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Strengthening Maternal and Child Health Literacy in Indigenous Communities of the Upper Amazon Region, Brazil

Maria Silva[1]
[1]*Universidade Federal do Amazonas, Brazil*

Paulo Costa[2]
[2]*Universidade Estadual Paulista, Brazil*

Corresponding Author: maria.silva@ufam.edu.br

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ABSTRACT

This community service project addressed critical gaps in maternal and child health literacy among indigenous communities in the Upper Amazon region of Brazil, specifically targeting the Tikuna indigenous population in the Javari Valley. The intervention was implemented across five villages with a combined population of 1,247 individuals over an 18-month period from January 2023 to June 2024. The program integrated culturally appropriate health education with traditional indigenous knowledge systems, training 35 community health workers who subsequently reached 342 mothers and caregivers. Program components included prenatal care education, nutrition guidance, disease prevention strategies, child development monitoring, and emergency recognition protocols. Baseline assessments revealed significant knowledge gaps regarding pregnancy complications, infant nutrition, and preventable childhood diseases. Post-intervention evaluation demonstrated substantial improvements: prenatal care attendance increased by 67%, exclusive breastfeeding rates rose from 43% to 78%, and childhood vaccination completion improved by 54%. The program successfully bridged Western medical knowledge with indigenous healing practices through collaborative dialogue and mutual respect. Cultural adaptation strategies included bilingual

materials, visual learning aids, participatory methodologies, and engagement of traditional healers. This model demonstrates effective approaches for health literacy interventions in indigenous contexts while respecting cultural sovereignty and traditional knowledge systems.

INTRODUCTION

Indigenous communities in the Amazon basin face disproportionate health challenges compared to national populations, with maternal and child health indicators significantly below Brazilian averages despite constitutional guarantees of universal healthcare access. The Upper Amazon region, encompassing remote territories along Brazil's western border, presents unique healthcare delivery challenges including extreme geographical isolation, limited infrastructure, linguistic diversity, and cultural differences between Western medical paradigms and indigenous health belief systems (Garnelo et al., 2023). Indigenous maternal mortality rates in the Brazilian Amazon remain approximately three times higher than national rates, while infant mortality in some indigenous territories exceeds 50 per 1,000 live births compared to the national average of 12.4 per 1,000 (Ministério da Saúde Brasil, 2022). These disparities reflect not merely geographical remoteness but complex intersections of historical marginalization, inadequate culturally appropriate healthcare services, limited health literacy, and systemic barriers to accessing quality care.

Health literacy, defined as the capacity to obtain, process, and understand basic health information needed to make appropriate health decisions, represents a critical determinant of health outcomes particularly in contexts where formal healthcare systems interface with indigenous populations possessing distinct epistemological frameworks (Nutbeam & Lloyd, 2021). Low health literacy correlates strongly with poor health outcomes, reduced utilization of preventive services, increased hospitalization rates, and higher mortality, with effects particularly pronounced for maternal and child health where timely recognition of danger signs and appropriate care-seeking behaviors are crucial (Berkman et al., 2021). However, conventional health literacy interventions designed for Western populations often fail in indigenous contexts when they ignore cultural knowledge systems, impose external frameworks without community participation, or fail to address structural determinants of health including poverty, discrimination, and political marginalization (Anderson et al., 2023).

The Tikuna indigenous people, Brazil's largest indigenous ethnic group with approximately 46,000 members predominantly residing in the Javari Valley of Amazonas State, maintain rich traditional knowledge systems regarding health, healing, and child-rearing that have sustained communities for millennia. Traditional Tikuna health practices integrate spiritual, physical, and social dimensions of wellbeing, with specialized healers (pajés) holding extensive botanical

knowledge and ritual healing competencies (Buchillet, 2022). However, rapid social change, increasing contact with national society, environmental degradation affecting traditional food systems, and emergence of new health challenges including chronic diseases and epidemics have created situations where traditional knowledge alone proves insufficient. Simultaneously, Western biomedical approaches introduced through government health services often clash with indigenous worldviews, creating tensions and mistrust that reduce healthcare utilization even when services are geographically accessible (Ferreira, 2021).

Previous maternal and child health interventions in indigenous Amazonian communities have demonstrated mixed results, with successes typically correlating with culturally adapted approaches that respect indigenous agency and integrate rather than replace traditional practices (Langdon & Garnelo, 2020). Participatory methodologies that position indigenous communities as knowledge holders and decision-makers rather than passive recipients of external expertise have proven more effective and sustainable than top-down public health campaigns (Smith et al., 2022). Community-based health worker programs, when properly designed with adequate training and ongoing support, have successfully bridged cultural and linguistic barriers while building trust between indigenous communities and formal health systems (Svitone et al., 2020). Evidence suggests that health literacy interventions must address not only individual knowledge deficits but also structural barriers including transportation difficulties, language barriers, discrimination within health facilities, and incompatibility between health service schedules and indigenous livelihood patterns.

This community service project emerged from direct collaboration with Tikuna community leaders and indigenous health councils who identified maternal and child health as priority concern following several preventable maternal and infant deaths in 2022. The villages of São Francisco, Bom Jesus, Vendaval, Campo Alegre, and Betânia, located along the Javari River between 150-300 kilometers from the nearest hospital in Tabatinga, requested support in strengthening community health knowledge while maintaining indigenous cultural identity and traditional healing practices. Community consultations revealed specific concerns including high rates of pregnancy complications going unrecognized until critical stages, inadequate infant and young child nutrition due to disrupted traditional food systems, low vaccination rates due to logistical barriers and vaccine hesitancy, and limited knowledge of danger signs requiring urgent medical evacuation.

The project objectives encompassed: (1) strengthening maternal health literacy regarding prenatal care, pregnancy danger signs, safe delivery practices, and postpartum care; (2) improving caregiver knowledge of infant and child nutrition, growth monitoring, and developmental milestones; (3) increasing awareness of preventable childhood diseases and importance of vaccination; (4) training community health workers to serve as cultural bridges between traditional and biomedical health systems; (5) developing culturally appropriate educational materials respecting Tikuna language and visual culture; and (6) establishing

sustainable community-based health education structures. The intervention adopted a intercultural health framework recognizing multiple valid knowledge systems and seeking complementarity rather than replacement of traditional practices. This article documents the comprehensive implementation process, culturally adapted methodologies, outcomes achieved, and lessons learned that may inform similar interventions in indigenous contexts globally.

METHODE

The project employed a community-based participatory research approach, fundamentally positioning Tikuna communities as co-designers and co-implementors rather than merely research subjects or intervention recipients. This methodological orientation aligns with indigenous research paradigms that prioritize community sovereignty, reciprocity, and practical benefits flowing to participating communities (Smith et al., 2022). The research partnership was formalized through protocols with the União das Nações Indígenas do Vale do Javari (UNIVAJA), the representative indigenous organization, and received approval from Brazil's National Indigenous Peoples Foundation (FUNAI) and the National Research Ethics Commission (CONEP). All project activities were conducted in accordance with indigenous community protocols, including ceremonial permissions from village leaders and traditional authorities, ensuring cultural appropriateness and ethical integrity throughout the implementation period.

The preliminary phase, spanning six months from January to June 2023, focused on participatory situational analysis and culturally grounded program design. The research team, comprising public health professionals, anthropologists, indigenous health specialists, and Tikuna community researchers, conducted ethnographic fieldwork including participant observation, in-depth interviews with 45 mothers and pregnant women, focus group discussions with traditional healers, and key informant interviews with village leaders across all five communities. Baseline health literacy assessment utilized adapted tools sensitive to oral tradition cultures, incorporating pictorial scenarios and narrative-based questioning rather than written literacy-dependent instruments (Nutbeam & Lloyd, 2021). Quantitative baseline data were collected through household surveys documenting maternal health knowledge, child health practices, healthcare utilization patterns, and health outcomes including pregnancy complications, birth outcomes, breastfeeding practices, childhood morbidity, and vaccination coverage. Participatory workshops brought together community members, traditional healers, and health professionals to identify priority health topics, preferred learning methodologies, appropriate communication channels, and acceptable integration points between traditional and biomedical approaches (Anderson et al., 2023). This extended preliminary phase, while resource-intensive, proved essential for building trust, understanding cultural context, and designing interventions genuinely responsive to community-defined needs rather than externally imposed priorities.

The implementation phase, conducted over twelve months from July 2023 to June 2024, centered on training 35 indigenous community health workers (agentes indígenas de saúde) selected by their respective communities based on criteria including trustworthiness, communication skills, commitment to community service, and respect for traditional knowledge. The training program, delivered in Tikuna language with Portuguese supplementation, comprised 120 hours of instruction organized in monthly four-day modules that accommodated seasonal subsistence activities and minimized disruption to community life. Curriculum topics included prenatal care fundamentals, recognition of pregnancy danger signs, nutrition during pregnancy and lactation, safe childbirth practices, newborn care, breastfeeding promotion and problem-solving, complementary feeding, childhood disease recognition, growth and development monitoring, vaccination schedules and safety, malaria prevention, diarrheal disease management, and emergency response protocols (Berkman et al., 2021). Pedagogical approaches emphasized active learning through demonstrations, case studies, role-playing, and practical skills practice, explicitly connecting biomedical concepts with traditional Tikuna knowledge where appropriate and acknowledging areas of complementarity versus conflict. Educational materials development involved iterative co-design processes with community members, producing illustrated flipcharts, pictorial counseling cards, audio recordings, and demonstration materials that reflected Tikuna visual culture, incorporated familiar symbols and metaphors, and avoided images potentially considered culturally inappropriate (Langdon & Garnelo, 2020). Trained community health workers subsequently conducted monthly small-group education sessions with mothers and caregivers, household visits for individualized counseling, community health talks during village gatherings, and accompaniment services for women accessing formal healthcare facilities. Concurrent activities included establishing community-based maternal and child health monitoring systems using adapted growth charts and simplified registers, creating community health committees to provide oversight and sustainability, and facilitating dialogue forums where traditional healers and biomedical health workers exchanged knowledge and negotiated complementary roles in maternal-child health. The implementation incorporated continuous quality improvement mechanisms with monthly reflection meetings where community health workers and supervisors discussed challenges, adapted strategies, and documented emerging lessons (Svitone et al., 2020). Post-intervention evaluation, conducted in May-June 2024, replicated baseline assessment methods to measure changes in knowledge, attitudes, practices, and health outcomes, supplemented by qualitative interviews and focus groups exploring community perceptions of the intervention's cultural appropriateness, acceptability, and sustainability.

RESULT AND DISCUSSION

Improvements in Maternal Health Knowledge and Prenatal Care Practices

The intervention produced substantial improvements in maternal health literacy, with comprehensive knowledge gains documented across all assessed domains. Baseline assessment revealed that only 34% of women could identify at least three danger signs during pregnancy, while post-intervention this increased to 81%, representing a 138% relative improvement. Specific knowledge of danger signs showed dramatic increases: recognition of severe headache with visual disturbances as potential pre-eclampsia warning increased from 23% to 76%; awareness that reduced fetal movement requires immediate evaluation rose from 31% to 84%; and understanding that vaginal bleeding demands urgent care improved from 45% to 89%. These knowledge gains translated into behavioral changes, with prenatal care attendance increasing from an average of 2.3 visits per pregnancy at baseline to 4.8 visits post-intervention, approaching the Brazilian Ministry of Health's recommended minimum of six visits (Ministério da Saúde Brasil, 2022). Women reported greater confidence in recognizing when pregnancy complications required urgent travel to healthcare facilities versus conditions manageable through traditional practices.

The program successfully navigated culturally sensitive topics including pregnancy diet, activity restrictions, and delivery practices where traditional beliefs sometimes conflicted with biomedical recommendations. Rather than dismissing traditional practices, the educational approach acknowledged cultural beliefs respectfully while providing evidence-based information, allowing women to make informed decisions. For example, traditional Tikuna practices include dietary restrictions during pregnancy, prohibiting certain fish and game animals believed to cause fetal abnormalities. Community health workers learned to discuss these beliefs non-judgmentally, affirm the cultural importance of dietary awareness during pregnancy, and provide guidance on ensuring adequate protein intake from permitted foods while respecting traditional prohibitions (Buchillet, 2022). This culturally humble approach proved more effective than previous public health campaigns that simply labeled traditional practices as "myths" requiring correction, an approach that generated resistance and disengagement (Ferreira, 2021).

Nutrition knowledge improved significantly, with understanding of iron-rich food sources increasing from 28% to 73%, and awareness of the importance of varied diet during pregnancy rising from 41% to 85%. Anemia prevalence among pregnant women, measured through a subsample of 85 women with accessible laboratory testing, decreased from 68% at baseline to 47% at follow-up, suggesting that improved nutrition knowledge translated into dietary changes despite economic constraints limiting food access. The program addressed the reality that traditional food systems have been disrupted by environmental degradation, reduced hunting territories, and fish population declines, while simultaneously market foods are expensive and irregularly available. Community health workers facilitated discussions on optimizing nutrition within available resources, including revival of traditional nutrient-dense foods, diversification of agricultural production, and strategic use of government nutrition supplementation programs.

Postpartum care knowledge, an area of particular deficit at baseline, showed remarkable improvement. Awareness of danger signs during the postpartum period including severe bleeding, high fever, and severe abdominal pain increased from 18% to 71%. Understanding of the importance of exclusive breastfeeding for six months improved from 52% to 91%, with corresponding behavioral change documented through increased exclusive breastfeeding rates from 43% at baseline to 78% at follow-up. The program addressed cultural practices of early introduction of water and herbal teas to infants, common in Tikuna communities, through respectful dialogue about infant physiology, breast milk sufficiency, and gradual behavior change rather than demanding immediate abandonment of traditional practices. Community health workers, themselves indigenous mothers, shared personal experiences with exclusive breastfeeding, making recommendations more credible than when delivered by outside health professionals (Svitone et al., 2020).

Table 1. Maternal Health Knowledge and Practice Indicators - Baseline and Post-Intervention

Indicator	Baseline (n=342)	Post-Intervention (n=342)	Change	p-value
Can identify ≥3 pregnancy danger signs	34%	81%	+47%	<0.001
Attended ≥4 prenatal care visits	38%	71%	+33%	<0.001
Knowledge of iron-rich foods	28%	73%	+45%	<0.001
Exclusive breastfeeding 0-6 months	43%	78%	+35%	<0.001
Can identify postpartum danger signs	18%	71%	+53%	<0.001
Knowledge of family planning methods	41%	76%	+35%	<0.001
Delivered with skilled attendant	52%	68%	+16%	<0.001
Anemia during pregnancy (subsample n=85)	68%	47%	-21%	0.003

Enhanced Child Health Literacy and Preventive Care Practices

Child health literacy demonstrated equally impressive improvements across multiple domains, with caregivers developing enhanced capacity to promote healthy child development and recognize conditions requiring medical intervention. Knowledge of appropriate complementary feeding practices increased substantially, with understanding of the recommended age to introduce solid foods (six months) improving from 46% to 88%. Awareness of the importance of continued breastfeeding alongside complementary foods through age two increased from 34% to 79%, addressing the common practice of early weaning when complementary

foods are introduced. Dietary diversity for young children improved, with the proportion of children aged 6-23 months receiving minimum dietary diversity (foods from ≥4 food groups daily) increasing from 31% at baseline to 58% at follow-up, though remaining below optimal levels due to persistent food security challenges requiring broader interventions beyond health education alone.

Growth monitoring knowledge and practices showed remarkable transformation. At baseline, only 12% of caregivers understood the purpose of growth charts or could interpret whether their child's growth was adequate. Post-intervention, 67% of caregivers demonstrated understanding of growth monitoring, could identify their child's growth pattern on simplified community-based growth charts, and recognized growth faltering as a health concern. The program introduced culturally adapted growth charts featuring Tikuna children and simplified interpretation systems using color-coded zones (green for adequate growth, yellow for at-risk, red for severe growth faltering) that accommodated varying literacy levels. Community health workers conducted monthly growth monitoring sessions during village gatherings, creating social events around child health that built community engagement and normalized growth monitoring as a valued practice (Anderson et al., 2023). Mothers whose children showed growth faltering received individualized counseling and referrals for additional support, creating a surveillance system for early identification of malnutrition.

Vaccination knowledge and acceptance increased substantially, addressing initial hesitancy rooted in historical experiences of coercive government interventions and lack of culturally appropriate health communication. At baseline, only 58% of children were fully vaccinated according to the Brazilian national schedule, with common reasons for incomplete vaccination including transportation difficulties (42% of cases), lack of knowledge about vaccine schedule (31%), vaccine hesitancy (18%), and vaccine unavailability during health post visits (9%). Post-intervention, vaccination completion rates improved to 89%, attributable to multiple factors: enhanced caregiver knowledge of vaccine-preventable diseases, community health workers providing vaccine reminders and facilitating transportation, establishment of community vaccination days timed to minimize transportation barriers, and respectful discussions addressing vaccine concerns. The program acknowledged indigenous communities' valid reasons for mistrust of government health interventions given historical context, addressed specific concerns about vaccine safety through transparent evidence-based information, and emphasized vaccine decision-making as a parental right rather than government obligation (Garnelo et al., 2023).

Recognition of childhood illness danger signs improved dramatically. Knowledge of signs requiring urgent medical care including difficulty breathing, inability to drink/breastfeed, persistent vomiting, fever with convulsions, and extreme lethargy increased from 29% of caregivers identifying at least three danger signs to 77% post-intervention. This knowledge gain appeared to influence care-seeking behavior, with health facility visits for childhood illness increasing by 43%

during the intervention period, suggesting that families were seeking care earlier in illness progression rather than waiting until conditions became critical. Diarrheal disease management knowledge improved, with appropriate home management practices including continued feeding and use of oral rehydration solution increasing from 37% to 81% of caregivers. Malaria prevention knowledge, critical in this endemic region, increased from 44% to 86%, with corresponding behavioral changes in bednet use rising from 58% to 84% of households consistently using bednets for children (Berkman et al., 2021). These comprehensive improvements in child health literacy addressed major preventable causes of childhood morbidity and mortality in indigenous Amazonian contexts.

Culturally Appropriate Health Education Model and Community Capacity Building

The intervention's success can be substantially attributed to its culturally grounded approach that respected indigenous knowledge systems while introducing complementary biomedical information, creating synthesis rather than replacement of traditional practices. Participatory evaluation documented high cultural acceptability, with 92% of participants rating the program as respectful of Tikuna culture and 88% reporting that educational content aligned well with traditional values and beliefs. Traditional healers (pajés), initially skeptical of the program fearing biomedical dominance over traditional medicine, became strong supporters after engagement processes that explicitly honored their expertise and sought collaborative rather than competitive relationships. Formal dialogue sessions brought together pajés and biomedical health workers to identify areas of complementarity, delineate appropriate scopes of practice, and develop referral mechanisms in both directions—health workers referring patients to traditional healers for certain conditions and traditional healers identifying situations requiring biomedical intervention (Langdon & Garnelo, 2020) and (Muhsyanur, 2024).

The community health worker model proved exceptionally effective, with these indigenous health educators achieving high credibility and trust within their communities. Being community members who spoke Tikuna as their first language, shared cultural background and experiences, and maintained ongoing relationships with participants created educational dynamics fundamentally different from external health professionals delivering episodic lectures. Community health workers reported that their indigenous identity enabled them to understand and address cultural concerns more effectively than outside health workers, while their biomedical training provided knowledge to answer health questions. This bridging position, however, created role tensions that required ongoing support and supervision. Community health workers sometimes faced pressure from community members to align exclusively with traditional practices while simultaneously experiencing expectations from biomedical supervisors to promote Western medical approaches (Muhsyanur et.al, 2024). The program addressed these tensions through regular reflection meetings where role conflicts were discussed openly, dual

supervision systems involving both indigenous leadership and health services, and clear messaging that community health workers served communities rather than government health systems (Svitone et al., 2020).

Educational materials co-designed with community participation proved far more effective than materials developed by outsiders, regardless of how carefully designed. Tikuna visual culture emphasizes certain symbolic representations, color meanings, and narrative structures that differ from Western visual communication conventions. Community-developed materials incorporated familiar visual metaphors, used Tikuna color symbolism appropriately, featured recognizable community settings, and employed narrative storytelling structures aligned with indigenous oral traditions. Audio materials in Tikuna language proved particularly valuable given varying literacy levels, allowing information dissemination through radio broadcasts on indigenous community radio stations and audio recordings distributed on mobile phones increasingly common in communities. The materials development process itself served as community capacity-building exercise, training community members in health communication and educational material production, skills applicable beyond this specific intervention (Smith et al., 2022).

Institutional sustainability mechanisms established during the intervention provide foundation for long-term impact. Community health committees formed in each village provide governance structures for ongoing health education activities, oversight of community health workers, and interface with external health services. Communities mobilized resources to provide modest compensation for community health workers through collective agricultural work, recognizing their valuable service while reducing dependency on external funding that may prove unsustainable. Documentation systems adapted to indigenous contexts, using simplified pictorial registers requiring minimal literacy, enable ongoing monitoring of maternal and child health indicators without creating unsustainable documentation burdens. Integration of community health workers into the formal Special Indigenous Health Districts (DSEI) system provides access to supplies, technical supervision, and referral mechanisms while maintaining community accountability (Ferreira, 2021). The program's participatory approach fostered community ownership evidenced by communities independently expanding health education activities beyond the original intervention scope, incorporating health topics into traditional ceremonies and gatherings, and neighboring communities requesting replication of the model. This organic diffusion suggests genuine community valuation of health literacy and capacity to sustain and expand interventions beyond external support, the ultimate indicator of community development success (Anderson et al., 2023).

CONCLUSION

This community service project successfully strengthened maternal and child health literacy among Tikuna indigenous communities in the Brazilian Amazon through culturally grounded, participatory approaches that respected indigenous

knowledge systems while introducing complementary biomedical information. The intervention achieved substantial improvements across multiple health domains: prenatal care attendance increased by 67%, exclusive breastfeeding rates rose from 43% to 78%, childhood vaccination completion improved by 54%, and knowledge of maternal and child health danger signs increased dramatically. These outcomes were achieved through an intercultural health model that positioned indigenous communities as co-designers and implementors rather than passive recipients, trained indigenous community health workers as cultural bridges between traditional and biomedical systems, developed culturally appropriate educational materials through participatory processes, and engaged traditional healers as partners rather than competitors.

The program demonstrated that effective health literacy interventions in indigenous contexts require addressing not only individual knowledge gaps but also structural barriers, cultural appropriateness, linguistic accessibility, and compatibility with indigenous livelihood patterns and worldviews. Key success factors included extended community engagement to build trust and understand cultural context, positioning indigenous community members as health educators, respectful dialogue between traditional and biomedical knowledge systems, adaptation of educational methods to oral tradition cultures, and establishment of community-governed sustainability mechanisms. This model offers replicable framework for health literacy interventions in indigenous communities globally, with core principles including cultural humility, participatory design, synthesis rather than replacement of knowledge systems, and long-term investment in community capacity building. The intervention provides evidence that when designed and implemented with genuine respect for indigenous sovereignty and knowledge, health literacy programs can simultaneously improve health outcomes and strengthen cultural identity, challenging false dichotomies between tradition and modernity that have characterized much of indigenous health policy.

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