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Neglected tropical diseases and traditional healing: a comparative analysis of divergent pathways in Nigeria and Brazil

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ABSTRACT

This study examines the comparative dynamics of neglected tropical diseases (NTDs) and traditional healing practices in Nigeria and Brazil, two countries with high NTD burdens and deeply embedded traditional medical systems. Despite their divergent geographical and cultural contexts, both nations grapple with fundamental questions about how to integrate traditional healing into formal NTD control strategies, respect indigenous knowledge while ensuring patient

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safety, and build collaborative relationships between biomedical and traditional health practitioners. The research employs a comparative case study methodology, drawing on ethnographic research, policy documents, epidemiological studies, and scholarly analyses spanning 2020-2026. Nigeria's engagement with traditional healing and NTDs is exemplified by research on noma (cancrum oris), a devastating orofacial gangrene affecting primarily children with a 90% mortality rate if untreated . A qualitative study in Sokoto state, northwest Nigeria, involving 12 caretakers of noma patients and 15 traditional healers (mai maganin gargajiya in Hausa), revealed that traditional healers view the stages of noma as distinct conditions requiring individualized remedies and are willing to refer patients to biomedical facilities . Caretakers expressed deep trust in traditional healers, who occupy an established position within the health system. The study concluded that traditional healers could play a crucial role in early detection and health-seeking decision-making, recommending their inclusion through training and referral partnerships . Recent policy developments include collaboration between the Nigerian Natural Medicines Development Agency (NNMDA) and the Nigerian Institute for Onchocerciasis, Trypanosomiasis and Research (NITR) to develop indigenous medicines for river blindness and sleeping sickness, recognizing that "drugs are not available for onchocerciasis" as it is "not a disease of interest to so many people in Europe and the West" .

Brazil presents a different picture characterized by extensive ethnographic research on traditional healing practices in the Amazon and growing recognition of indigenous knowledge within NTD control frameworks. Research in five riverine communities in Aritapera, Santarém-PA, documented snakebite envenomation—a neglected tropical disease with high incidence in the Brazilian Amazon—finding that 28.7% of participants had been bitten, with treatments varying between hospitalization (42.8%), home treatments (23.8%), both together (25.4%), and healers (7.9%) . Traditional remedies include "Pau X" and the fat of the endangered Amazon River dolphin, the latter considered highly effective but raising conservation concerns . A 2023 study on explanatory models of snakebite envenoming among indigenous Tikuna, Kokama, and Kambeba caregivers in the Alto Solimões River revealed sophisticated frameworks distinguishing between natural and supernatural causation, with treatment sequences involving immediate self-care, village-based interventions (tobacco smoking, chants, prayers, animal bile, emetic plants), hospital antivenom treatment, and post-discharge rituals for social reintegration . Caregivers expressed

support for antivenom treatment in indigenous areas, suggesting potential for articulation between health sectors .

Nigeria's strength lies in its recognition of traditional healers as established actors within the health system, recent institutional collaboration for indigenous medicine development, and qualitative evidence of healer willingness to refer NTD patients. Brazil's advantage is its deep ethnographic documentation of indigenous explanatory models, sophisticated understanding of treatment sequences, and emerging frameworks for inter-sectoral articulation. Both countries demonstrate that effective NTD control requires: (1) recognition of traditional healers as legitimate actors rather than obstacles; (2) understanding of local explanatory models, including supernatural causation frameworks; (3) trust-based relationships between biomedical and traditional practitioners; (4) culturally appropriate referral pathways that respect healer authority; (5) training partnerships that build mutual understanding; (6) research into pharmacologically active traditional remedies; (7) attention to conservation concerns when traditional remedies involve endangered species; and (8) institutional collaboration for indigenous medicine development .

KEYWORDS: Neglected tropical diseases, traditional healing, Nigeria, Brazil, noma, snakebite envenomation, indigenous knowledge, health systems integration, explanatory models, medical pluralism

RÉSUMÉ

Cette étude examine les dynamiques comparatives des maladies tropicales négligées (MTN) et des pratiques de guérison traditionnelles au Nigeria et au Brésil, deux pays fortement touchés par les MTN et dotés de systèmes de médecine traditionnelle profondément ancrés. Malgré leurs contextes géographiques et culturels divergents, les deux nations sont confrontées à des questions fondamentales sur la manière d'intégrer la guérison traditionnelle dans les stratégies de contrôle des MTN, de respecter les connaissances autochtones tout en garantissant la sécurité des patients, et d'établir des relations de collaboration entre les praticiens de santé biomédicaux et traditionnels. La recherche emploie une méthodologie d'étude de cas comparative, s'appuyant sur des recherches ethnographiques, des documents politiques, des études épidémiologiques et des analyses savantes couvrant la période 2020-2026. L'engagement du Nigeria envers la guérison traditionnelle et les

MTN est illustré par la recherche sur le noma (cancrum oris), une gangrène orofaciale dévastatrice touchant principalement les enfants avec un taux de mortalité de 90 % en l'absence de traitement . Une étude qualitative dans l'État de Sokoto, au nord-ouest du Nigeria, impliquant 12 soignants de patients atteints de noma et 15 guérisseurs traditionnels (mai maganin gargajiya en haoussa), a révélé que les guérisseurs traditionnels considèrent les stades du noma comme des conditions distinctes nécessitant des remèdes individualisés et sont disposés à référer les patients vers des établissements biomédicaux . Les soignants ont exprimé une profonde confiance dans les guérisseurs traditionnels, qui occupent une place établie dans le système de santé. L'étude a conclu que les guérisseurs traditionnels pourraient jouer un rôle crucial dans la détection précoce et la prise de décision en matière de recours aux soins, recommandant leur inclusion par le biais de formations et de partenariats de référence . Les développements politiques récents incluent une collaboration entre l'Agence nigériane de développement des médicaments naturels (NNMDA) et l'Institut nigérian de recherche sur l'onchocercose, la trypanosomiase et la recherche (NITR) pour développer des médicaments indigènes contre la cécité des rivières et la maladie du sommeil, reconnaissant que « les médicaments ne sont pas disponibles pour l'onchocercose » car ce n'est « pas une maladie qui intéresse beaucoup de personnes en Europe et en Occident » .

Le Brésil présente un tableau différent caractérisé par des recherches ethnographiques approfondies sur les pratiques de guérison traditionnelles en Amazonie et une reconnaissance croissante des connaissances autochtones dans les cadres de contrôle des MTN. Une recherche menée dans cinq communautés riveraines d'Aritapera, Santarém-PA, a documenté les envenimations par morsure de serpent—une maladie tropicale négligée à forte incidence en Amazonie brésilienne—révélant que 28,7 % des participants avaient déjà été mordus, avec des traitements variant entre l'hospitalisation (42,8 %), les traitements à domicile (23,8 %), les deux combinés (25,4 %) et les guérisseurs (7,9 %) . Les remèdes traditionnels comprennent le « Pau X » et la graisse du dauphin rose de l'Amazonie, une espèce menacée, cette dernière étant considérée comme très efficace mais soulevant des préoccupations de conservation . Une étude de 2023 sur les modèles explicatifs de l'envenimation par morsure de serpent chez les soignants autochtones Tikuna, Kokama et Kambeba dans la région du Haut Solimões a révélé des cadres sophistiqués distinguant les causes naturelles et surnaturelles, avec des séquences de traitement impliquant l'autosoins immédiats, des interventions villageoises (fumée de tabac, chants, prières, bile animale, plantes émétiques), un traitement hospitalier par antivenin et des rituels post-sortie pour la

réintégration sociale . Les soignants ont exprimé leur soutien au traitement par antivenin dans les zones indigènes, suggérant un potentiel d'articulation entre les secteurs de la santé .

La force du Nigeria réside dans la reconnaissance des guérisseurs traditionnels comme acteurs établis du système de santé, la récente collaboration institutionnelle pour le développement de médicaments indigènes et les preuves qualitatives de la volonté des guérisseurs de référer les patients atteints de MTN. L'avantage du Brésil est sa documentation ethnographique approfondie des modèles explicatifs autochtones, sa compréhension sophistiquée des séquences de traitement et l'émergence de cadres d'articulation intersectorielle. Les deux pays démontrent qu'un contrôle efficace des MTN nécessite : (1) la reconnaissance des guérisseurs traditionnels comme acteurs légitimes plutôt que comme obstacles ; (2) la compréhension des modèles explicatifs locaux, y compris les cadres de causalité surnaturelle ; (3) des relations de confiance entre les praticiens biomédicaux et traditionnels ; (4) des voies de référence culturellement appropriées respectant l'autorité des guérisseurs ; (5) des partenariats de formation établissant une compréhension mutuelle ; (6) la recherche sur les remèdes traditionnels pharmacologiquement actifs ; (7) une attention aux préoccupations de conservation lorsque les remèdes traditionnels impliquent des espèces menacées ; et (8) une collaboration institutionnelle pour le développement de médicaments indigènes .

MOTS-CLÉS : Maladies tropicales négligées, guérison traditionnelle, Nigeria, Brésil, noma, envenimation par morsure de serpent, connaissances autochtones, intégration des systèmes de santé, modèles explicatifs, pluralisme medical.

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1. INTRODUCTION

Neglected tropical diseases (NTDs) are a diverse group of conditions that primarily affect the world's poorest populations, thriving in settings with inadequate water and sanitation, limited healthcare access, and entrenched poverty. They are "neglected" not only by global health funding and research agendas but often by the very health systems that should address them. Paradoxically, the communities most affected by NTDs possess rich traditions of healing—knowledge systems developed over generations that address the same diseases through locally available resources and culturally meaningful practices.

Nigeria and Brazil, two countries with high NTD burdens and deeply embedded traditional medical systems, offer a compelling comparative lens. Nigeria bears a disproportionate share of Africa's NTD burden, including onchocerciasis (river blindness), trypanosomiasis (sleeping sickness), and noma, a devastating orofacial gangrene affecting primarily children . Traditional healers, known as *mai maganin gargajiya* in Hausa, are established actors within the health system, providing care that communities trust .

Brazil's Amazon region experiences high incidence of snakebite envenomation, a neglected tropical disease that disproportionately affects rural and indigenous populations . Indigenous and riverine communities have developed sophisticated explanatory models and treatment protocols, integrating plant-based remedies, animal-derived treatments, and spiritual practices . Research documents how these communities navigate between traditional healing and biomedical interventions, seeking to combine the best of both worlds .

This study examines the comparative dynamics of neglected tropical diseases and traditional healing in Nigeria and Brazil. Drawing on ethnographic research, policy documents, epidemiological studies, and scholarly analyses, it explores how each country's approach to integrating traditional healing into NTD control reflects distinct cultural contexts, health system structures, and research traditions. The analysis is organized around four interconnected themes: (1) NTD burdens and traditional healing landscapes; (2) traditional explanatory models and treatment practices; (3) integration with biomedical systems; and (4) lessons for policy and practice.

The study contributes to scholarship on medical pluralism, health systems strengthening, and NTD control. It argues that effective NTD strategies must recognize traditional healers as legitimate

partners, understand local explanatory models, and build trust-based relationships across medical systems.

2. LITERATURE REVIEW

2.1 Conceptualizing Neglected Tropical Diseases and Medical Pluralism

Neglected tropical diseases (NTDs) are a group of 20 conditions prioritized by the World Health Organization, affecting over 1 billion people globally. They share common features: association with poverty, limited research and development investment, and inadequate control in affected countries. The WHO's NTD roadmap (2021-2030) aims to reduce the number of people requiring interventions by 90% through integrated, cross-sectoral approaches .

Medical pluralism refers to the coexistence of multiple healing traditions within a society. In many low- and middle-income countries, biomedical, traditional, and faith-based systems operate in parallel, with patients navigating between them based on accessibility, affordability, and perceived efficacy. Understanding how these systems interact is essential for designing effective NTD control strategies that respect local realities.

2.2 Nigeria's NTD Burden and Traditional Healing

Nigeria has one of the highest NTD burdens in Africa. Key features include:

- **Noma (cancrum oris):** A devastating orofacial gangrene affecting primarily children, with 90% mortality if untreated. Early-stage antibiotic treatment can halt progression, but late presentation is common .
- **Onchocerciasis (river blindness):** Endemic in many Nigerian states, caused by filarial worms transmitted by black flies. Control relies on mass drug administration with ivermectin .
- **Trypanosomiasis (sleeping sickness):** Transmitted by tsetse flies, with advanced neurological symptoms including drowsiness .
- **Traditional healers (*mai maganin gargajiya*):** Established actors within the health system, providing care for a range of conditions and trusted by communities .

- **Research on noma:** A 2019 qualitative study in Sokoto state conducted 12 in-depth interviews with caretakers of noma patients and 15 traditional healers in their home villages. Key findings included:

  - Traditional healers viewed the stages of noma as distinct conditions with individualised remedies
  - Healers were willing to refer noma patients to biomedical facilities
  - Caretakers expressed deep trust in traditional healers
- **Policy development:** The Nigerian Natural Medicines Development Agency (NNMDA) and the Nigerian Institute for Onchocerciasis, Trypanosomiasis and Research (NITR) are collaborating to develop indigenous medicines for river blindness and sleeping sickness. As NNMDA Director-General Prof. Martins Emeje noted, "drugs are not available for onchocerciasis" because it is "not a disease of interest to so many people in Europe and the West" .

2.3 Brazil's NTD Burden and Traditional Healing

Brazil's Amazon region bears a disproportionate burden of certain NTDs, particularly snakebite envenomation. Key features include:

- **Snakebite envenomation:** Considered a neglected tropical disease by WHO, with Brazil reporting over 29,000 accidents in 2022. The northern region has incidence 4.1 times the national average, with Pará state reporting the most cases .
- **Amazon riverine communities:** Populations in floodplain (*várzea*) areas face high encounter rates with venomous snakes, particularly *Bothrops atrox* (locally "surucucu") .
- **Research in Aritapera:** A 2024 study in five riverine communities documented:

  - 28.7% of participants had already been bitten by snakes
  - 15.8% of interviews mentioned deaths from snakebites
  - Treatment distribution: 42.8% hospitalization only, 23.8% home treatments only, 25.4% both, 7.9% healers
  - Traditional remedies included "Pau X" and Amazon River dolphin fat, the latter considered highly effective but raising conservation concerns
- **Indigenous explanatory models:** A 2023 study among Tikuna, Kokama, and Kambeba caregivers revealed sophisticated frameworks:

- Snakes viewed as enemies with conscience and intention
- Snakebites attributed to natural or supernatural causes, the latter more difficult to prevent and treat
- Ayahuasca tea used to identify underlying causes
- Treatment sequences involving: immediate self-care; village-based interventions (tobacco smoking, chants, prayers, animal bile, emetic plants); hospital antivenom; post-discharge rituals for social reintegration
- Dietary taboos and behavioral interdictions (avoiding contact with menstruating and pregnant women) prevent complications
- Caregivers support antivenom treatment in indigenous areas

- **Conservation concerns:** Amazon River dolphin fat, considered an effective treatment, raises concerns as the species is endangered, highlighting tensions between traditional medicine and biodiversity conservation .

3. RESEARCH QUESTIONS

This study addresses the following research questions:

1: How do the NTD burdens and traditional healing landscapes differ between Nigeria and Brazil, and how have these shaped research and policy responses?

2: What traditional explanatory models and treatment practices exist in each country, and how do they address specific NTDs?

3: How do traditional healers and biomedical systems interact in each context, and what factors enable or constrain effective collaboration?

4. METHODOLOGY

This study employs a comparative case study methodology to examine neglected tropical diseases and traditional healing in Nigeria and Brazil. The research design integrates document analysis of

primary sources with synthesis of secondary literature to develop a comprehensive understanding of medical pluralism dynamics in both countries.

Primary sources analyzed include: qualitative research on noma and traditional healing in Nigeria; peer-reviewed research on snakebite envenomation and traditional healing in the Brazilian Amazon; policy documentation on indigenous medicine development in Nigeria; and explanatory model research among indigenous groups in Brazil.

The comparative framework examines four dimensions of NTDs and traditional healing: (1) NTD burdens and traditional healing landscapes; (2) explanatory models and treatment practices; (3) integration with biomedical systems; and (4) policy responses and challenges.

The analysis covers the period from approximately 2019 to 2026, capturing recent research developments and policy initiatives.

5. RESULTS

5.1 NTD Burdens and Traditional Healing Landscapes

Nigeria: Nigeria's NTD burden is characterized by diverse conditions affecting predominantly rural populations. Key features include:

- **Noma:** A devastating orofacial gangrene with 90% mortality if untreated, primarily affecting children in conditions of extreme poverty and malnutrition.
- **Onchocerciasis (river blindness):** Endemic across many states, transmitted by black flies breeding in fast-flowing rivers.
- **Trypanosomiasis (sleeping sickness):** Focal distribution, transmitted by tsetse flies, with advanced neurological manifestations.
- **Traditional healers (*mai maganin gargajiya*):** Established actors within the health system, providing care that communities trust. Healers offer specialized forms of care for specific conditions and provide referral guidance.

- **Caretaker trust:** Research indicates that caretakers deeply trust traditional healers, who are often the first point of contact for illness.
- **Policy recognition:** The Nigerian Natural Medicines Development Agency (NNMDA) operates with a mandate to research and develop natural medicines, recognizing traditional knowledge as a resource for pharmaceutical development.

Brazil: Brazil's NTD burden in the Amazon region is dominated by snakebite envenomation. Key features include:

- **Snakebite epidemiology:** Over 29,000 accidents reported nationally in 2022, with northern region incidence 4.1 times national average. Pará state reports most cases (19.28%).
- **Venomous snakes:** *Bothrops atrox* (locally "surucucu") responsible for most cases in northern Brazil. The region also has species of *Crotalus*, *Lachesis*, and *Micrurus*.
- **Riverine communities:** Populations in floodplain (*várzea*) areas face high encounter rates with snakes, with 28.7% of research participants reporting previous bites.
- **Indigenous groups:** Tikuna, Kokama, and Kambeba peoples maintain sophisticated traditional medical systems integrating natural and supernatural causation frameworks.
- **Conservation context:** Use of endangered species (Amazon River dolphin) in traditional remedies creates tensions between cultural practice and biodiversity protection.

Table 1: Comparative NTD Burdens and Traditional Healing Landscapes

Dimension	**Nigeria**	**Brazil**
Primary NTDs addressed	Noma; onchocerciasis; trypanosomiasis	Snakebite envenomation
Affected populations	Children; rural agricultural communities	Riverine communities; indigenous groups
Traditional healers	*Mai maganin gargajiya* (Hausa)	Indigenous caregivers; community healers
Healer status	Established health system actors	Embedded in community and indigenous structures

Research documentation	Qualitative studies (2019)	Extensive ethnographic research (2023-2024)
Conservation context	Not applicable	Endangered species use (Amazon River dolphin)

5.2 Explanatory Models and Treatment Practices

Nigeria: Research on noma in northwest Nigeria reveals distinct explanatory frameworks. Key features include:

- **Disease perception:** Traditional healers view the stages of noma as different conditions, each requiring individualized remedies.
- **Etiological understanding:** While the study does not detail supernatural causation, healers' specialized knowledge suggests complex diagnostic frameworks.
- **Treatment approach:** Healers provide specialized forms of care for specific conditions, indicating systematic knowledge organization.
- **Referral practices:** Healers demonstrate willingness to refer noma patients to biomedical facilities, recognizing limitations of traditional treatment for advanced disease.
- **Caretaker trust:** The deep trust caretakers place in traditional healers influences health-seeking behavior and treatment adherence.
- **Remedies:** The study does not detail specific herbal or other remedies used for noma, focusing instead on healers' role and referral practices.

Brazil: Research in the Brazilian Amazon reveals sophisticated explanatory models and treatment sequences. Key features include:

- **Snake ontology:** Indigenous caregivers view snakes as enemies with conscience and intention, shaping prevention and response strategies.
- **Causation frameworks:** Snakebites attributed to natural causes (encounter with snake) or supernatural causes (sorcery), with the latter considered more difficult to prevent and treat.
- **Diagnostic practices:** Ayahuasca tea used by some caregivers to identify underlying supernatural causes of snakebites.

- **Treatment sequence:** A four-stage process:

1. Immediate self-care (often not detailed in research)
2. First care in village: tobacco smoking, chants, prayers, intake of animal bile and emetic plants
3. Hospital stay: receiving antivenom and other biomedical treatments
4. Post-discharge care: re-establishment of well-being and social reintegration through tobacco smoking, massages, compresses, and teas of bitter plants

- **Preventive practices:** Dietary taboos and behavioral interdictions (avoiding contact with menstruating and pregnant women) prevent complications, relapses, and death, observed for up to three months post-bite.
- **Natural remedies:** "Pau X" (an unidentified plant) and Amazon River dolphin fat are among the most used treatments. Dolphin fat appears to be a recent discovery and is considered highly effective.
- **Treatment pluralism:** Research documents that 25.4% of snakebite victims used both home treatments and hospitalization, indicating active navigation between medical systems.

Table 2: Comparative Explanatory Models and Treatment Practices

Dimension	**Nigeria (Noma)**	**Brazil (Snakebite)**
Disease perception	Stages viewed as different conditions	Snake as enemy with conscience/intention
Causation	Not detailed in research	Natural vs. supernatural (sorcery)
Diagnostic practices	Specialized knowledge of healers	Ayahuasca for supernatural causation
Treatment sequence	Specialized care; referral	Four-stage process (village → hospital → post-discharge)
Specific remedies	Not detailed	"Pau X"; Amazon River dolphin fat
Preventive practices	Not documented	Dietary taboos; behavioral interdictions

Healer-biomedical interaction	Willingness to refer	25.4% use both systems

5.3 Integration with Biomedical Systems

Nigeria: Nigeria's integration of traditional healing with biomedical NTD control is characterized by emerging recognition and partnership potential. Key features include:

- **Healer willingness:** Traditional healers expressed willingness to refer noma patients to biomedical facilities, recognizing the limitations of traditional treatment for advanced disease .
- **Caretaker trust:** The deep trust caretakers place in traditional healers positions healers as gatekeepers who can influence health-seeking behavior .
- **Intervention opportunities:** Researchers recommend that "intervention programmes should include traditional healers through training and referral partnerships" .
- **Institutional collaboration:** The partnership between NNMDA and NITR to develop indigenous medicines for onchocerciasis and trypanosomiasis represents formal recognition of traditional knowledge's potential .
- **Policy framework:** NNMDA operates with a legal mandate to research and develop natural medicines for humans, animals, and plants, providing institutional infrastructure for integration .
- **Challenges:** While the noma study documents healer willingness to refer, systematic training and referral partnerships have not yet been implemented at scale.

Brazil: Brazil's integration landscape is characterized by sophisticated documentation of indigenous explanatory models and emerging frameworks for articulation. Key features include:

- **Treatment pluralism:** 25.4% of snakebite victims used both home treatments and hospitalization, demonstrating active navigation between systems .
- **Healer support for biomedicine:** Indigenous caregivers expressed support for antivenom treatment in indigenous areas, recognizing its value alongside traditional practices .
- **Articulation potential:** The 2023 study concludes that "there is a potential for articulation between different healthcare sectors to improve the management of SBEs in the Amazon region" .

- **Decentralization vision:** Researchers suggest decentralizing antivenom treatment to indigenous health centers with "active participation of the indigenous caregivers" .
- **Conservation tensions:** The use of endangered Amazon River dolphin fat in traditional treatment raises challenges, as promoting traditional knowledge must be balanced with species protection .
- **Research depth:** Brazil benefits from extensive ethnographic research documenting indigenous perspectives, providing evidence base for policy development .

Table 3: Comparative Integration with Biomedical Systems

Dimension	**Nigeria**	**Brazil**
Healer-biomedical interaction	Willingness to refer documented	25.4% use both systems; caregivers support antivenom
Integration mechanisms	Proposed training and referral partnerships	Proposed articulation; decentralization to indigenous centers
Institutional collaboration	NNMDA-NITR partnership for indigenous medicines	Research-policy linkages; ethnographic documentation
Policy recognition	Legal mandate for natural medicines development	Recognition of indigenous knowledge in research
Barriers	Scale of implementation	Conservation concerns (dolphin fat)
Evidence base	Qualitative study (n=27 participants)	Extensive ethnographic research; multiple studies

5.4 Policy Responses and Challenges

Nigeria: Nigeria's policy responses are evolving. Key features include:

- **NNMDA-NITR collaboration:** Partnership to develop indigenous medicines for onchocerciasis and trypanosomiasis, recognizing that Western drugs are unavailable.

- **Public-Private Partnership model:** NNMDA is working on establishing a PPP model for natural medicine development.
- **Legal framework:** NNMDA has statutory authority to conduct research and development into natural medicines.
- **Challenges:** Moving from research to product development requires significant investment and regulatory approval. Scale of traditional medicine use remains largely informal.

Brazil: Brazil's policy context includes:

- **Recognition of indigenous knowledge:** Research documenting indigenous explanatory models provides evidence for policy development.
- **Conservation concerns:** Use of endangered Amazon River dolphin fat highlights need to balance traditional medicine with biodiversity protection. Researchers call for studies to identify "which properties of this fat act as counterpoisons" to develop substitutes.
- **Decentralization vision:** Proposed decentralization of antivenom treatment to indigenous health centers with caregiver participation.
- **Research-policy linkages:** Studies published in accessible journals (PLoS Neglected Tropical Diseases, Journal of Ethnobiology and Ethnomedicine) facilitate translation to policy.

Table 4: Comparative Policy Responses and Challenges

Dimension	**Nigeria**	**Brazil**	
Recent policy initiatives	NNMDA-NITR collaboration; PPP model	Research documentation; decentralization vision	
Institutional framework	NNMDA legal mandate	Health system with indigenous health centers	
Key challenges	Implementation scale; regulatory approval	Conservation (dolphin fat); funding	

Opportunities	Indigenous medicine development	Articulation between health sectors	

5.5 Summary of Comparative Findings

Table 5: Comprehensive Comparative Analysis

Dimension	**Nigeria**	**Brazil**	
Primary NTDs	Noma; onchocerciasis; trypanosomiasis	Snakebite envenomation	
Traditional healers	*Mai maganin gargajiya* (Hausa)	Indigenous caregivers; community healers	
Explanatory models	Stages as distinct conditions; specialized knowledge	Snake as enemy; natural/supernatural causation; four-stage treatment sequence	
Specific remedies	Not detailed	"Pau X"; Amazon River dolphin fat	
Healer-biomedical interaction	Willingness to refer noma patients	25.4% use both systems; caregivers support antivenom	
Research base	Qualitative study (n=27)	Extensive ethnographic research (2023-2024)	

Institutional collaboration	NNMDA-NITR partnership for indigenous medicines	Research-policy linkages	
Key strengths	Recognition of healers as actors; institutional mandate for natural medicines	Deep ethnographic documentation; sophisticated explanatory models; caregiver support for antivenom	
Key challenges	Implementation scale; moving from research to product	Conservation concerns (dolphin fat); funding	
Policy recommendations	Training and referral partnerships	Decentralization to indigenous centers with caregiver participation	

6. DISCUSSION OF RESULTS

6.1 Explaining Divergent Pathways: Research Traditions and Health System Structures

The differences between Nigeria's and Brazil's approaches to traditional healing and NTDs reflect distinct research traditions and health system structures.

Nigeria's research on noma and traditional healing, while limited in scale, provides critical insights into the role of traditional healers as gatekeepers and their willingness to collaborate . The recent NNMDA-NITR partnership represents a significant policy development, recognizing that NTDs neglected by Western pharmaceutical research may find solutions in indigenous knowledge . This institutional approach to natural medicine development positions Nigeria to potentially develop locally produced treatments for diseases that have been deprioritized globally.

Brazil's approach benefits from extensive ethnographic research traditions, producing detailed documentation of indigenous explanatory models, treatment sequences, and health-seeking behaviors . The 2023 study on indigenous caregivers' explanatory models provides a sophisticated framework for understanding how Tikuna, Kokama, and Kambeba peoples conceptualize snakebite envenomation and navigate between traditional and biomedical care . This depth of understanding enables culturally appropriate interventions that respect indigenous knowledge while promoting effective treatment.

6.2 The Importance of Explanatory Models

Brazil's research demonstrates the critical importance of understanding local explanatory models for designing effective NTD interventions. The distinction between natural and supernatural causation shapes prevention strategies, treatment seeking, and post-treatment care . Severe or lethal snakebites understood as triggered by sorcery require different responses than those attributed to ordinary encounters. Ayahuasca-based diagnosis of underlying supernatural causes is a practice that biomedical providers would not typically encounter but that shapes patient and caregiver behavior.

The four-stage treatment sequence—immediate self-care, village-based interventions, hospital antivenom, post-discharge rituals—reveals that indigenous communities do not simply choose between traditional and biomedical care but actively integrate them . The 25.4% of victims using both home treatments and hospitalization demonstrates sophisticated health-seeking behavior that respects multiple healing systems.

Nigeria's research, while less detailed on explanatory models, reveals that traditional healers view noma's stages as distinct conditions requiring individualized remedies . This suggests a complex diagnostic framework that could inform early detection efforts. Understanding these frameworks is essential for designing training and referral partnerships that resonate with healers' existing knowledge.

6.3 Building Trust-Based Collaboration

Both countries' experiences underscore the importance of trust in health-seeking behavior. In Nigeria, caretakers' deep trust in traditional healers positions healers as influential gatekeepers who can facilitate or hinder biomedical care . The finding that healers are willing to refer noma patients suggests that trust can be leveraged for improved outcomes.

In Brazil, indigenous caregivers' support for antivenom treatment indicates that biomedical interventions are valued when they align with community needs . The proposed decentralization of antivenom to indigenous health centers with caregiver participation recognizes that trust is built through presence and partnership, not simply through service availability.

The implication is that NTD control programs must invest in relationship-building with traditional healers and indigenous caregivers, not simply train them in biomedical protocols. Trust-based collaboration requires respect for healers' knowledge, understanding of their explanatory frameworks, and willingness to engage as partners rather than subordinates.

6.4 The Promise and Peril of Traditional Remedies

Both countries' experiences highlight the potential of traditional remedies while also revealing challenges. Brazil's documentation of Amazon River dolphin fat as a highly effective treatment for snakebite envenomation illustrates the pharmacological potential of traditional knowledge . The fat is considered by communities to be very efficient, and its use appears to be a recent discovery, demonstrating that traditional knowledge continues to evolve.

However, the use of an endangered species creates conservation tensions. The Amazon River dolphin is threatened, and promoting its use for traditional medicine could accelerate population decline. Researchers call for studies to identify "which properties of this fat act as counterpoisons" to develop substitutes that could be "incorporated in other rural and remote communities" as an "economic and ecologically viable option" .

Nigeria's NNMDA-NITR partnership represents a systematic approach to traditional medicine development, recognizing that "drugs are not available for onchocerciasis" because it is "not a disease of interest to so many people in Europe and the West" . This framing positions traditional

medicine development not as a supplement to Western pharmaceutical research but as a necessary alternative where that research has failed.

6.5 Implications for NTD Control Policy

The findings have significant implications for NTD control policy in contexts of medical pluralism.

First, recognize traditional healers as legitimate actors. Nigeria's research demonstrates that healers are trusted and willing to collaborate . Exclusion from NTD programs misses opportunities for early detection and referral.

Second, understand local explanatory models. Brazil's research reveals that effective intervention requires understanding how communities conceptualize disease causation, prevention, and treatment . Supernatural causation frameworks shape behavior in ways that biomedical training alone cannot address.

Third, build trust-based referral pathways. Referral partnerships must be built on mutual respect, not simply technical training. Healers' authority within communities is an asset to be leveraged, not undermined.

Fourth, support research into traditional remedies. The NNMDA-NITR partnership and calls for pharmacological study of dolphin fat both recognize that traditional knowledge may contain effective treatments that Western science has not discovered .

Fifth, address conservation concerns. The dolphin fat example highlights that traditional medicine development must be balanced with biodiversity protection. Research to identify active compounds and develop substitutes can address both health and conservation goals.

Sixth, integrate traditional and biomedical care. Brazil's finding that 25.4% of snakebite victims use both systems demonstrates that patients already navigate medical pluralism . Health systems should support this navigation rather than forcing binary choices.

Seventh, decentralize services to reach remote populations. Proposed decentralization of antivenom to indigenous health centers with caregiver participation recognizes that effective NTD control requires services where people live.

Eighth, invest in partnership infrastructure. Training programs, referral protocols, and ongoing dialogue mechanisms require sustained investment, not one-off interventions.

7. CONCLUSION

This comparative analysis of neglected tropical diseases and traditional healing in Nigeria and Brazil reveals two distinct but complementary pathways shaped by different research traditions, health system structures, and cultural contexts. Nigeria's research on noma and traditional healing in Sokoto state demonstrates that traditional healers are willing to refer patients and could play a crucial role in early detection and health-seeking decision-making . Caretakers' deep trust in healers positions them as influential gatekeepers who could be mobilized through training and referral partnerships . Recent institutional collaboration between NNMDA and NITR to develop indigenous medicines for onchocerciasis and trypanosomiasis represents a significant policy development, recognizing that "drugs are not available" for these neglected diseases because they are "not a disease of interest to so many people in Europe and the West" .

Brazil's extensive ethnographic research in the Amazon reveals sophisticated explanatory models among indigenous and riverine communities. Research in Aritapera documented that 28.7% of participants had been bitten by snakes, with treatments varying between hospitalization, home treatments, and healers . Traditional remedies including "Pau X" and Amazon River dolphin fat are valued by communities, though dolphin fat use raises conservation concerns . A 2023 study among Tikuna, Kokama, and Kambeba caregivers revealed a four-stage treatment sequence, distinction between natural and supernatural causation, and support for antivenom treatment in indigenous areas . Researchers conclude that "there is a potential for articulation between different healthcare sectors" and envision decentralizing antivenom to indigenous health centers with "active participation of the indigenous caregivers" .

Several cross-cutting conclusions emerge from this analysis.

First, traditional healers are not obstacles to biomedical care but potential partners. Nigeria's research demonstrates healer willingness to refer; Brazil's research reveals that 25.4% of snakebite victims already use both systems. Health systems should build on existing pluralism rather than attempting to displace it.

Second, understanding local explanatory models is essential for effective intervention. Brazil's documentation of supernatural causation frameworks, diagnostic use of ayahuasca, and post-treatment taboos reveals that biomedical approaches alone cannot address community concerns.

Third, trust is the currency of health-seeking behavior**.** Caretakers trust traditional healers in Nigeria; indigenous caregivers trust their own knowledge while supporting antivenom. NTD programs must invest in building trust, not simply training.

Fourth, traditional knowledge contains pharmacological potential. The NNMDA-NITR partnership and interest in dolphin fat's properties both recognize that communities may have discovered effective treatments that Western science has not.

Fifth, conservation and health must be balanced. The dolphin fat example highlights tensions that will arise as traditional medicine is studied and promoted. Research to identify active compounds and develop substitutes can address both goals.

Sixth, decentralization and participation are essential for reaching remote populations**.** Antivenom in indigenous health centers with caregiver participation could dramatically improve outcomes for snakebite victims in the Amazon.

Seventh, research-policy linkages matter**.** Brazil's rich ethnographic research provides evidence for policy development; Nigeria's institutional partnership creates pathways for product development.

For Nigeria, the path forward involves implementing the training and referral partnerships recommended by the noma study , supporting NNMDA-NITR collaboration with adequate resources, and building systematic evidence on traditional healing practices for other NTDs.

For Brazil, the priority is translating research into policy by decentralizing antivenom treatment to indigenous health centers with caregiver participation , supporting pharmacological research on

traditional remedies like dolphin fat while addressing conservation concerns, and continuing to document indigenous knowledge through participatory methods.

For the broader global health community, the experiences of Nigeria and Brazil demonstrate that neglected tropical diseases cannot be effectively controlled without engaging the traditional healing systems that communities trust. As the Nigerian NNMDA Director-General noted, the solutions to challenges facing Africa and other developing regions may be found within those regions, requiring "expertise collaborations" that bring together traditional knowledge and modern science. The challenge is building the partnerships, trust, and institutional frameworks that make such collaboration possible.

8. LIMITATIONS OF THE STUDY

This study has several limitations that should be acknowledged. First, the comparative analysis relies primarily on secondary sources and published research rather than primary data collection. Direct fieldwork in both countries, including interviews with traditional healers, biomedical providers, and policymakers, would strengthen comparative insights.

Second, data availability differs significantly between the two countries. Brazil benefits from extensive ethnographic research, including detailed explanatory model studies . Nigeria's evidence base is more limited, with the noma study providing valuable qualitative insights but less comprehensive documentation of traditional healing practices for other NTDs.

Third, the Nigerian study focuses on a single NTD (noma) in a specific region (Sokoto state), and findings may not generalize to other NTDs or regions. The NNMDA-NITR partnership, while significant, is recent and outcomes are not yet documented.

Fourth, the study captures traditional healing practices at a moment of documentation but cannot fully capture the dynamic evolution of these knowledge systems.

Fifth, the voice of traditional healers and indigenous caregivers—their experiences, challenges, and aspirations—is mediated through research rather than captured directly.

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10. AUTHOR CONTRIBUTIONS

The author conceived the study, designed the comparative framework, conducted the literature review and document analysis, synthesized findings across countries, and drafted the complete manuscript. The author takes full responsibility for the accuracy of information presented and interpretations offered.

11. COMPETING INTERESTS

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential competing interest.

12. AUTHORS' CONTRIBUTIONS

As sole author, I performed all roles including conceptualization, methodology development, investigation, formal analysis, writing, review, editing, and project administration.

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14. DATA AVAILABILITY

All sources analyzed in this study are publicly available documents, including peer-reviewed articles, research reports, and news media. Primary sources are cited in the references and accessible through the referenced publications and organizations.

15. DISCLAIMER

The views expressed in this article are solely those of the author and do not necessarily reflect the views of any institution or organization with which the author may be affiliated. The analysis is provided for scholarly purposes and should not be construed as policy guidance or investment advice. Neglected tropical diseases and traditional healing practices are subject to change, and readers should consult current official sources for specific information about Nigeria, Brazil, and NTD control policy.

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