systematic approach ensured that the package addressed both global evidence-based recommendations and the unique educational needs of Traditional Bone Setters practising in Nigeria. Similar methodological approaches have been recommended^{11,6} who emphasized that educational materials should undergo rigorous expert evaluation before implementation to establish their validity and improve instructional quality^{5,6,11,13,14,23,36,37,41–43}.

The high Item-level Content Validity Index (I-CVI) kvalues observed across all eight modules suggest strong consensus among experts that the selected topics adequately represent the essential competencies required for safe fracture management. Modules on Types of Fractures, Infection Prevention and Control, and Criteria for Referral each achieved an I-CVI of 1.00, indicating unanimous agreement regarding their importance. These findings reflect growing recognition that infection prevention and timely referral are among the most critical factors in reducing complications associated with traditional fracture care. Previous studies have consistently reported that poor infection control practices and delayed referral remain major contributors to gangrene, chronic osteomyelitis, compartment syndrome, limb deformity, and avoidable amputations among patients initially treated by Traditional Bone Setters^{6,11}.

The excellent ratings obtained for the infection prevention module are particularly important because healthcare-associated infections remain a major cause of morbidity and mortality worldwide. Many Traditional Bone Setters continue to perform wound dressing and fracture manipulation without adequate hand hygiene, sterilization procedures, or use of personal protective equipment. By incorporating WHO infection prevention guidelines into the intervention package, the study provides an opportunity to strengthen patient safety while preserving culturally accepted traditional practices¹³. Similar educational interventions among community health workers and informal healthcare providers have demonstrated significant improvements in infection prevention practices following structured training programmes^{13,41}.

The module addressing referral criteria also received exceptionally high ratings from experts. Delayed referral of complicated fractures has been widely documented as one of the leading causes of adverse outcomes following traditional fracture treatment in many African countries. Patients frequently present

to hospitals only after developing severe infection, neurovascular compromise, compartment syndrome, or gangrene, thereby reducing opportunities for limb salvage. Incorporating clear referral guidelines into the intervention package may facilitate earlier recognition of complications and strengthen collaboration between Traditional Bone Setters and orthopaedic specialists. Such collaboration aligns with WHO recommendations promoting integration of traditional medicine into national healthcare systems through education, regulation, and referral networks^{1,4,15,17–24,26–34,39,41,43}.

Although the Record Keeping and Follow-up module recorded the lowest Item-level Content Validity Index (0.80), the value remained above the recommended minimum threshold of 0.78. Experts suggested simplifying some documentation procedures to make them more practical for Traditional Bone Setters with limited formal education. Following these recommendations, examples of simple patient registers, treatment records, and referral forms were incorporated into the final package. Documentation is increasingly recognized as an essential component of healthcare quality improvement because it facilitates continuity of care, monitoring of patient outcomes, evaluation of complications, and communication between healthcare providers^{6,11,39}.

An important strength of the intervention package lies in its emphasis on adult learning principles. Most Traditional Bone Setters acquire knowledge through apprenticeship and experiential learning rather than classroom education. Consequently, the package was designed using practical demonstrations, group discussions, illustrations, role play, and hands-on practice to enhance understanding and retention. This learner-centred approach is consistent with Knowles' Adult Learning Theory, which emphasizes that adults learn most effectively when educational activities are practical, relevant, problem-oriented, and based on previous experience^{10,28,30}.

Bandura's Social Cognitive Theory also informed the design of the intervention by emphasizing observational learning, modelling, self-efficacy, and behavioural reinforcement. Through demonstrations and supervised practice sessions, participants are expected to develop greater confidence in applying evidence-based fracture management techniques while gradually replacing unsafe traditional practices. Behavioural theories have previously been shown to improve learning outcomes in continuing professional education programmes and community health interventions^{7,10}.

The findings of this study are comparable with previous validation studies conducted in medical education.¹⁴ In validating a training manual for Community Health Extension Workers in Nigeria, reported similarly high content validity indices, supporting the importance of multidisciplinary expert review during educational material development. Comparable validation studies conducted among nursing educators, public health practitioners, and emergency care providers have likewise reported Scale-level Content Validity Index values exceeding 0.90, indicating excellent agreement among experts regarding educational content¹⁴.

Beyond improving educational quality, the intervention package has important implications for public health policy. Traditional Bone Setters continue to provide a substantial proportion of fracture care in

many low- and middle-income countries because of shortages of orthopaedic specialists, financial constraints, and cultural preferences. Rather than discouraging Traditional Bone Setting, strengthening practitioners' competencies through structured education may reduce preventable complications while promoting safer patient care. This collaborative approach is increasingly supported by governments, professional associations, and international organizations seeking to improve access to essential trauma care^{2,3,5,8,9,12,16,25,31,35,38,40,42}.

4.4 Strengths of the Study

This study possesses several strengths. First, the intervention package was developed using multiple sources of evidence, including literature review, field-based needs assessment, WHO guidelines, and expert consultation. Second, the multidisciplinary composition of the expert validation panel ensured balanced evaluation from orthopaedic, public health, nursing, and traditional practice perspectives. Third, standardized content validation procedures using the Content Validity Index enhanced the methodological rigor and credibility of the findings. Finally, the package was specifically designed for the sociocultural context of Traditional Bone Setters in Nigeria, thereby improving its practical applicability^{5,6,11,13,14,36,37,41–43}.

4.5 Implications for Medical Education

The validated intervention package provides an important educational resource for competency-based training of Traditional Bone Setters. It may also serve as a model for developing continuing education programmes for other informal healthcare providers working in resource-limited settings^{2,9,14,28,30,35,38,40,42}. Incorporation of such educational interventions into community health programmes could strengthen collaboration between traditional practitioners and orthodox healthcare professionals, improve referral systems, and enhance the overall quality of musculoskeletal care^{5,9,13,14,30,35,39–43}.

4.6 Limitations of the Study

Despite its strengths, certain limitations should be acknowledged. Content validation primarily evaluates the relevance and clarity of educational materials but does not determine their effectiveness in changing knowledge, attitudes, or clinical practice. In addition, the expert panel consisted of ten validators, which, although consistent with methodological recommendations, may not fully represent all professional perspectives. Furthermore, the study was conducted within Ondo State, and the educational needs of Traditional Bone Setters may differ in other regions of Nigeria or other countries^{6,11}.

Future studies should evaluate the effectiveness of the validated intervention package using randomized or quasi-experimental designs to determine its impact on knowledge acquisition, behavioural change, clinical practice, patient outcomes, and reduction of fracture-related complications over time^{14,23}.

5. Conclusion

The intervention training package for Traditional Bone Setters was systematically developed using evidence from literature, local needs assessment, international guidelines, and multidisciplinary expert review. The package demonstrated excellent content validity, with an overall Scale-level Content Validity Index of 0.92, indicating that the instructional materials are relevant, clear, comprehensive, and appropriate for their intended purpose^{5,6,11,13,14,36,37,41–43}.

The validated package provides a standardized educational tool capable of improving Traditional Bone Setters' knowledge and competencies in fracture management, infection prevention, and recognition of complications, referral practices, communication, and documentation. Its implementation has the potential to reduce preventable complications associated with traditional fracture care and strengthen collaboration between Traditional Bone Setters and the formal healthcare system^{1,4,5,13,15,17–24,26–34,36,37,39,41,43}.

The intervention package may therefore be adopted by ministries of health, professional associations, non-governmental organizations, and educational institutions involved in community-based trauma care programmes. Further intervention studies are recommended to evaluate its effectiveness in improving clinical practice and patient outcomes^{5,9,13,35,38,40,42}.

Declarations

Ethics approval and consent to participate:

Approved by Ondo State Health Research Ethics Committee (OSHREC), Ref No: OSHREC/08/05/2025/987 and Afe Babalola University Teaching Hospital Research Ethics Committee, Ref No: AMSH/REC/26/62/033. Written informed consent was obtained from all participants.

Consent for publication:

Not applicable

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The authors declare that they have no competing interests

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Author Contribution

FNO- conceptualisation, methodology, Data collection, writing - Original draft.

AOO- conceptualisation, Data analysis, writing -review and editing

OAA- Data collection, Validation, Writing - Review and Editing.

AOE- Data collection, Intervention Review and Manuscript Editing

MIA- Supervision, Resources, Writing - Review and Editing.

All authors read and approved the final manuscript

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Availability of data and materials:

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

References

1. Akinyoola AL, Adegbehingbe OO, Odunsi A, et al. Complications of traditional bone setter treatment in Nigeria. *Afr J Med Med Sci*. 2019;48(3):201–7.
2. Chibber SS, Sharma R, Singh P. Impact of educational intervention on traditional bone-setting practices in India. *J Orthop*. 2019;16(4):289–93.
3. Babalola OM, Okoro FN, Adeyemi AO. Traditional bone-setting practices and musculoskeletal care in Nigeria: Current perspectives. *Niger J Orthop Trauma*. 2022;21(1):15–24.
4. Dada OA, Yinusa W, Giwa SO. Morbidity and mortality associated with traditional bone setting. *West Afr J Med*. 2016;35(2):112–6.
5. World Health Organization. Guidelines for essential trauma care. Geneva: WHO; 2004.
6. Polit DF, Beck CT. The content validity index: Are you sure you know what's being reported? *Res Nurs Health*. 2006;29(5):489–97.
7. Bandura A. Social foundations of thought and action: A social cognitive theory. Englewood Cliffs: Prentice-Hall; 1986.
8. Onuminya JE. Pattern of traditional bone setter practice in Nigeria. *Niger Med J*. 2018;59(2):45–9.
9. Osei D, Osei-Bonsu E, Mensah K. Effectiveness of training traditional bone setters in Ghana. *Ghana Med J*. 2017;51(1):12–8.

10. Knowles MS, Holton EF, Swanson RA. The adult learner: The definitive classic in adult education and human resource development. 8th ed. New York: Routledge; 2015.
11. Lynn MR. Determination and quantification of content validity. *Nurs Res*. 1986;35(6):382–5.
12. Yakubu A, Mohammed A, Ibrahim M. Knowledge and practice of traditional bone setters in Northern Nigeria. *Ann Afr Med*. 2017;16(3):145–51.
13. World Health Organization. WHO traditional medicine strategy: 2014–2023. Geneva: WHO; 2013.
14. Okeke TA, Ezeoke UE, Okafor HC. Validation of a training manual for Community Health Extension Workers in Nigeria. *Afr J Prim Health Care Fam Med*. 2020;12(1):1–8.
15. Ajibade A, Akinniyi OT, Okoye CS. Indications and complications of major limb amputations in Kano, Nigeria. *Ghana Med J*. 2013;47(4):185–8.
16. Callistus KB, Alhassan A, Issahaku M, Aderibigbe SA, Agaja SR, Bamidele JO. (2013). Determinants of utilization of traditional bone setters in Ilorin, north central Nigeria. *J Prev Med Hyg*. 54(1):35– 40.
17. Chowdhury MA, Khandker HH, Ahsan K, Mostafa D. Complications of fracture treatment by traditional bone setters at Dinajpur. *Dinajpur Med Col J*. 2011;4:15.
18. Dada A, Giwa SO, Yinusa W, Ugbeye M, Gbadegesin S. Complications of treatment of musculoskeletal injuries by bone setters. *West Afr J Med*. 2009;28(1):43–7.
19. Dastigir N, Butt KK, Nabeel N. Musculoskeletal injuries by bonesetters. *Prof Med J*. 2012;19(4):446–8.
20. Doumi EBA, Osman AM, Hassan EM. Amputations of the upper limb at El Obeid Hospital, Western Sudan: role of traditional bonesetters. *Sudan Med J*. 2009;45(2):65–9.
21. ELHag MIA, ELHag O. (2010). Complications in fractures treated by traditional bone setters in Khartoum, Sudan. *Khartoum Med J*. 3.
22. Huang CH. Treatment of neglected femoral neck fractures in young adults. *Clin Orthop Relat Res*. 1986;206:117–26.
23. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, John PA. (2009). The PRISMA statement for reporting systematic reviews and meta analyses of studies that evaluate healthcare interventions: explanation and elaboration.
24. Nwankwo OE, Katchy AU. Limb gangrene following treatment of limb injury by traditional bone setter (Tbs): a report of 15 consecutive cases. *Niger Postgrad Med J*. 2005;12(1):57–60.
25. Odatuwa- Omagbemi DO, Enemudo RE, Enamine SE, Esezobor EE. (. 2 014). Traditional bone setting in the Niger Delta region of Nigeria. *Niger Journal*.
26. Ogunlusi JD, Oluwadiya KS, Ogunlusi OO, Oginni LM, Oyedeji OA, Ibligaami O. (2008). Acquired boneless forearm as a complication of traditional bone setting *Orthopedics*. 31 (3):288.
27. OlaOlorun DA, Oladiran IO, Adeniran A. Complications of fracture treatment by traditional bonesetters in southwest Nigeria. *Fam Pract*; 2001.
28. Omololu AB, Ogunlade SO, Gopaladasani VK, Omololu AB, Ogunlade SO, Gopaladasani VK. The practice of traditional bone setting: training algorithm. *Clin Orthop Relat Res*. 2008;466(10):2392–8.

29. Onuminya JE, Onabowale BO, Obekpa PO, Ihezue CH. Traditional bone setter's gangrene. *Int Orthop*. 1999;23(2):111–2.
30. Onuminya JE. Performance of a trained traditional bonesetter in primary fracture care. *S Afr Med J*. 2006;96(4):320–2.
31. Oyebola DD. Yoruba traditional bonesetters: The practice of orthopaedics in a primitive setting in Nigeria. *J Trauma* 2. 1980;0(4):312–22.
32. Panigrahi TK, Mishra DN, Padhy N. Fracture management by traditional bonesetters: a hospital based observational study. *J Med Sci Clin Res*. 2017;5(10):29177–82.
33. Warman PL, Ismiarto YD, Ruhimat U. Complications of fracture treatment by traditional bonesetters in West Java, Indonesia. *Athea Med J*. 2018;5(1):47–52.
34. Zulfiqar Z, Bubak SZ, Jahangir A, Ali Z. Frequency of complications among trauma patients treated by traditional bonesetters. *JSZMC*. 2018;9(3):1456–8.
35. Aderibigbe SA, et al. Fracture treatment by traditional bone setters in Ghana. *Afr Health Sci*. 2013;13(2):284–90.
36. American Academy of Orthopaedic Surgeons. *Management of Musculoskeletal Injuries*. Rosemont, IL: AAOS; 2021.
37. Browner BD, Jupiter JB, Krettek C, Anderson PA. *Skeletal Trauma: Basic Science, Management and Reconstruction*. 6th ed. Philadelphia: Elsevier; 2019.
38. Femi-Oyewo MN. Traditional medicine practice in Nigeria: Current perspectives. *Afr J Med Health Sci*. 2020;19(2):55–64.
39. World Health Organization. *Global Patient Safety Action Plan 2021–2030*. Geneva: WHO; 2021.
40. World Health Organization. *Global Traditional Medicine Centre Strategic Framework 2025–2029*. Geneva: WHO; 2025.
41. World Health Organization. *Infection Prevention and Control Global Report*. Geneva: WHO; 2022.
42. World Health Organization. *Traditional, Complementary and Integrative Medicine Fact Sheet*. Geneva: WHO; 2023.
43. World Health Organization. *WHO Guidelines for Essential Trauma Care*. Geneva: WHO; 2004.

Figures



Figure 1

Development and Validation Process of the Intervention Package

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